HISTORICAL BACKGROUND OF MEDICAL INFORMATICS DEVELOPMENT

Izet Masic, Editor

AVICENA
Sarajevo, 2022

LIBRARY OF BIOMEDICAL PUBLICATIONS
Book 55

Editor:
Professor Emeritus Izet Masic, MD, PhD, FWAAS, FEASA, FIAHSI, FEFMI, FACMI
Faculty of Medicine, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

Authors of the Chapters in the book:
Marion Ball (Chapter 19), Barry Barber (Chapter 7), Patrice Degoulet (Chapter 20), Francis Roger France (Chapter 5), Gjuro Dezelic (Chapter 14), Arie Hasman (Chapter 8), Jacob Hofdijk (Chapter 17), Ilias Iakovidis (Chapter 22), Casimir A. Kulikowski (Chapter 16), Izet Masic (Chapters 1, 3, 4, 9, 11, 12, 13, 18, 23, 24), George Mihalas (Chapters 2, 10), Hans Peterson (Chapter 6), Gustav Wagner (Chapter 21), Jana Zvarova (Chapter 15) (in alphabetical order)

Reviewers:
Professor Emeritus Marion J. Ball, EdD, FACMI, FAAN, FIAHSI, FMLA, FAHIMA, FHIMSS, FCHIME
University of Texas at Arlington, USA

Professor Gjuro Dezelic, PhD
Academy of Medical Sciences of Croatia, Zagreb, Croatia

Professor Armin Skrbo, PhD
Academy of Sciences and Arts BANUK, Sarajevo, Bosnia and Herzegovina

Professor Emeritus Doncho M. Donev, MD, PhD
Faculty of Medicine, University "Ss Cyril and Methodius", Skopje, North Macedonia

Professor Slobodan M. Jankovic, MD, PhD
Faculty for Healzh Sciences, University of Kragujevac, Serbia

Technical editor:
Mirza Hamzic, dipl. oec.

CIP - Katalogizacija u publikaciji
Nacionalna i univerzitetska biblioteka
Bosne i Hercegovine, Sarajevo

61:004(091)

HISTORICAL background of medical informatics development / editor Izet Mašić. - Sarajevo : "Avicena", 2022. - 362 str. : fotogr. ; 25 cm. - (Library of biomedical publications ; book 55)

Bibliografija uz svaki rad ; bibliografske i druge bilješke uz tekst.

ISBN 978-9958-720-75-8

COBISS.BH-ID 49333766

Published by:
Avicena, d.o.o., Sarajevo

Printed by:
Stamparija Fojnica, d.o.o., Fojnica

CONTENTS

00

Izet Masic

PREFACE

The history of Medical/Health/Biomedical informatics had begun between fifties and sixties of the last century. In the wake of the Second World War when a few doctors and researchers were exploring the role of the computers and when they tried to involve their possibilities for improving diagnostic and treatment of health condition of patients and helping to better diagnose of diseases. They used logic and probabilistic reasoning to tackle specific healthcare problems in biology, physiology and a few disciplines in medicine.

Initial step was Lee Lusted's and Robert Ledley's article published in 1959 in the respected journal "Science" in which authors described their idea of using data analysis in medical research and diagnosis. Robert S. Ledley and Lee B. Lusted published "Reasoning Foundations of Medical Diagnosis," a widely read that article which introduced computing, especially operations research techniques to medical professionals. Ledley's and Lusted's article has remained influential for decades, especially within the field of Medical Decision-Making. Guided by Ledley's late 1950s survey of computer use in biology and medicine the National Institute of Health in Bethesda, USA (NIH) undertook the first major effort to introduce computers to biology and medicine. Drs. Lee Lusted and Robert Ledley promoted formalizing statistical approaches for modeling medical decision-making as a way of reducing errors, among other benefits. In that time computers were not yet advanced enough to provide individual care providers and hospital systems with the tools to conduct these analyses.

Medical informatics as a academic and scientific discipline is relatively young if we compared it to other biomedical disciplines. Development of Medical informatics was in direct correlation with the advent and widespread in use of digital computers and the development of information and communication technologies (ICTs) based just on these computers. In previous decades the medicine and health care services have changed significantly thanks to developments of biomedical informatics and its application in medical education and health care protection, especially in medical diagnostics.

In the period after Second World War USA was the leading country in the field of Computer science and the leader in using the first computers in medicine and healthcare services. During the last two decades of 20th century was particularly important for development of Medical informatics, with great influence of Internet by medical professionals at every level of health care system.

Today, we can hardly imagine diagnostic procedures, such as, for example, Magnetic Resonance Imaging (MRI), Computerized Tomography (CT), Positron Emission Tomography (PET scan), etc. MRI is a medical imaging technique that uses a magnetic field and computer-generated radio waves to create detailed images of the organs and tissues in your body. CT of the body uses sophisticated X-ray technology to help detect a variety of diseases and conditions. CT scanning is fast, painless, noninvasive and accurate. In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives. A PET-scan is an imaging test that can help reveal the metabolic or biochemical function of your tissues and organs. The PET scan uses a radioactive drug (tracer) to show both normal and abnormal metabolic activity.

Most of these sofisticated mashines contain excellent software for access to medical knowledge without access to numerous databases, or electronic storage of data relating to patients, without information technology in medicine.

At the very beginning of its development, Medical informatics is considered as discipline that could be helpful but not necessary discipline. However, today it is one of the bases in medicine and health care in general. That is why, a lot is expected of Medical informatics, in terms of providing support to health care services in all parts of the world as well as in contributing to its quality and efficiency, and innovation in biomedicine and research in biomedical sciences. The process of its growth continues so that today's work is tomorrow's history. A 'historical' discussion of the area is its history to date, a report rather than a summation.

When talking about the development of Medical informatics, the important place have an international non-profit organization IMIA (International Medical Informatics Association) and its branch associations, especially European Federation for Medical Informatics (EFMI) that their work covers all continents, comprises more than 70 academic institutions and more than 50,000 individuals. In promotion and spreading out of knowledge and experiences of the Medical informatics as scientific and academic discipline both of them have great impact in spreading medico-tecnological knowledge worldwide.

Its role in this rapid development of Medical informatics presented by its objectives: promotion of ICTs in health care, public health and biomedical research; stimulating research, development and everyday promotion of education and responsible behavior¸ moving ICT from theory to practice in all areas of health care and stimulation of progress, implementation of new technologies and research.

Everything mentioned above couldn't be realized without contributions of the great scientists and their discoveries and achievements. Thanks to them today we can speak about great improvement of health care protection on every level of the health care systems in almost every country in the world.

Comprehensive and essential contents on Medical informatics, but also the aspects nurtured by the main „schools of Medical informatics" - Anglo-Saxon's (Abbot, Anderson, Barber, etc.), French (Gremy, Remond, etc.), German (Reichhertz, Wagner). et al.), American (Collen, Warner, Greens, Hammond, Ball, Shortliffe, et al.), Middle and East Europe (Dezelic, Masic, Zvarova, Naszlady, Mihalas, etc.), whose terms „Health Informatics" (Abbot) and „Medical Informatics" (Gremy and Reichertz) have entered the European and world medical literature. For those studying the subject or working in the field, the experiences of others who use Information and Communication Technologies (ICTs) for the better of health care can provide a necessary perspective.

But, most influential association became European Federation for Medical Informatics (EFMI), established on September 11th 1976 in Copenhagen with members of 10 national representatives (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Netherlands), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) who adopted Statute of EFMI and other documents and prepared the first MIE Conference in Cambridge (UK) in 1978. Today EFMI represent leading European medical informatics professional organization representing 31 European countries and institutional members. EFMI is organized as a non-profit organization concerned with the theory and practice of Information Science and Technology within the Health and Health Sciences sector, in a European context.

Finally, Editor of this book shortly described important facts about history of development of Biomedical informatics in the world including South-Eastern Europe countries, pointed facts about biomedical experts contributions during long period of his participation in IMIA General Assembly and EFMI Council.

As well as its successes, the history of Health/Medical/Biomedical Informatics is populated with visionary promises that have failed to materialize despite the best intentions. Some of the chapters in this book already were published in the book "Contributions to the History of Medical Informatics" in the First Edition edited and printed in 2014 by Izet Masic and George Mihalas, after organized the Special Topic Conference about History of Medical Informatics, held in Prague in 2013, organized by Professor Jana Zvarova and chaired by George Mihalas, Casimir Kulikowski, and full papers presented at this Conference were published in the journal Acta Informatica Medica and, also, involved in this book.

Development of Medical informatics in other parts of Europe and in the world, including description of contributions of most influential academics, scientists and experts within this field of medicine, author described with 30 co-authors from all parts of the world, in the mentioned book and, also, in other two monographs - "Honorary Fellows of EFMI" and "Honorary Fellows of IMIA" (published in 2017 and 2018). Also, some other authors, most influental medical informatics academics and experts described some important historical facts about development of the Medical informatics in the past.

Editor of this book in his Chapter "The Most Influential Scientists in the Development of Medical Informatics" described Curriculum Vitae and biosketch formats of a few most influential biomedical experts in the scientific and academic field of biomedicine with their important contributions in the biomedical informatics. In this chapter we tryed to describe a short facts about some of the most influential medical informaticians during the history of development of this scientific discipline. The number of 31 published CVs in the biomedical journal "Acta Informatica Medica" (the journal founded by Izet Masic in 1993) were printed in the issues, published from 2014 until 2021 and deposited in PubMed, PubMed Central, Scopus and other databases.

Also, some of the chapters in this book were published as articles in Acta Informatica Medica journal and in the International Journal on Biomedicine and Healthcare, issues printed during 2018-2020 (the journal is founded by Jana Zvarova in 2013, and she was Editor-in-Chief during period 2013-2017, and Izet Masic, who is Editor-in-Chief from 2018 to present). Mentioned published articles are re-published with permission of the authors of the chapters in the book and Publisher "Avicena", Sarajevo and Academy of Medical Sciences of Bosnia and Herzegovina (both journals are official journals of the Academy - AMNuBiH). Acta Informatica Medica journal is, also, official journal of the European Federation for Medical Informatics (EFMI).

Sarajevo, May 2022

01

Izet Masic

INFLUENCE OF COMPUTER SCIENCES ON THE DEVELOPMENT OF MEDICAL INFORMATICS

The intensive development of science and technology led to the constant improving of the architecture of computers and extent of their operational capabilities. From the construction of the first electronic computers in the last century up to nowadays, the computers passed through several phases of development, and now we are awaiting the upcoming generation of so called neuro-computers.

The first device for calculations called Mark I ("Automatic Sequence controlled Calculator") was constructed by Howard Aiken, a Harvard scientist for the International Business Machines Corporation (IBM), established in 1911, by founder Charles Ranlett Flint, at Endicott, New York, U.S. This device performed automatic calculations from the beginning to the end. For this reason, the majority of scientists consider this to be the first electromechanical computer which performed the operations without human intervention (1-3).

In 1943, John Prosper Eckert and John W. Mauchley, from Pennsylvania University in Philadelphia, constructed the device ENIAC ("Electronic Numerical Integrator and Calculator") which weighted 30 tons and had 18.000 electronic tubes. ENIAC occupied a lot of space, around 1.500 square meters. Although ENIAC was, in technological sense a bit below from Mark I, it was still about thousand times quicker. This machine, and those similar to it, were exceptionally big if we apply nowadays standards, they produced huge quantities of heat and were very expensive in construction and

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

operation. Malfunctioning was also frequent. The machines required special rooms, and the speed of work was very slow compared to machines we have today. For example, one addition lasted about 0.6 milliseconds, and multiplication took about 15 milliseconds. The price of these machines was relatively high, there were great costs for the qualified personnel and experts, programmers were deficient, which lead that these machines being reserved for bigger and more complex tasks of manipulating with huge amount of data for both scientific and engineering purposes (1).

John von Neumann proposed that operational instructions should be included inside the computer memory, beside the data memory, which lead to the production of EDVAC ("Electronic Discrete Variable Automatic Computer") in 1946, and also the production of UNIVAC ("Universal Automatic Computer") in 1952 as the first computer for the commercial use with UNIVAC II, IBM 704, IBM 705, etc. This was a period of fantastic development of the computers. We emphasize that von Neuman was the first who precisely described all the elements and functions of the computer system, and this project is considered cornerstone for the series of computer systems of different performances in the future generations of computers (1). The first computers of the second generation were built in 1957, and the majority in the period from 1959 till 1964. Their characteristic is that instead of the electronic tubes they used the transistors and semi conductor diodes. The appearances of transistors in the electronics provoked the revolution in the building of widely available computers. This significantly reduced the requests for size, space, costs of electricity and efficiency. The speed of these computers is significantly greater and multiplication took about 20 microseconds. It is specific that the computers of the second generation used a small magnetic core for construction of the primary memory. This was the time of general use of computers, and there were more of those interested in training to become professional programmers. The people who worked on these machines inspired the awe in general public. In this period several programming languages were introduced, such as ALGOL and COBOL. Some of the computers from this generation are RCA 501, IBM 7070, 7090, HONEYWELL 800, IBM 1400, IBM 1600, CDC 160, NCR 500 and others (1).

The computers of the third generation (1964) operated on the principles of monolithic technique and the integrated circuits. The period of the building of these computers lasts to 1971. The new technique led to the further microminiaturization, so that on the tile of small dimensions there was great number of various elements (transistors and diodes). For example, on the tile sized 1-2cm there was around 30 different electronic elements. The velocity of work of these computers is great and they could calculate around 10 million additions in a minute. The computers of this generation use numerous languages for programming and multiprogramming. The basic characteristic is that they could simultaneously perform more jobs at once, using the "divided time" technique for working.

The deficiency of the previous computers is that there is time when the central processors unit ("Control Processing Unit - CPU") is inactive and waiting for some input or output device to finsg its task. This was converted so that the CPU serves more jobs at once. Namely, the CPU, which is the "brain and heart" of every computer, is now divided between concurrent programs serving them, and simultaneously follow-up and manage the work of the more output/input (I/O) units. Difference from the previous generation, where the job had to be transferred on punched paper tape or on punched cards which were previously prepared far from the computer, while the user waited for the results for several hours or days, is also that this generation of computers was more available. They had strength and the capacity to perform the complex tasks, to perform the extensive tasks and made sense of operational systems which enabled much easier performing of the schedule of work. The resources within system could divide without mutual interrupting, and the users had the "direct approach" to the computer through monitor with the option of communicating with the computer from distant locations. This favored the production of various input-output units, different screens and memory devices (disks) on which millions of data was easily available to the user. Some of the computers from this generation are IBM 360, RCA SIEMENS 4004, UNIVAC 9000, CDC 6600, HONEYWELL 200 and others.

The computers of the fourth generation were built in 1971 on the principle of so called "Large Scale Integration" (LSI). The basis of this technique are tiles sized 3x3 millimeters and similar, with 100-200 different electronic elements placed on 1mm. This allowed even greater miniaturization, are created devices of great possibilities, with the costs being reduced. The computers of this generation operated in nanoseconds with approximately 10-15 millions operations in a second. These computers have a large capacity of central memory, from one to several gigabytes. Regardless of the significant capacity of the large computers, they still could not answer to the increased requests of users. Therefore, the development of the minicomputer systems with hardware and software ("operational systems") was pushed with significant reduction of costs, from the ground change of the conceptions of the development and applications of the informational systems in the sense of their decentralization. The decentralization, which is the distribution into the network terminals and of PC significantly, elevates the management of the computer equipment and transfers the management of organizations to the lower level. The computers from these generations have simplified internal structure, the length of "words" is shorter and it uses simplified logics in "addressing the data" placed in computers memory (1).

The notion of the length of the word reflects the potential possibilities of a computer. The majority of large computers used 32 elements for representing one word ("32-bits computers"), some even 48 bits and longer words. Large computers also have complex operation systems (in fact "the computer programs") that classify and manage different tasks. Mini computers of this generation are constructed for "16-bits words" and could not operate with great numbers in the frame of an instruction cycle (theoretically this requires more time to process the same problem). However "16-bits minicomputers", significantly cheaper and slower, with the operational system adapted for the definite task, can manage it better and quicker than large computers. The greatest producers of minicomputers of the sixties and seventies are (besides IBM), Digital Equipment Corporation, Data General, NCR and others. The typical representatives of these generations of computers are IBM 370, Siemens 7700, Univac 100, Honeywell 66 and others. By the end of the seventies the producers of large computers begin to produce 32-bits minicomputers, and widen the possibilities of their operational systems. The use of the computers becomes cheaper, and the number of the trained skilled people abruptly grows which leads to wider applications of computers.

The progress in the field of the "integrated circuits" (created by Jack Kilby in 1958) leads to the development of micro-processors which use the input/output processors in the frame of the large computers and also in small minicomputers for the management with greater number of local terminals, and for their connection in large networks (3). The significantly perfected microelectronics enables the rise of the mighty logic functions in the frame of the small Silica components - of the integrated circuits or microchips. The logic device which can be programmed and all its components are found on the one and unique Silica chip, called the microprocessor.

The microprocessors are being developed as process units of the simple structure for integration into chapter microcomputers. This provoked the revolution in the development of mini and microcomputer systems, because microprocessors became the central processor units for the new type or the computers intended for individuals. The creator of the first microprocessor is IBM (Intel 8008), and the first personal computer appeared in 1975 (Altair 8800). In 1977 the market offered computers made by Apple Computer inc., Commodores Business Machines, Tandy-Radio Shack and others.

First microcomputers which use microprocessors with 8-bits were available at the market for both professional organizations and inviduals (mainly programmers). In these years we already had mighty machines with the possibilities of managing big libraries. "The characteristic of these machines is that they are projected for more usable use and have the possibilities of the simultaneous performance of several various programs or applications" (1). Among the different products in the domain of microcomputers we differ: "the pocket computer, laptop/notebook, the personal and small general purpose computers" (1). In the literature the term "the personal computer" and "microcomputer" are often used as synonyms (1, 3).

The later microcomputer for the multi business application used 16-bits and memory locations could be addressed with 32-bits binary address system. At the time Intel announced detailed information about its first 64-bits processor called Itanium (Marced). Itanium was to work on 800 MHz and was announced to be able to process about 6.4 billions of operations and according to Intel's words was about ten times quicker than the RISC processor and usual 32-bits instructions would perform equally fast as the Pentium III processors. The nucleus itself contained 25.4 million transistors and the integrated 4 MB of the three degree CACHE memory had even 320 millions of transistors. Pentium III processors with its 256 KB CACHE memory had only 28 million transistors. The first chipset which was to support Itanium enabled the parallel work of 512 processors and to 64 GB SDRAM memory. With the corresponding software, they could successfully serve more users. In the basis, we have the structure developed by John von Neuman and is called "von Neumann architecture" (1).

The fifth generation of computers enables even more simple communication between human and computer. The fifth generation has the advantages of computer - the speed and reliability of the counting and memory, and is similar with the advantages of humans when they make decisions and act in new and unpredictable situations.

The computer of the fifth generation work similarly to humans, that is they work as "intelligent". They solve problems by means of the expert systems which support the work of the experts in a field (for example, in the diagnosing of the disease, deciding on the therapy and similar), by which the computer helps that he explains why and on the basis of what he decided for the definite solution (for the given diagnosis or the choice of the definitive therapy). The breakthrough of the computer and information technologies in all the segments of the society, led to the needs for the computer and information technologies. The knowledge of information technology is now part of general literacy. The computer literacy does not require comprehensive and detailed knowledge of the electronics or programming.

The electronic computer is the mean by which we can more successfully solve the problems. The electronic computer is probably one of the most important inventions in the second half of the previous century. The expansive breakthrough of the computer technologies into all spheres of human work, characterizes the new wave of the great changes which often is called 'the computer revolution' (1). The intensive development of the electronic technology in this century enabled the construction of such machines which besides the arithmetic operations can perform also more complex logic operations by means of which it is possible to quickly easily and reliable solve such tasks which up to the invention of the computer was impossible to solve by the standard way of processing. Practically is proved that the computers have extraordinary ability to process a great number of the data in short time period. The personal computers (PC) today are widely used in all the segments of society. They are used

Figure 1. Great informaticians: Charles Babbage, Herman Hollerith, John von Neumann, Konrad Zuse, John Atanasoff, Jack Kilby, Dennis Ritchie, Bill Gates (1)

Charles Babbage (1792-1871), inventor of "diferential machine" that could add and subtract and "analytical machine" the first mechanical programmable computer.

Herman Hollerith (1860-1929), constructor of electrical tabulating machine. Machine could punch, read and sort cards and are produced in his own corporation - International Business Machines – IBM, built up in the year 1896.

John von Neumann (1903-1957), create IAS machine, software version of EDVAC that used binary arithmetic and programs in memory of computer presented in digital form.

Konrad Zuse (1910-1995), create series of automatic computing machines based on technology of electromagnetic relays.

John Vincent Atanasoff (1903-1995), made in collaboration with Berry Kliford ABC computer in 1939. (Atanasoff Berry Computer), first digital computer ever made. He had patent for more than 30 inventions.

Jack Kilby (1923-2005), in September 1958 created first microchip (Miniature Electronic Circuit). He got Nobel Prize for Physics in the year 2000 for this and other 60 patents in this field.

Dennis Ritchie (1941-2011), in collaboration with Ken Tomphson made the first version of operating system UNIX in Bell Laboratory, USA that worked on PDP -7 computer using Assembler for code creation. First licenced version of UNIX, created on PDP-11 computer, was realised in the year 1976.

Bill Gates (1955-), founder of Microsoft Corporation, made great contribution to the fact that Internet has become global world network.

into two fields: in the business bookkeeping and household accounting. It is true, that today are much more convent for use in the household bookkeeping, but is very wide also their application in the business bookkeeping, by which the segment of the health care is one from the most significant ('the PC are widely used individually, in network or as the intelligent terminals on the great systems') (1, 3).

Some computers are built only for specific tasks such as monitor for vital function of patient in medicine or control satellite in space. It is usually not possible to modify the purpose of computer. According to the type the computers are divided onto 'analogs and digital'. The analog computer 'works on the principle of the analogy of the different physical processes,' and is in the state to memorize the different sizes by means of the different values of the electric current strength in the individual points inside the computer.

WHAT IS THE INFORMATICS?

The answer to this question is neither facile nor unambiguous, as informatics being a young scientific discipline, still has no unique definition. There are at least three reasons; terminological disagreements, various approaches in the comprehension of informatics notion and region wide enough to study informatics problem. Therefore the informatics definition differentiates from one user to another and these differences are most prominent between west and east informatics theoreticians (1, 4, 5).

The term "Informatics" in the literature was included by Philippe Dreyfus in 1962, combined french words: "information" and "automatique", because in that time automatique was main part of information service (1). The breakthrough of the computer and information technologies in all the segments of the society, led to the needs for the computer and information technologies. The knowledge of information technology is now part of general literacy. The computer literacy does not require comprehensive and detailed knowledge of the electronics or programming.

Although with the electronic computer which is the invention of our age, the attempts of the construction of the first machine for the processing of the information reach far in the history of human civilization. The only and global function of a computer data processing can be naturally separated into the series of the other elementary operations, as for examples are: 'the follow-up of the data, their registration, reproduction, selection, sorting, and comparison' and so on. The computers are being classified according to 'the purpose, type and computer size'. According to the purpose the computers it can be of the general and specific purposes. The computers for the general purpose serve for the commercial applications or any other application that is necessary (1). With the penetration of the contemporary informational technologies the developed human communities have entered in the informational or postindustrial society. In the techno polis or scientific centers, as for example are Tuskuba (by Tokyo) and Sicilian value in USA, by the concentration of knowledge and team work, are being created the new generations of the electronic computers and bio computer. The previous development and the predictions of the new achievements have brought and are bringing to the enormous changes in the structure of the high developed countries, both in the way of the production and changes in the structure of the personnel and in the methodologies and solving the problems and time orientations. The basic characteristics of the informational society is that knowledge and the information achieve the strategic and active resource of the converting and the development of such society, in the same way as are the human work and the capital were for the industrial society. The informatics societies inspected to the future, and not the past. In that sense the new informational technologies become the basic intellectual technology in which the theoretic learning out and new methods ("system analysis theory of the probability theory of the decision" and so on) connected with the possibilities of the computers become the essential factor of the further development of the society. From such a coupling are born the new generations of the computers, "the intelligent robots, the artificial intelligence and expert systems, the automatized production and offices, computer diagnostic and therapeutic systems and new software technologies" (1, 6).

As a consequence of the computer revolution and the revolution in the telecommunication came to the political changes worldwide. So, today, the economy in USA in the largest measure is founded on the information's; already by the beginning of the seventieth, about the half of the working strength in USA could be classified into the informational workers employed in the production, processing and the distribution of informatics workers with employment in the production, processing and distribution of information. On the other hand, by the development of information comes to expression also the so called "technologic colonization", which reflects in the dictation of the way of use of the connected technology, engaging the foreign experts, spying and wiretapping and so on. Recently it was recorded the expressive growth of industry of the computers. In the year 1987, is accounted that in the world there was 50 million computers but it is supposed that over 70% of the population use the computers in their work. Only in USA about 43% of the adult inhabitants nowadays use the Internet for their needs. The software industry has in 1980 3 billions dollars turnover, and growth per year step from 30%, while the companies which treat commercial applicative software realized in 1981 year about 2.5 billions dollars of the income for its business. The telecommunication of services realized the turnover about 4.6 billions of dollars, and their annual year increase amounts about 21%. In 1995 in the world was built about 600 million bigger phone power stations, and the value of the market of the telecommunicate equipment amounts about 500 billions of dollars.

Figure 2. Pioneers of Medical informatics: Morris F. Collen (1913-2014), Francois Gremy (1929-2014), Peter L. Reichertz (1930-1987), Philippe Louis-Dreyfus (1925-2018)

Although the electronic computer the invention of our age, the attempts of the construction of the first "machine for accounting" and for the processing of the information's reach far in the history of human civilization. The antecedents to this machine were the different kinds of the documents as carriers of the data. From the beginning the data were inscribed onto stone or on the papyrus, then on the paper, that by the arrival of electronics and informatics completely changed their nature. For the mankind it was the first technological revolution. If medical informatics is regarded as a scientific discipline dealing with theory and practice of information processes in medicine, comprising data communication by information and communication technologies (ICT), with computers as an especially important ICT, then it can be stated that the history medical informatics is connected with the beginnings of computer usage in medicine.

WHAT IS MEDICAL INFORMATICS?

The Medical informatics is the foundation for understanding and practice of the up- to-day medicine. Its basic tool is the computer, subject of studying and the means by which the aspects and achieve the new knowledge in the studying of a man, his health and disease, and functioning of the total health activities (1, 3, 6, 7). The name 'medical informatics' originated in Europe where it was first used by Francois Grémy and Peter Reichertz in 1973. Current network system possesses the limited global performance in the organization of health care, and that is especially expressed in the clinical medicine, where the computer technology has not received the wanted applications yet. In front of us lies the brilliant future of the medical informatics. It should expect that the application of terminal and personal computers with more simple manners of operation will enable routine use of computer technology by all health professionals in the fields of telemedicine, Distance Learning - DL (Web based medical education), application of Information and Communication Technologies (ICT), Medical robotics, Genomics, etc. The development of nature languages for communication with the computers and the identification of input voice will make the work simpler. Regarding the future of medical informatics education there are numerous controversies. New experimental approaches (cell therapy, tissue engineering) raise important issues to be addressed by ICT in health. Informatics can substantially contribute to the advance of these fields. This knowledge must be applied not only at an individual level, in terms of patient care, but also to improve the health of populations, through new public health studies and programs. The aggregation of electronic health records and informatics infrastructures to facilitate longitudinal and bio-bank-based association studies poses new opportunities for health informaticians (8). Everybody agrees that the Medical informatics is very significant for the whole health care and for the needs for personnel. However, there is not yet the general agreement regarding the teaching programs, because the medical informatics is very involved and propulsive, what makes the performance of the stable education programs more difficult.

Facts described in this chapter of the book could be great help for accepting knowledge about development of very propulsive biomedical scientific disciplines - Medical/ Health informatics, which is big part of all medical disciplines and make contents of everyday practice of all medical professionals. Breakthrough of the computer and information technologies in all the segments of the society, led to the needs for the computer and information technologies. The knowledge of information technology is now part of general literacy. During his presentation at MIE 2012 Conference in Pisa prof Edward Ted Shortliffe proposed to use the term Biomedical Informatics in the future, regarding IMIA strategic plan for 2015: "Biomedical informatics is a multi-disciplinary area that involves multiple content areas. It is one of the fastest growing subject/content areas in the world. The use of informatics is expected to enhance research efforts in areas such as genomics and proteomics, for example, and also to change the way medicine is practiced in the 21st century. Research in informatics ranges from the theoretical to applied efforts. The demand for more research in biomedical informatics and for biomedical informatics to support other researchers escalates daily" (8).

REFERENCES

1. Masic I, Ridjanovic Z. Medicinska informatika. Avicena. Sarajevo, 1994: 269-92.
2. Masic I. Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-8. doi: 10.5455/aim.2014.22.44-48.
3. Masic I, Ridjanovic Z, Pandza H, Masic Z. Medical Informatics. Second edition. Avicena. Sarajevo, 2010: 13-36. ISBN 978-9958-720-39-0.
4. Masic I. A History of Medical Informatics in Bosnia and Herzegovina. Avicena, Sarajevo, 2007: 3-26.
5. Masic I. History of Informatics and Medical informatics. Avicena. Sarajevo, 2013: 5-40. ISBN 978-9958-720-50-5.
6. Kern J, Petrovecki M. i sur. Medicinska informatika. Medicinska naklada, Zagreb, 2009: 269-76.
7. Bemmel van HJ, Musen AM. Handbook of Medical Informatics, Springer-Verlag, 1997: 37-51.
8. www.imia.org

02

George Mihalas, Jana Zvarova, Casimir A. Kulikowski, Marion Ball, Jan H. van Bemmel, Arie Hasman, Izet Masic, Diane Whitehouse, Barry Barber

HISTORY OF MEDICAL INFORMATICS IN EUROPE - A SHORT REVIEW USING A DIFFERENT APPROACH

The aim of this panel was to enlarge the involvement of the EFMI community in preparing the 40th anniversary of EFMI in 2016 and the 50th of IMIA in 2017 and also to identify the pioneering activities in EFMI countries and all potential sources of data.

But, a comprehensive presentation of the history of Medical Informatics (MI) required a systematic and multiaxial approach, to provide not only a list of events, journals, organizations or people, but also to analyze the characteristics of each epoch, to reveal the trends and to recall both successes and failures.

By offering such a dynamic view, the "history" became a tool for a realistic estimation of the impact of medical informatics on various domains - healthcare, computer science, industry, education, even on our daily life.

PANEL DESCRIPTION

The scientific content of the panel consisted of a set of nine presentations from outstanding scientists, with personal contributions to the development of MI (1-14). They approached, from different angles, various aspects of the evolution of this domain. The introduction came from a member of the EFMI founding team (Barry Barber). Then the evolution of ideas, seen from an academic point of view (Jan H. van Bemmel), but also from the level of European Commission (Diane Whitehouse) were

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Figure 1. Diane Whitehouse, Izet Masic, Arie Hasman, Casimir A. Kulikowski, Jana Zvarova, George Mihalas (chair), Marion Ball and Jan H. van Bemmel. in Prague, April 2013, as panelists about Medical informatics history (from left to right) (Photo: Izet Masic)

presented, followed by a reflection of this evolution in medical informatics education (Arie Hasman). An illustrative example followed about how the actions at a national level (Jana Zvarova) had an echo at European level. Nevertheless, the history of MI in Europe can only be well understood within the global context, which was the focus of the last part of the panel. First, a view of the importance to learn from history for shaping the future (Marion Ball), followed by two independent attempts to define major stages in the evolution of medical informatics with their general characteristics: one mostly oriented on the evolution of concepts and organizational impact (George Mihalas), the other mostly oriented on the evolution of technologies and applications (Izet Masic). The panel ended with a presentation of the History project of IMIA (Casimir A. Kulikowski) (Figure 1).

Looking Back on Fifty Years of Medical Informatics (Barry Barber and Maureen Scholes)

Based on the materials sent by Barry Barber (included in this volume as a separate article), the chair of the panel presents the story of EFMI foundation, within the context of the enthusiastic 70’s development of IT applications in all areas, including healthcare. Comments about expectations from medical informatics in those early stages offered a more comprehensive picture of this pioneering era in Europe (1).

Evolution of people and ideas in Medical Informatics (Jan H. van Bemmel)

In the past decades we have seen major changes in medical informatics. Some reasons for it were that nobody was able to predict the advent of the personal computer in the 1970s, the world-wide web in 1991, followed by the rapid rise of the Internet, and the spread of the social media in this century. Foremost, however, nobody expected that it wouldn't be primarily the hardware or the software, but that human factors would become crucial for the successful applications of computers in health care (2, 4, 5).

In the past, sometimes unrealistic expectations were held, e.g., regarding medical decision-support systems, or the use of electronic patient records. Although the technology was widely available, some applications in health care appeared to be far more complex than expected. Health care processes can seldom be fully standardized. This holds even more for individual patients and their diseases. Humans take part at least in two very different roles in the loop of information processing: as subjects, delivering patient care, and as subjects that are the objects of care - the patients. Besides, medical informatics lacks a specific methodology; all its methods were borrowed from neighboring disciplines such as physics, mathematics and, of course, computer science. Also human factors play a major role in applying computers in health care. Everyone pursuing a career in biomedical informatics needs to be very aware of this.

It is to be expected that patients and their relatives will request an increasing role in using computers for health. There is also a strong demand to use the computer for the assessment of the quality of health care. All this implies that research in medical informatics is much more challenging than thought in the past.

European eHealth Visions (Diane Whitehouse)

When looking back 50 years, it can also be exciting to peer into the future by several decades. Current European policy documents already look ahead, mostly to 2020. All current policy initiatives are firmly embedded in the notion of what a commitment to the EU2020 agenda can offer. Each of the seven flagship initiatives involve a set of coherent, comprehensive, actions that are intended to bring these aspirations to fruition. Several of these flagships can either support or offer a response to the challenges of active and healthy ageing, and enhancing a sense of well-being.

The second variant of Europe's eHealth action plan, published in December 2012, therefore faces forward to 2020. Its content was already indicated in some ways by the ideas of the European Union's 2012 task force on eHealth. Lying ahead are potential interpretations of European policy development in 2030, 2040 and even up to the Digital Futures of 2050: they already include visions of healthy lifestyles supported dynamically by information and communication technologies.

In 2013, together with Magda Rosenmoeller (IESE, Spain) and Petra Wilson (CISCO, Belgium), Diane Whitehouse was editing a book aimed at providing an update on eHealth in Europe (Figure 2).

The volume reviewed the current state-of-the-art in European eHealth developments, yet started by tracing the history of European eHealth and its advances and challenges. It describes best practices as well as challenges, offers a voice to stakeholders, and examines the future eHealth market in the European Union.

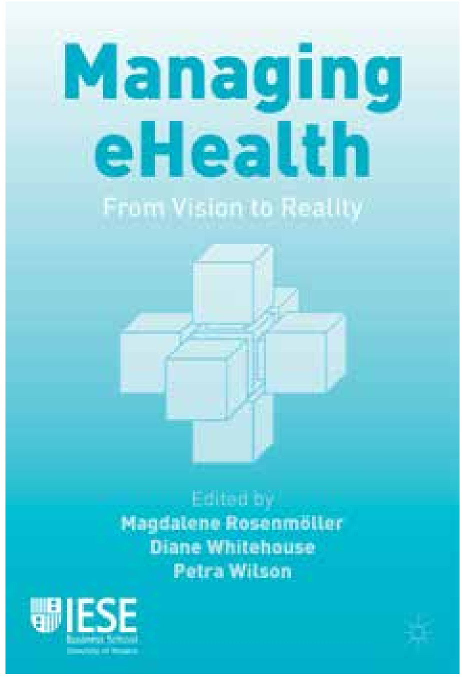


Figure 2. Cover of the book "Managing eHealth: From Vision to Reality", published in 2014 by Palgrave, UK.

It concludes with a vision for the future. The book brings together 25 chapters written by more than thirty leading experts and corporate executives in their respective eHealth fields. All are encouraged to cite past and contemporary case studies. Looking ahead, it provides their insights and visions of eHealth tomorrow.

An abridged history of medical informatics education (Arie Hasman)

Medical informatics education started in the seventies of the last century. Medical informatics was considered by some as applied informatics, others were of the opinion that medical informatics was more than informatics and medicine together and therefore considered it as a discipline separate from informatics. In both cases the 'end product' of these types of education was considered to be a professional not being a medical professional (although these new professionals could initially have been educated as a medical specialists). In 1973 an invitational workshop was held at the Reisensburg near Ulm, Germany where the above noted opinions were expressed. The purpose of the workshop was to define approaches to education in medical informatics. This workshop resulted in the Reisensburger Protocol that pointed out the way in which medical informatics should be taught.

In addition the idea became more widespread that medical informatics also had to be taught to medical students (e.g. in the USA the GPEP (General Professional Education of the Physician and College Preparation for Medicine) 'Physicians for the Twenty-First Century', or the Dutch approach to medical informatics). In the Netherlands there were even three possible different approaches in teaching informatics: as part of a program in a specific discipline (as was done in medicine where medical informatics was introduced in the curriculum, as a specialization of a discipline with up to 30% informatics in its curriculum and an applied informatics program that focused on a specific discipline, like medical informatics.

In the past a number of conferences were held about experiences in medical informatics education. During these conferences the various programs showed what topics they included in their curricula or the curricula of other disciplines. The IMIA working group on education developed a database in which the characteristics of programs in medical informatics were stored and could be viewed. Also in the European Commission stimulated education in MI by funding the (IT)-EDUCTRA projects and the Nightingale project. It became time to make recommendations about how curricula in medical informatics should be organized (3). In 2000 the first international IMIA Recommendations on education in medical informatics were published. In 2010 the first revision was published. The Recommendations have been widely used.

A last development is the accreditation of programs. This year three programs were accredited by IMIA. In the panel the above mentioned developments will be further discussed.

Medical Decision Support and Medical Informatics Education: Roots, Methods and Applications in Czechoslovakia and the Czech Republic (Jana Zvárová)

The history of medical informatics in Czechoslovakia and the Czech Republic was described, with a focus mainly on the topics of medical informatics education and decision support methods and systems. Several conferences were held in Czechoslovakia and in the Czech Republic, organized in cooperation with IMIA or EFMI. The first IMIA conference held in a socialist country was organized in Prague, Czechoslovakia in 1985. The proceedings covering selected full papers titled Diagnostic Strategies and Expert Systems were published by the Elsevier, North Holland (4). The Velvet Revolution in Czechoslovakia, provoked by a students' strike on November 17th, 1989, opened the door for cooperation in science and education with a number of countries in the world. In 1990s medical informatics topics were further developed in education and decision support tasks on the national level and in an international cooperation. The second IMIA conference in Prague in 1990's focused on medical informatics and medical education. It brought together participants from 18 countries from all over the world and the proceedings Knowledge, Information and Medical Education, published by Elsevier in 1991 (5, 6). Support of several European and national projects focused on medical informatics topics also highly contributed to medical informatics development in the Czech Republic. In 1994, two European projects contributed to the foundation of the European Center for Medical Informatics, Statistics and Epidemiology, EUROMISE, as the joint workplace of Charles University in Prague and Academy of Sciences of the Czech Republic that has been further developing the field of medical informatics in the Czech Republic (6).

Back to the Future: What Can We Learn from History (Marion Ball)

The presentation was inspired from the keynote speech at Medinfo 2010 in Capetown (7). For framing the problem, the presentation started, in a critical but realistic view, with some examples, revealing that newer, more sophisticated and more expensive methods are not always better! A deeper view revealed that, while health information technology worked well in clinical applications such as those which involve laboratory and image data, but for primary care or internal medicine or other more complex clinical environments, the introduction of computer technology has often added to the clinician's time and work. A major challenge of HIT, then, is to develop systems that actually save time, and simplify work, rather than the opposite. Other challenges, like a new type of medical error, which frequently arises due to the involvement of computer systems, or the fragmentation of medical care and the intrusion of administrative and bureaucratic managers to deal with billing and insurance, which often contribute to the unsustainable growth in costs of healthcare. The benefit of such a view is the understanding that these problems can be addressed by reengineering health care systems, while recognizing that not all change requires IT for success and that health IT needs to capitalize on innovations by developing intelligent software tools that can help reduce, rather than increase costs.

Evolution of concepts in Medical informatics (George I. Mihalas)

The classical way to present a "history" is to list major events in a chronological order, with more or less detailed comments about the persons, ideas or events. A distinction between periods brings a systematization flavor, easing the comments. We can distinguish the following stages in the development of medical informatics (8):

- Early stage: (up to ~1975): pioneering work of scientists, major work on: signal analysis, laboratory applications, first attempt on decision support, databases, modeling and simulation of biological processes, biostatistics.

- MI "childhood/youth" (~1975–~1990): founding national and international organizations, conferences, attempts to systematize major areas of MI, first specialized schools, development of methodologies, patient records, health information systems (HIS), advanced decision support - expert systems.

- Consolidation period (~1990–~2000): MI consolidates its position as independent discipline, it became clear that the object of study is "medical information" (not computer applications); implementation of hospital information systems, new chapters (imaging, telemedicine); substantial funding for e-health research start, more visible the complexity of EHR, including confidentiality, data protection, standards etc.

- Maturity of MI (~2000–~2010): clearer understanding of e-health potential to address major challenges of present healthcare, internet impact on medical applications; involvement of politicians, extension of regional/national projects, e-health as business, patient-centered MI, new keywords: integration, interoperability, consumer informatics; awareness on difficulties in real implementation of HIS, "failures" reported; analysis of "barriers", quality assessment, clear contour of sub disciplines: bioinformatics, neuroinformatics, VPH (Virtual Physiological Human) etc.

- Full integration of MI in Medicine and Healthcare (~2010–~2020): increased user acceptance, generalization of EHR/EMR, inclusion in HIS, vertical integration data (molecular/cellular/genetic up to organ/system and whole body, horizontal integration (primary care, specialized ambulatory and hospital data), full interoperability, patient empowerment, visible steps towards "personalized medicine", increase patient safety, preventive medicine, use of portable devices, home monitoring systems, tele-assistance, intensive use of web facilities.

Staging medical informatics (Izet Masic)

The Medical informatics is the foundation for understanding and practice of the up-to-day medicine. Its basic tool is the computer, subject of studying and the means by which the aspects and achieve the new knowledge in the studying of a man, his health and disease, and functioning of the total health activities (9). For the last fifty years of Medical informatics development the five time period are characteristic:

- First period (1955-1965): experimenting, and the studying of the new technologies in the medicine, automatic medical decision making, use of computers in biostatistics, automatic analysis of electrocardiograms, health information systems, computerization of clinical laboratories.

- Second period (1965-1975): solutions for automatized data processing, hospital information systems, medical equipment with built in computers, new biomedical engi-

Figure 3. Jana Zvarova and Casimir A. Kulikowski, co-chairs of Panel about History of Medical Informatics in Prague, April 2013 (Photo: Izet Masic)

neer disciplines, new diagnostic methods and therapeutic procedures based on microprocessors, the computer tomography, computer assisted medical decision.

- Third period (1975-1985): significant progress of computer technique development, the interest for education by health workers grew, important congresses were organized, software packages on market, with significant commercial effects; appearance of personal computers with perfected technical performances, especially memory, intensive application of personal computers.

- Fourth period (1985-1995): standardization of knowledge; intensive research on improvement of methods and technique of artificial intelligence, expert system in medical diagnostics and therapy; intensive connection of hospitals with private doctor surgeries.

- Fifth period (1995-present): development of medical informatics cannot be separated from development of computer technologies; integration of informatics methods into medical segments in health care work sites, improvements of hardware and software technologies, mostly in the domain of projecting on basis of high quality language of the fourth and fifth generation of computers; expansion of the use of microprocessor technology in the diagnostic systems, informatics methods in doctor surgery, building of informatics equipment, instrumentation and prostheses.

IMIA 50th Anniversary History Project and the Prototype Rutgers History Informatics System (Casimir A. Kulikowski)

Developing informatics tools to support the writing of the history of biomedical and health informatics is an important endeavour given the approaching 50th Anniversary of IMIA in 2017. The need is to archive, index, and produce readily accessible recollections from the pioneering days of our field. The Rutgers History Informatics project has developed a MediaWiki to experiment with ways of collecting, indexing and visualizing the materials that related to the evolution of IMIA. The wiki allows access to documents, biosketches and short descriptions of historical events for IMIA, together with timeline summaries which place them in context. The prototype system will be augmented with audio material, and will serve as an archival repository for historical research, including software tools for text analysis and extraction of the information that can be used by authors contributing to the 50th Anniversary IMIA History, which is planned as an edited volume of contributions from all world regions and societies that are members of IMIA. Contributions to the IMIA History Project are already being published as articles in the IMIA Yearbook (2, 10, 11, 12, 13). The analysis of materials on the MediaWiki should help in studying the participation of different researchers and research groups in the activities of IMIA, and the "social networks" of scientists, practitioners, and education specialists that have led the activities of the organization, supplementing conventional citation analyses. The patterns of participation and interaction between different regional and world-wide activities of IMIA will be clearly outlined and visualizable on maps and correlated to summaries of the subfields of specialization of medical informatics, and the main themes that have dominated the discourse and publications in our discipline will also be more clearly analyzable. This represents a novel informatics-based community-building enterprise, very much like Wikipedia content development, but focused on the specific discipline of biomedical and health informatics, and for its specific worldwide association: IMIA (Figure 3).

PANEL ORGANIZERS AND PARTICIPANTS

- George I Mihalas - president of EFMI 2006-2008, member of IMIA History Task Force, University of Medicine and Pharmacy, Timisoara, Romania.
- Jana Zvarova - director of the EuroMISE Center since 1994, Czech Republic representative in EFMI and IMIA, First Faculty of Medicine of Charles University in Prague and Institute of Computer Science of the Academy of Sciences of the Czech Republic.
- Casimir Kulikowski - member of IMIA Board, chair of IMIA History Task Force, Rutgers University, New Jersey, USA.

- Marion Ball - president of IMIA 1992-1995, senior advisor IBM Research, John Hopkins University, Baltimore, Maryland, USA.
- Jan H. van Bemmel - president of IMIA 1998-2001, former rector of Erasmus University Rotterdam, The Netherlands.
- Arie Hasman - vicepresident of IMIA 2010-2013, chair Education WG of EFMI, University of Amsterdam, The Netherlands.
- Izet Masic - Bosnia-Herzegovina representative in EFMI, chair of MIE 2009, President of Academy of Medical Sciences of Bosnia and Herzegovina, Chair of Task Force of EFMI Medical informatics journals.
- Barry Barber - member of EFMI Founding group, UK representative in EFMI 1976-1999, honorary member of EFMI.
- Diane Whitehouse - The Castlegate Consultancy UK, previously worked in the e-Health and e-Inclusion units, European Commission, Brussels, co-editor of "e-Health Management: From Vision to Reality" Palgrawe, MacMillan, London, UK., 2014.

REFERENCES

1. Hayes G, Barnett D. (eds). UK Health Computing. Recollections and Reflections, BCS, Swindon, UK, 2008.
2. Van Bemmel JH. People and Ideas in Medical Informatics - A Half-Century Review. IMIA Yearbook of Medical Informatics, Schattauer, Stuttgart, 2011: 175-82.
3. Hasman A, Albert A, Wainwright P, Kar R, Sosa M. Education and Training in Health Informatics in Europe. IOS Press. Amsterdam, 1995.
4. Van Bemmel JH, Gremy F, Zvarova J. (eds.): Diagnostic Strategies and Expert Systems. North Holland, Amsterdam, 1985.
5. Van Bemmel JH, Zvarova J. (eds.). Knowledge, Information and Medical Education. North Holland, Amsterdam 1991.
6. Zvárová J. Medical Decision Support and Medical Informatics Education: Roots, Methods and Applications in Czechoslovakia and the Czech Republic. IMIA Yearbook of Medical Informatics. 2013: 206-12.
7. Ball M. Back to the Future: What Have We Failed to Learn? How Does the Future Look? Yearb Med Inform. 2011: 196-8.
8. Mihalas GI. An attempt to define major stages of Medical Informatics development, CD Proceedings. IMIA-LAC Conference, Guadalajara, Mexico, 2011.

9. Masic I. Review of informatics and Medical informatics History. Acta Inform Med. 2007; 15(3): 178-88.

10. Peterson HE, Lundin P. Documenting the Use of Computers in Swedish Health Care up to 1980. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2011: 169-74.

11. Yacubsohn VA. Short History of the Beginnings of Hospital Information Systems in Argentina, IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2012: 163-8.

12. Fieschi M. The Development of AI in Medicine and the Research Environment of the SPHINX Project at the Start of the 1980s, IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2012: 153-60.

13. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics, IMIA Yearbook on Medical Informatics. Schattauer, Stuttgart, 2007: 165-75.

14. Zvárová J. Education in Methodology for Health Care - EuroMISE. Methods of Information in Medicine. 1994; 33: 315-7.

03

Izet Masic

FIVE PERIODS IN THE DEVELOPMENT OF MEDICAL INFORMATICS

Development of Medical informatics started in the fifties of 20th century, first in USA, later in Europe and developed Eastern countries. Development of Information and Communication Technologies (ICT) was very important for development of Health and Medical informatics in all scientific biomedical fields and practicaly in all sectors of healthcare protection (1-5). The decrease of hardware price and wide availability of personal computer (PC), led to the formation of particular application and problem solving under the control of users. Decentralized structure of the contemporary medicine with lots of specialization favors such tendency (6-10). The computers become more and more the integral parts of the medical equipment (for example: Color Doppler, Computerized tomography (CT), MRI, etc. Also, more and more of PCs are used for physicians dayly work in surgeries for data collecting, processing and storaging on different media about patients for purposes like decision making, research or education. Such peripheral applications do not favor including into central approaches as net nodes or in the peripheral stations of the central systems, so the users collect the fruits from the general field of informatics, they are not getting rich with achievements of the new method of the medical informatics (11-18) .

The development of own methodology is the characteristics of the new science. However, the medical informatics does not use the unique methodology. Particular applications in the medicine have lead to the mixture of interdisciplinary methodologies and application of formal methods at empiric discipline.

*This text is republished from the book “Contributions to the History of Medical Informatics” (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

The medical aspects of the methodologies which they consider necessary for the creation of the medical informatics as scientific discipline are as follows (1, 7):

- Tests evaluation data collecting method regarding to the objectivity, sensitivity,-confidence and value;
- Analysis of data informational contents;
- Analysis and formal treatment of medical opinion and actions;
- Evaluation of usefulness of medical decisions and actions;
- Regulation of the theoretic concept of causative interrelation between the objects and processes;
- System analysis in health care: modeling and simulations.

By connecting medical science and disciplines with technologies, as well as disciplines in information and computer sciences, creates the methodologies by means of which those technologies and disciplines can contribute to the adequate use of medical knowledge basis and providing better health protection. It should also be noticed that with the use of medical informatics methods, those technologies which get into the composition of wide field of the medical informatics are being reexamined, such as the evaluation of diagnostics technologies (by computer supported or non supported) and the evaluation of the informational system.

INTRODUCING OF COMPUTERS APPLICATIONS IN THE MEDICINE AND HEALTHCARE PROTECTION

The development of contemporary medical documentation was followed by advancement of data method processing. The real application of informatics on health care activity dated only some decades backwards and appeared in the time of computers devices and electronic computers development (1, 4, 6, 7, 16, 20). The first expert article in which the idea about application of computer technologies in the medicine was presented by Robert S. LEDLEY and Lee Browning LUSTED (1959), and that article was considered to be the basic literature from the field of the medical informatics (1, 4). In the mentioned article the authors mediate about medical application of the electronic computers in the diagnostics and therapy, establishing theoretic foundations for medical decisions by means of computers. Therefore the beginning of the medical informatics connect for the fifties years of 20th century, in which is fertilized the appearances of the first commercial electronic computers and their application in the field of medicine.

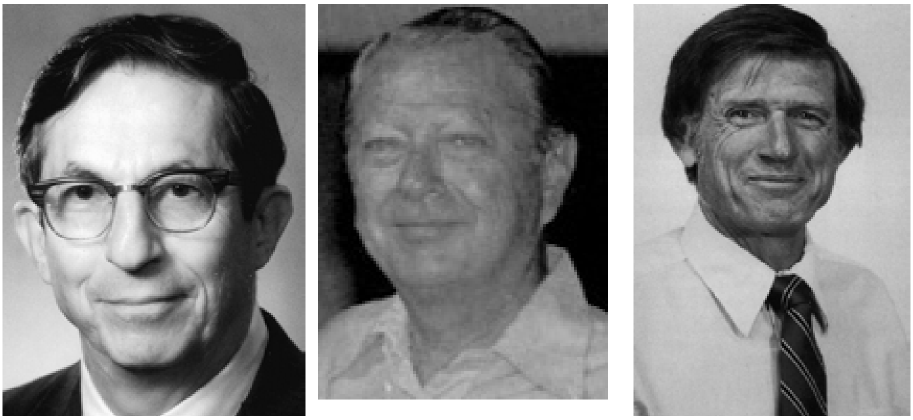


Figure 1. Robert S. Ledley (1926-2012), Lee Browning Lusted (1922-2012), Octo G. Barnett (1930-2020)

Since those years and till today has increased the number of information; came to the exponential growth of knowledge; also the number of scientists and researches has increased, and the science has become the real industry of the modern world which uses the contemporary electronic technology on the market of ideas. On the electronic technology has begun, also, to base the contemporary medical equipment, and in the practice are developing the numerous health care information systems, as well as mighty bases of the bibliographic information of the medical literature. The informatics age has strongly splashed the medicine.

FIVE PERIODS IN DEVELOPMENT OF MEDICAL INFORMATICS

For the last fifties and some more years of Medical informatics development the five time period are characteristic (1, 4, 6, 7, 18):

The first period from 1955 till 1965 mainly is characterized by experimenting, and the studying of the new technologies in the medicine. The pioneers of medical informatics are Joshua LEDERBERG (1925-2008) and William Shigeru YAMAMOTO (1924-2009) who early showed interest in automatic calculation in the forties of the 20th century. The important work of Robert S. Ledley (1926-2012), as the first medical professional working with the first computer of the pre-transistor era SEAC on the development of new computing methods in the field of symbolic logics is described, leading later to his famous work with Lee Browning Lusted (1922-2012) in automatic medical decision making. Another important step in medical informatics history was the development of BMDP software (Biomedical Programs) by Wilfrid J. DIXON (1915-2008) and collaborators, allowing the use of computers in biostatistics. As the first project in the field of computerized diagnostics, resulting from an incentive of Arthur E. “Buck”RIKLI (1917-

Figure 2. Joshua Lederberg (1925-2008), William Shigeru Yamamoto (1924-2009), Wilfrid J. Dixon (1915-2008), Charles Molnar (1935-1996), Wesley Allison Clark (1927-2016), William Edward Hammond II (1935-)

2015), Cesar A. CACERES ("father of clinical engineering") and Hubert V. PIPBERGER (1920-1993) developed a method for automatic analysis of electrocardiograms. The introduction of ARPANET, inovated by Timothy John Berners-Lee (1955-), known as TimBl, an early forerunner of INTERNET, is noted as an important step for development of computerized medical applications. The history of the development of health information systems, computerization of clinical laboratories, computerized medical records, automated multiphase health screening is presented.

The names as G. Octo BARNETT (1930-2020) from the Massachusetts General Hospital, Wesley Allison CLARK (1927-2016) and Charles MOLNAR (1935-1996) from the Massachusetts Institute of Technology, William Edward "Ed" HAMMOND II (1935-) from the Duke University, Lawrence L. WEED from the University of Vermont ("The father of the Problem-Oriented Medical Record" - POMR), Morris F. COLLEN (1913-2014) from the Kaiser-Permanente Medical Care ("The father of Medical Informatics"), and others are mentioned (Figure 1 and 2). The National institute for health care in USA (NIH) in 1960 founded the Advisory committee for the computer application in the

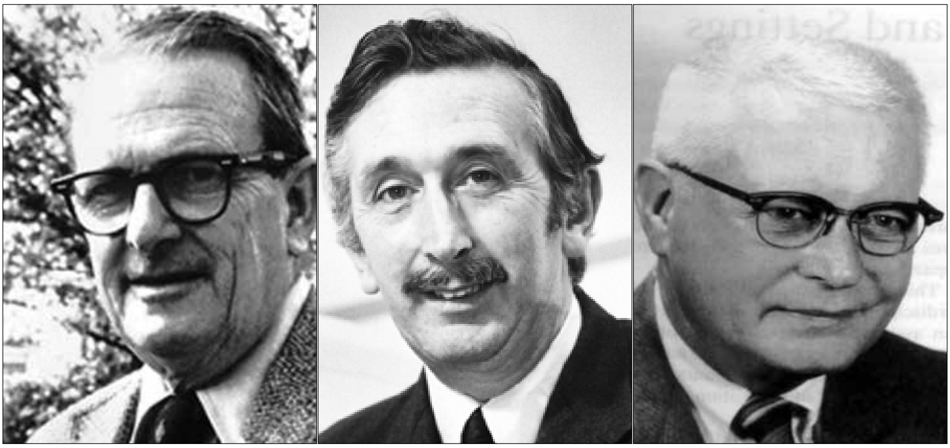


Figure 3. Allan Cormack (1924-1998), Godfrey N. Hounsfield (1919-2004), Jack D. Myers (1914- 1998)

Figure 4. Eugene Garfield (1925-2017), Edward Shortliffe (1947-), Bruce G. Buchanan (1935-)

researchers (ACCR) with significant material investment of money (about 40 million dollars), induced the development in the field of automatization of the medical health care services, of modeling and simulation, equipment and instrumentarium, recognition of samples, training in biomedical of literature. That was the strong stimulus to the rapid development of the medical informatics, first of all in USA, and then in the whole world. In this period appeared also the first prototype of the clinical information system (BIS) in El Camino Hospital in California. For creating of BIS was very important was realizing of documenting patient encounters in the medical record, as integral part of practice workflow - starting with patient appointment scheduling to writing out notes and finishing with medical billing, using a developed method of documentation - SOAP (an acronym for subjective, objective, assessment and plan), and originated from POMR, developed by dr. Lawrence Weed.

Figure 5. Casimir A. Kulikowski (1944-), Klaus Peter Adlassnig (1950-), Carl Djerassi (1923-2015)

The second period from 1965 till 1975 characterizes the numerous invention activities of adequate solutions for the automatized data processing. By the end of the sixties West European countries were establishing the numerous hospital information systems (HIS). Firstly, medical equipment with built in computers were applied. The new biomedical engineer disciplines were developed; new diagnostic methods and therapeutic procedures based on the micro processing technology were introduced. The development of medical informatics in Europe was presented, describing the pioneering role of Peter L. Reichertz (1930-1987) in Hannover, Germany and François Grémy (1929-2014) in Paris, France. First hospital information systems in Europe were implemented during the late sixties in Sweden (Danderyd and Karolinska Hospital), Great Britain (Kings Hospital in London) and Germany (Medizinische System Hannover). In 1979 the first Nobel Prize in physiology and medicine was given for an achievement in medical informatics, the computer tomography – the laureates were Godfrey N. HOUNSFIELD (1919-2004) and Allan M. CORMACK (1924-1998). Computer assisted medical decision making started to develop significantly in the seventies in USA with the consultation system HELP of Homer R. WARNER (1911-2012) ("A pioneer of Using Computer in Patient Care") and collaborators. In early seventies the development of artificial intelligence methods and expert systems was noted. In this connection, presented were the systems DENDRAL of Edward Albert FEIGENBAUM (1936-), Bruce BUCHANAN (1940-), Joshua LEDERBERG (1905-2008) and Carl DJERASSI (1923-2015-), INTERNIST of Jack D. MYERS (1914-1998) and collaborators, CASNET of Kasimir A. KULIKOWSKI (1944-) and Sholom M. WEISS, MYCIN and ONCOCIN of Edward H. SHORTLIFFE (1947-) and collaborators, CADIAG-2 of Klaus-Peter ADLASSNIG (1950-), KARDIO of Ivan BRATKO (1946-) and collaborators. (Figure 3, 4 and 5). Mentioned scientists are representative of the group who created Pattern recognition as a branch of "machine learning".

The third period from 1975 till 1985 year is significant with the progress of computer technique development when it became cheaper, which lead to very intensive development of the information system at all the levels of health care system, from the primary to the quaterly level. The interest for education by health workers grew being engaged by medical informatics. The expert and scientific assemblies from the field of the medical informatics become with time more and more numerous and assembled a lot of experts of all profiles, including also the significant number of doctor who began to engage in the medical informatics professionally. Important congresses were organized: twelve world congresses of medical informatics organized by International Medical Informatics Association - IMIA, founded in 1974 and twentyfive European congresses organized by European Federation of Medical Informatics - EFMI, founded in 1976 (21, 22). In this period appear the (software) packages on market, becoming the profitable venture with the significant commercial effects. Only in USA, during those years, they had 25 producers for the health care information systems with year turnover between 5 and 7 milliard dollars. This period is characterized also by the appearance of personal computers at the world market with the perfected technical-technologic performances, especially by memory capacities, what enabled the powerful development of informatics in health care system. Besides, the intensive and mass application of personal computers opened the new possibilities - namely connecting computers from home ambulance directly to the informational systems in health care centers. The installation of terminals was being intensified by patient beds (bed side terminal), when medical nurses for their current tasks, and patients - if they are able to - had possibilities of correcting wrongly taken data.

The fourth period from 1985 to 1995 was the new phase of medical informatics development. And further was the development of health care informatics intensified and was meeting high standards through new manner enabling processing and standardization of knowledge. Intensive researches on improvement of methods and technique of artificial intelligence was conducted, and included development and application of expert system in medical diagnostics and therapy. The artifficial intelligence was being introduced as separate discipline of medical informatics, and began to be used by numerous expert systems in practice, about which we will speak later. The hospital information systems, in this period, became more complex, more functional and more qualitative than the previous ones and supported greater number of hospital function. These systems were composed of more independent modules integrated by contemporary communications into unique system which supported all functions of a health care organization regardless to its size and complexity. Formerly built in information systems they Integrated primary health care (ISPHC) and hospital information systems (HIS) into complex systems both on regional and national level. Such approach showed significant advantages in the development of HIS, Especially intensive connection of hospitals with private doctor surgeries by computer technologies was seen in USA. In recent years, the clinical information systems ("Clinical Departmental Systems") with applications into HIS are being developed supporting connection of a patient and definite medical specialization, supporting decisions making in every day medical work.

The fifth period, from 1995 to present, development of medical informatics can not be separated from development of computer technologies. With regard to this, we have to emphasize the fact once again, that the area of the medical informatics significantly grows wider than just the application of electronic computers, although the technical development of microprocessor and telecommunication technologies are significantly influenced by the development of the medical informatics and can not be imagined without electronic computers. At the beginning the technical foundation ("hardware"), is necessary for support of information systems development, and was unimproved and inadequate so that the beginning of applications in this region were modest and limited. In the meantime, however, accounting and computer technologies immensely advanced. For example, the appearance of electronic computers with network of terminals significantly influenced integration of informatics methods into medical segments in health care work sites, which was the basis for development of health care information systems in all segments of health care activities. Investment in huge material means of payment and adequate human potentials in this high specialized development, resulted with significant improvements of hardware and software technologies, mostly in the domain of projecting on basis of high quality language of the fourth and fifth generation of computers. All this brought to the expansion the use of microprocessor technology in the diagnostic systems, and expansion of technology usage brought to wider use of microprocessor technologies and led to so called "information revolution" of our time, resulting in application of informatics methods in doctor surgery, building of informatics equipment, instrumentation and prostheses (1, 15).

Behind us is five generations of computers, and already considerably is being done upon the sixth generation, of which hardware basis makes the "biochip" as a foundation of microcomputers. This is completely new technique which, according to many, approaches to physiologic mechanism of neurosynapsis in human brain. The contemporary informatics technology enables current realization of Lusted and other pioneers idea for medical computer application, especially in the domain of medical decisions making. By this the medical informatics becomes the basic discipline of nowadays medical science and practice (15, 16).

REFERENCES

1. Masic I, Ridjanovic Z, Pandza H, Masic Z. Medical Informatics. Second edition. Avicena. Sarajevo, 2010: 13-36. ISBN 978-9958-720-39-0.

2. Masic I. History of Medical Informatics. an Overview. Avicena. Sarajevo, 2014: 29-63. ISBN 978-9958-720-56-7.

3. Masic I. A History of Medical informatics in Bosnia and Herzegovina. Avicena, 2007: 3-26.

4. Masic I. A Review of Informatics and Medical informatics History. Acta Inform Med. 2007; 15(3): 178-88.

5. Masic I. The History and New Trends of Medical Informatics. Donald School J Ultrasound Obstet Gynecol. 2013; 7(3). 301-12.

6. Kern J, Petrovecki M. i sur. Medicinska informatika. Medicinska naklada, Zagreb, 2009: 269-92.

7. Shortlife EH, Pereault LE, Wiederhold G, Fagan LM. Medical Informatics. Computer Applicationsin Health Care and Biomedicine. Springerrlag, New York, 2000: 3-40.

8. Masic I, Ridjanovic Z. Medicinska informatika. Avicena. Sarajevo, 1994: 269-92.

9. Masic I, Ridjanovic Z. Medicinska informatika. Knjiga 1. Osnove Medicinske informatike. Avicena. Sarajevo, 1999; 195-220. ISBN 9958-720-16-7.

10. Dezelic Gj. Zdravstvena informatika. Medicinski fakultet Sveucilista u Zagrebu. Zagreb, 1991: 53-6.

11. Bemmel van J, Musen AM. Handbook of Medical Informatics, Springer-Verlag, 1997: 37-51.

12. Ball M, Lindberg D, Masic I. Special Tribute on Morris F. Collen: Charismatics Leader of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 4-5. doi: 10.5455 aim/2014.22.4-5.

13. Masic I, Pandza H. Praktikum iz medicinske informatike. Avicena. Sarajevo, 1999: 5-22.

14. Mihalas G, Zvarova J, Kulikowski K, Ball M, van Bemmel J, Hasman A, Masic I, Whitehouse D, Barber B. History of Medical Informatics in Europe - a Short Review by Different Approach. Acta Inform Med. 2014 Feb; 2014; 22(1): 6-10. doi. 10.5455 aim/2014.22.6.10.

15. Milinkic S, Masic I. Information technologies in the new millenium. Med Arh. 1999; 53(4, sup.3): 100.

16. Masic I. Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-48. doi: 10.5455(aim.2014.22.44.48.

17. Zvarova J, Masic I. Medical informatics - an interdisciplinary approach. Med Arh. 1996; 50(3-4): 107-9.

18. Colen MF. Fifty Years in Medical informatics. IMIA Yearbook of Medical Informatics, 2006: 174-9.

19. Dezelic G, Kern J, Petrovecki M, Ilakovac V, Hercigonja-Szekeres M. Medical Informatics in Croatia - a Historical Survey. Acta Inform Med. 2014 Feb; 22(1): 49-59. doi: 10.5455/aim.2014.22.49-59.

20. Dezelic Gj. Short review of Medical informatics history. Acta Inform Med. 2007; 15(1): 49-61.

21. Hofdijk J, Weber P, Mantas J, Mihalas G, Masic I. A Short Factography About International Medical Informatics Association and European Federation for Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 71-78. doi: 10.5455/aim.2014.22.71-78.

22. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics. IMIA Yearbook of Medical Informatics. 2007: 165-75.

04

Izet Masic

THE HISTORY OF MEDICAL INFORMATICS DEVELOPMENT - AN OVERVIEW

WORLDWIDE MEDICAL INFORMATICS DEVELOPMENT

Medical Informatics as academic and scientific biomedical discipline

Medical/Health/Biomedical informatics is a multi-disciplinary area that involves multiple content areas. It is one of the fastest growing subject/content areas in the world (1-3). The use of informatics is expected to enhance research efforts in areas such as genomics and proteomics, for example, and also to change the way medicine is practiced in the 21st century (3-6).

Research in Medical informatics ranges from the theoretical to applied efforts. The demand for more research in Medical informatics and for Biomedical informatics to support other researchers escalates daily (2, 5).

The development of Medical informatics began in the 1950's of 20th century, when the earliest reference to applications of electronic digital computers in medicine appeared. Historical facts in this article reflect on the development of the discipline of Medical/Health informatics that is now part of all medical disciplines and part of the medical practice of all health professionals (2). Applications of computer and information technologies in all segments of society and knowledge of information technology is now part of general literacy (1).

*This text is republished with permission of IJBH journal - Int J Biomed Healthc. 2020; 8(1): 37-52. doi: 10.5455/ijbh.2020.8.37-52, with permission of Publisher: Avicena, d.o.o., Sarajevo, Bosnia and Herzegovina. Some parts are corrected and edited by Editor of this book.

The classical way to present a “history” is to list major events in chronological order, with more or less detailed comments about the persons, ideas or events. A distinction between periods brings a systematization flavor, easing the comments.

During that period, new terms were born: medical computer science, computer medicine, medical electronic data processing, medical automatic data processing, medical information processing, medical information science, medical software engineering and medical computer technology. Most of these terms were interchangeable, such as medical computer science for medical information science, etc.

George Mihalas at Prague Conference about History of Medical Informatics (MI) in April 2013 proposed the following stages in the development of Medical Informatics (7):

a) **Early-stage Medical Informatics (MI):** (up to ~1975): pioneering work of scientists, major work on signal analysis, laboratory applications, the first attempt on decision support, databases, modeling and simulation of biological processes, biostatistics;

b) **Childhood / youth of MI (1975 -1990):** founding national and international organizations, conferences, attempts to systematize major areas of MI, first specialized schools, development of methodologies, patient records, health information systems (HIS), advanced decision support–expert systems;

c) **Consolidation of MI (1990-2000):** MI consolidates its position as an independent discipline. It becomes clear that the object of study is medical information (not computer applications); implementation of hospital information systems (HIS), and new chapters (imaging, telemedicine). Substantial funding for e-health research is allocated, the complexity of EHR becomes more visible, including confidentiality, data protection, standards etc.;

d) **Maturity of MI (2000-2010):** a clearer understanding of e-health potential to address major challenges of present healthcare, internet impact on medical applications; involvement of politicians, an extension of regional/national projects, e-health as a business, patient-centered MI, new keywords: integration, interoperability, consumer informatics; awareness on difficulties in the real implementation of HIS, “failures” reported; analysis of “barriers”, quality assessment, the clear contour of sub-disciplines: bioinformatics, neuroinformatics, Virtual Physiological Human, etc.

e) **Full integration of MI in Medicine and Healthcare (2010-2020):** focus on user acceptance, a generalization of EHR/EMR, inclusion in HIS, vertical integration data (molecular/cellular/genetic up to organ/system and whole body, horizontal integration (primary care, specialized ambulatory, and hospital data), full interoperability, patient empowerment, visible steps towards “personalized medicine”, increase pa-

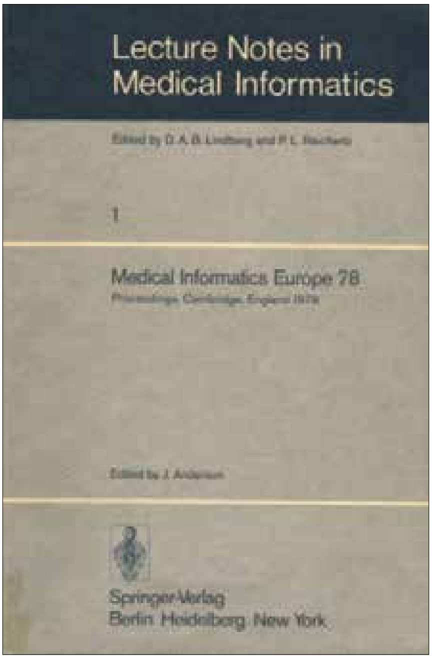


Figure 1. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

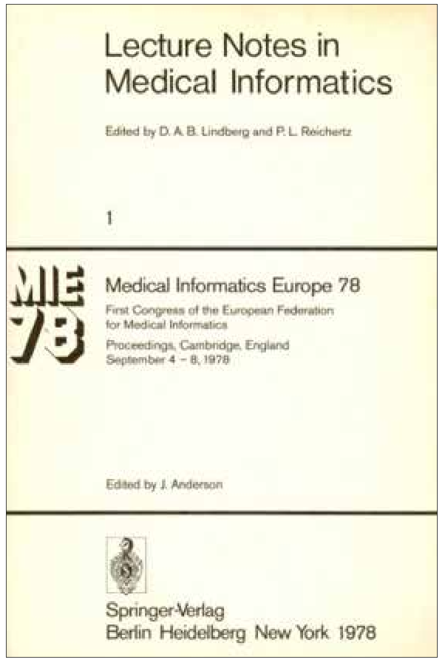


Figure 2. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

tient safety, preventive medicine, use of portable devices, home monitoring systems, Tele-assistance, intensive use of web facilities.

If Medical informatics is regarded as a scientific discipline dealing with theory and practice of information processes in medicine, comprising data communication by information and communication technologies (ICTs), with computers as an especially important ICT, then it can be stated that the history of Medical informatics is connected with the beginnings of computer usage in medicine (1, 5, 1-20).

Consequently, in accordance with this definition of Medical informatics, it was implemented in fifties of 20th century, when first electronic computers appeared and were implemented in different fields of science and business, including medicine (21-26).

It wasn't until the late 1950s, that the argument was made for computers to be integrated into the healthcare field for the sake of automation, error reduction and perhaps even performance improvement, thanks to Philippe Dreyfus in Paris, France. After gaining his Master Degree in physics in 1950 from the École supérieure de physique et de chimie industrielles de la ville de Paris (9) he became a professor at the Informatics faculty at Harvard University using Mark I, the first automated computer ever built. In 1958 he was nominated director of the Bull Calculus Centre. In 1962 he

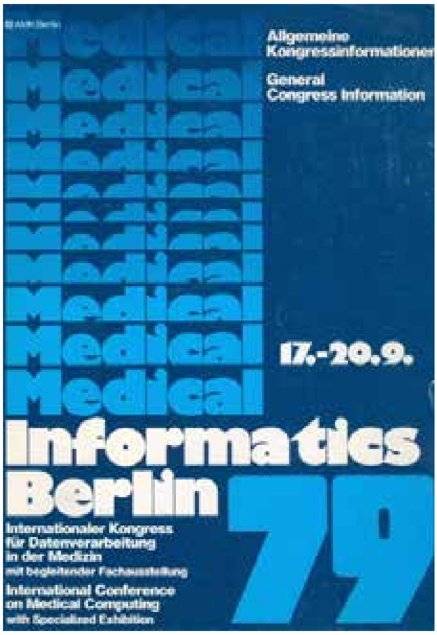


Figure 3. Cover page of Proceeding of MIE '79, Berlin, FR Germany 1979

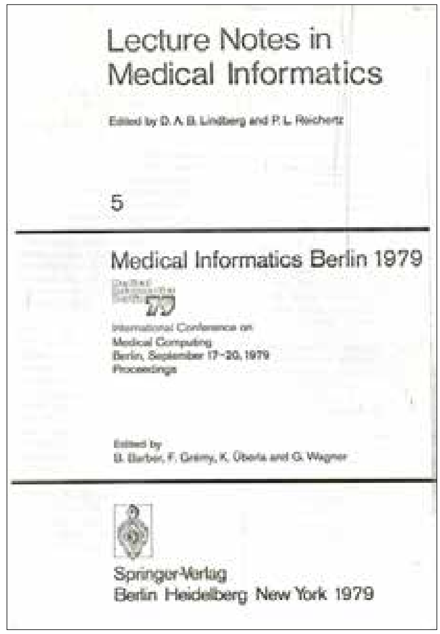


Figure 4. Cover page of Proceeding of MIE '79, Berlin, FR Germany, 1979

coined the new term informatique (9). He established the coined term - Informatics (information + automatique) in 1962 (1, 9).

The publication of a highly influential paper, "Reasoning Foundations of Medical Diagnosis," by Ledley and Lusted, helped propel the movement even further. Early names for Health informatics included medical computing, biomedical computing, medical computer science, computer medicine, medical electronic data processing, medical automatic data processing, medical information processing, medical information science, medical software engineering, and medical computer technology (1-3). Joshua Lederberg and William S. Yamamoto in the forties of 20th century early showed interest in automatic calculation (1).

Development of Medical informatics started in the fifties of last century. In the post-war period USA was the leading country in the field of computer science and this led to the first uses of computers in medicine (11-15). In the very beginning, there was Germany's Dr. Gustav Wagner, founder of the German Society for Medical Documentation, Computer Science and Statistics and Peter Leo Reichertz (4, 5). It was the world's very first professional organization for informatics (1). In UK pioneers of Health informatics were William Abott, John Anderson, etc., In France Francois Gremy, Antoine Remond, etc., in USA Morris Collen, Homer Warner, Marsden Blois, Jr. etc., in Canada David Shires, in Austria Heinz Zemanek, in Japan Shigekoto Kaihara, in former Yugoslavia Gjuro Dezelic, Stefan Adamic, in Czechoslovakia Jana Zvarova, in Romania George Mihalas, etc.

The development of information and communication technologies (ICT) during the last two decades of 20th century was particularly important for medical informatics, with Internet and its profound influence on the everyday medical work. It is emphasized that Internet caused a new information revolution since Medical information became available to the public and ceased to be in exclusive control of health professionals. The development and global spreading of ICT brought also new medical fields, interdisciplinary connected to medical informatics: telemedicine and cyber-medicine (16-20).

According to its name, Medical informatics is connected to the beginnings of electronic computers implementation in medicine. It started in fifties of 20th century when first electronic computers appeared and were implemented in different fields of science and economy.

What is the informatics?

The answer to this question is neither facile nor unambiguous, as informatics being a young scientific discipline, still without unique definition. There are at least three reasons; terminological disagreements, various approaches in the comprehension of informatics notion and region wide enough to study informatics problem. Therefore the informatics definition differentiates from one user to another and these differences are most prominent between west and east informatics theoreticians.

Medical informatics has to do with all aspects of understanding and promoting the effective organization, analysis, management, and use of information in health care. While the field of Medical informatics shares the general scope of these interests with some other health care specialties and disciplines, Medical (Health) informatics has developed its own areas of emphasis and approaches that have set it apart from other disciplines and specialties (1-3). Being a young scientific discipline the informatics has found exceptionally wide application, not only in every science branch, but also in every economy and non-economy activities of human society. Informatics bacomes practically irreplaceable in all life regions and man work. Especially emphasized interest for the application of informatics is automatized information system, and appears in health activity field. In these efforts emerges and develops new medical discipline under the name “Medical informatics”.

Medical informatics has been emerging as a discipline in its own right over the past quarter century with number of notable attempts along the way to define the field in scientific and formal yet succinct terms (1). The Medical informatics is the foundation for understanding and practice of the up- to-day medicine. Its basic tool is the computer, subject of studying and the means by which the aspects and achieve the new knowledge in the studying of a man, his health and disease, and functioning of the total health activities (5).

Medical informatics as a multidisciplinary field that uses health information technology (HIT) to improve health care via any combination of higher quality, higher efficiency (spurring lower cost and thus greater availability), and new opportunities, developed differently in USA and Europe (8). Most notably, the UK spearheaded the field forward. The broad history of health informatics in the UK is often described with 'early development of health informatics was unorganized and idiosyncratic'. In the early 1950s, it was prompted by those involved in NHS finance and only in the early 1960s did solutions including those in pathology (1960), radiotherapy (1962), immunization (1963), and primary health care (1968), emergency care, etc. (1, 4).

Many of these solutions, even in the early 1970s were developed in-house by pioneers in the field to meet their own requirements. In part this was due to some areas of health services (for example the immunization and vaccination of children) still being provided by Local Authorities. The UK health informatics community has long played a key role in international activity, joining TC4 of the International Federation of Information Processing (1967), which became IMIA (1979). Under the aegis of BCS Health, Cambridge was the host for the first EFMI Medical Informatics Europe (1978) conference and London was the location for IMIA's tenth global congress (Figure 1 and 2), and the second MIE Conference held in Berlin (Federal Republic of Germany in 1979 (Figure 3 and 4) (5).

The Medical informatics community is still growing, it is by no means a mature profession, but work in the UK by the voluntary registration body, the UK Council of Health Informatics Professions has suggested eight key constituencies within the domain - information management, knowledge management, portfolio/programme/ project management, ICT, education and research, clinical informatics, health records(service and business-related), health informatics service management. These constituencies accommodate professionals in and for the NHS, in academia and commercial service and solution providers. Since the 1970s the most prominent international coordinating body has been the International Medical Informatics Association (IMIA) (4, 5).

In America, the field of Medical informatics unfolded somewhat differently. Even though the idea of using computers in medicine emerged as technology advanced in the early 20th century, it was not until the 1950s that informatics began to have an effect in the United States. The earliest use of electronic digital computers for medicine was for dental projects in the 1950s at the United States National Bureau of Standards by Robert Ledley. During the mid-1950s, the United States Air Force (USAF) carried out several medical projects on its computers while also encouraging civilian agencies such as the National Academy of Sciences - National Research Council (NAS-NRC) and the National Institutes of Health (NIH) to sponsor such work (1, 11, 12, 18).

In 1959, Robert S. Ledley and Lee B. Lusted published “Reasoning Foundations of Medical Diagnosis,” a widely read article in Science, which introduced computing (especially operations research) techniques to medical workers. Ledley and Lusted’s article has remained influential for decades, especially within the field of Medical Decision-Making (MDM). Guided by Ledley’s late 1950s survey of computer use in biology and medicine (carried out for the NAS-NRC), and by his and Lusted’s articles, the NIH undertook the first major effort to introduce computers to biology and medicine.

Very important step in Medical informatics history was the development of BMDP software (Biomedical Programs) developed by Wilfrid J. Dixon and collaborators, allowing the use of computers in Biostatistics. As the first project in the field of computerized diagnostics, resulting from an incentive of Arthur E. Rikly, Cesar A, Caceres (“Father of Clinical Engineering”) and Hubert V. Pipberger developed a method for automatic analysis of electrocardiograms. The introduction of ARPANET, inovated by Timothy John Berners-Lee, known as TimBl, an early forerunner of INTERNET, is noted as an important step for development of computerized medical applications. The development of Health Information Systems (HIS), computerization of clinical laboratories, computerized medical records, automated multiphase health screening were very important for intesified qauality of all kind health services. The names as Octo G. Barnett from the Massachusetts General Hospital, Wesley Allison Clark and Charles Molnar from the Massachusetts Institute of Technology, William Edward “Ed” Hammond from the Duke University, Lawrence L. Weed from the University of Vermont (“The Father of the Problem-Oriented Medical Record” - POMR) with Morris Collen signed pioneering period of the development Medical informatics field between 1955th and 1965th (11, 12).

This effort, carried out initially by the NIH’s Advisory Committee on Computers in Research (ACCR), chaired by Lusted, spent over $40 million between 1960 and 1964 in order to establish dozens of large and small biomedical research centers in the US. One early (1960, non-ACCR) use of computers was to help quantify normal human movement, as a precursor to scientifically measuring deviations from normal, and design of prostheses (1). The use of computers (IBM 650, 1620, and 7040) allowed analysis of a large sample size, and of more measurements and subgroups than had been previously practical with mechanical calculators, thus allowing an objective understanding of how human locomotion varies by age and body characteristics.

The next steps, in the mid-1960s, were the development (sponsored largely by the NIH) of expert systems such as MYCIN, developed by Edward H. "Ted" Shotliffe and collaborators, Internist-I, developed by Jack D. Myers et collaborators.

In 1965, the National Library of Medicine started to use MEDLINE and MEDLARS. Around this time, Neil Pappalardo, Curtis Marble, and Robert A. Greenes developed MUMPS (Massachusetts General Hospital Utility Multi-Programming System) (1, 11, 18). In the 1970s and 1980s it was the most commonly used programming language for clinical applications. The MUMPS operating system was used to support MUMPS language specifications. As of 2004, a descendent of this system is being used in the United States Veterans Affairs hospital system.

During the 1960s, Morris Collen developed computerized systems to automate many aspects of multiphasic health checkups (1). These systems became the basis the larger medical databases Kaiser Permanente developed during the 1970s and 1980s. The American College of Medical Informatics (ACMI) has since 1993 annually bestowed the Morris F. Collen, MD Medal for Outstanding Contributions to the Field of Medical informatics. In the 1970s a growing number of commercial vendors began to market practice management and electronic medical records systems. Although many products exist, only a small number of health practitioners use fully featured electronic health care records systems.

In 1970, Warner Slack, MD, and Howard Bleich, MD, co-founded the academic division of clincal informatics at Beth Israel Deaconess Medical Center and Harvard Medical School (2). Warner Slack is a pioneer of the development of the electronic patient medical history and in 1977 Dr. Bleich created the first user-friendly search engine for the worlds biomedical literature. In 2002, Dr. Slack and Dr. Bleich were awarded the Morris F. Collen Award for their pioneering contributions to Medical informatics.

Computerized systems involved in patient care have led to a number of changes. Such changes have led to improvements in electronic health records which are now capable of sharing medical information among multiple healthcare stakeholders thereby, supporting the flow of patient information through various modalities of care.

Computer use today involves a broad ability which includes but isn't limited to physician diagnosis and documentation, patient appointment scheduling, and billing (5, 8, 18). Many researchers in the field have identified an increase in the quality of healthcare systems, decreased errors by healthcare workers, and lastly savings in time and money. The system however is not perfect and will continue to require improvement. Frequently cited factors of concern involve usability, safety, accessibility, and user friendliness.

As leaders in the field of Medical informatics improve upon the aforementioned factors of concern, the overall provision of healthcare will continue to improve. AMIA has named an award after Homer H. Warner, one of the fathers of Medical informatics, who with associates developed consultation system HELP, and who founded the Department of Medical Informatics at the University of Utah in 1968 (2), on application of informatics to medicine (11, 12).

Clinical Informatics AMIA's contribution

New medical specialties and subspecialties emerge over time like Anesthesia in the 19th century or Emergency Medicine in the 20th century (1). Medical Informatics and its subspecialties of Biomedical, Clinical, and Public Health informatics have emerged as a new discipline within health and health care in the 21st century - after a gestation period of roughly sixty years (14, 18). The formative period coincides with the development of computer science – information and communications technology – and the emergence of electronic health records as essential technology for health care. It also coincides with the development of training programs in biomedical, clinical, and public health informatics. The American Medical Informatics Association (AMIA) is the USA professional home for biomedical and health informaticians. In response to the needs of a growing work force in Clinical Informatics, AMIA developed a professional code of ethics as well as a front ranking scientific research journal - Journal of the American Medical Informatics Association (JAMIA) (1). In 2006, AMIA was elected to full membership in the Council of Medical Specialty Societies, in recognition of its importance as an emerging specialty area in healthcare.

Clinical Informatics is not only one of the first new subspecialties that have emerged in this century, in the authors' opinion; it is fundamentally different from all prior subspecialties. Even though the knowledge and skills of a medical informatician are unique, the need for informatics as an essential component of daily medical care and research cuts across all primary specialties. For example, clinical specialties like surgery, pediatrics, and internal medicine rely on informaticians and to a lesser extent information and communication technologists to implement, manage, and advance electronic health record systems, aid in designing clinical decision support and manage research data. Imaging and laboratory specialties have long had a need for experts in clinical information systems. Expertise in Clinical Informatics has been recognized as crucial for the operation of clinical institutions as demonstrated by the large number of newly created Chief Medical Informatics Officer (CMIO) and Chief Nursing Informatics Officer (CNIO) (1) positions. Because Clinical Informatics is of growing importance and value to all existing medical specialties, at this point it is possible if not probable that it will be incorporated as a subspecialty certification option open to all existing primary specialties.

In 2004, then President George W. Bush called for the widespread use of electronic health records (EHRs) by 2014. This challenge generated an important goal for those in Clinical Informatics but it quickly became apparent that the US health care system was sorely lacking the informatics workforce sufficient in number and knowledge to accomplish this goal.

These work force demands dictated that it was time for Clinical Informatics to evolve from an avocational or part time activity of self-identified informaticians to a fully professional career track with training, standards, codes of ethics and certification (14-16). Clinical Informatics needed to shed its status as a 'club' sport and become a fully recognized profession within the house of medicine. Knowledge and skills in Clinical Informatics are widely acknowledged as crucial to future success in patient care, research related to biomedicine, and public health, as well as to health policy design and implementation. It is apparent that success in realizing electronic health record systems depends more on knowledge and expertise like needs assessment, organizational leadership, and change management skills than on information technology itself. The core expertise of a medical informatician is thus more strategic than tactical in nature. The training requirements proposed by AMIA incorporate these competencies as a central element of the training for clinical informaticians.

AMIA is the professional home to clinical informaticians representing a variety of health professions including medicine. Clinical Informatics professionals are not the first to develop a professional model: The nursing profession created a certified nurse informatician and as of November 2000, 381 nurses had been certified as nurse informaticians by the American Nurses Credentialing Center. Several years ago, pathologists within AMIA started an unsuccessful effort to create formal informatics specialty training and certification (14-16).

In 2005, the membership of AMIA concluded at a town hall meeting that AMIA should move forward with creating a formal certification program for health professionals in Clinical Informatics, beginning with physicians. The AMIA Board then formally approved a strategic plan to pursue a Clinical Informatics subspecialty within the structure of the American Board of Medical Special ties. In 2010, AMIA will embark upon an effort to create an Advanced Inter-Professional Informatics Certification process to supplement the existing nurse certification and support professional education for practicing dentists, pharmacists, as well as physicians and others who do not wish to seek certification through ABMS. While options other than the America Board of Medical Specialties (ABMS) for physician certification and the Accreditation Council for Graduate Medical Education (ACGME) for training program accreditation exist, the importance and leadership of these two organizations are so solidly established that essentially, they oversee the approval of new specialties in medicine. The ABMS approves the content of a medical specialty and through their member boards oversees the creation of a competency examination and the certification of physicians, who meet their training standards. The ACGME offers accreditation to training programs that meet the subspecialty's formal training criteria. Before the ACGME would establish the program accreditation process, a new specialty would traditionally first receive approval from the ABMS.

AMIA officers have also communicated with ACGME officials in the past so they are aware that work is moving forward in a timely manner. The establishment of Clinical Informatics as a sub-certification requires that several conditions be met. First, one must convince physician peers within the ABMS governance structure that the emerging discipline is substantive and essential to the health care needs of patients. In short, the specialty must pass the test of being vital to comprehensive care (e.g., the vital importance of the EHR for the 'Medical Home' for the sick and injured as well as being important to preventing illness and maintaining health status. Markers to determine the essential nature of a specialty include the availability of formal educational programs of sufficient rigor and length and the definition of knowledge and skills relevant and critical to working as a professional in the discipline. The presence of one or more scholarly publications in the field that offer peer reviewed articles is another marker. The existence of an organizational home for such professionals like AMIA is a prerequisite, as is a professional code of ethics.

Other criteria include documentation of regular well organized meetings, with a national scale and scope that offer relevant high quality continuing educational programs. It is necessary that the subspecialty demonstrate the existence of a 'population' of practicing medical professionals in the discipline. Both, the American College of Medical Informatics (ACMI – a college of elected fellows who have made significant and sustained contributions to the field of medical informatics) and an active well established Clinical Informatics working group within AMIA, are indicators of stability and permanence.

Further requirements include demonstration of well structured collection of the knowledge and skills that comprise competence in the field and well formulated training requirements. While AMIA as an organization fulfilled several other criteria simply by serving as the professional home for biomedical and health informaticians, and by providing continuing medical education and means to disseminate scholarly activity; the requirements for formal descriptions of the core content and training requirements specifically for Clinical Informatics had not been met until recently. The generation of core content and training requirements involved substantial AMIA efforts supported though funding from the Robert Wood Johnson Foundation (RWJ) under the leadership of RWJ's Vice President John R. Lumpkin, MD.

Two groups were created and empowered by the AMIA Board of Directors to create the core content and training requirements documents to frame the approach to the ABMS. Participants in the groups included clinical informaticians from medicine, nursing, dentistry, and pharmacy in the belief that Clinical Informatics needs to be focused primarily on informatics rather than medicine per se. Close attention was given to assuring that the documentation met the ABMS requirements.

Once the core content and training documents were created and published, attention turned to identifying a specialty board recognized by the ABMS that was willing to serve as the 'parent' for the Clinical Informatics subspecialty through its certification authority. In the summer of 2009, the American Board of Preventive Medicine (ABPM) formally agreed to become the home for the Clinical Informatics certification for physicians. Further, ABPM designated AMIA as the organization of record for issues related to this emerging specialty. Preventive Medicine is a primary specialty that takes a broad systems view of its discipline and focuses both on individual patients and on populations.

This philosophy corresponds well with AMIA's commitment to systems thinking, using informatics to support both individual and population health, and its aim to be the professional home for both clinical and public health informaticians.

The role of academic and scientific associations in development of Medical informatics

Until the creation of IFIP-TC4 (later IMIA) in 1967 and EFMI in 1976, theoretical and practical aspects of Medical informatics developed fast, presenting results in the beginning in scientific and professional journals of a predominantly interdisciplinary character, and later in dedicated Medical informatics (MI) journals (3-5).

In this period conferences with MI contents were organized mostly either under the umbrella of "parent" societies (e.g. general computer or specialized health documentation and statistics/epidemiology societies) or under organization of particular groups and associations of people engaged in MI, research and development of MI applications. In scientifically and technologically strong countries (e.g. in France, Germany, U.K., U.S.A.), but also in other countries, such conferences were organized predominantly as national events. International interaction at such events was rather sporadic.

First international acceptance came from the International Federation for Information Processing (IFIP), an organization formed under the patronage of UNESCO. In 1967 François Grémy (the first IMIA president) initiated the IFIP-TC4 on MI gathering medical informaticians, especially from Europe and triggered organization of national MI societies. IFIP-TC4 was perceived as a Federation of National Societies, thus reflecting the spirit of international cooperation among nations in education, science and culture. This federative thinking was transfered to EFMI.

By establishing IFIP-TC4 on MI, Grémy was the first to add the adjective "medical" to the new term "informatics". Under his chairmanship several TC4 working groups were initiated, organizing meetings on information processing of medical records, education in MI, decision making and data protection. Earlier, in 1966, Grémy had initiated at the Faculté de Médicine of the Université de Paris, as professor of the Centre de calcul et de statistique, with a curriculum on information processing by computers.

Development of Medical informatics was also strongly pushed forward in Germany by Peter Leo Reichertz, who started in the beginning of the 1970's a series of MI conferences in Hannover. Reichertz founded the Department of Biometrics and Medical Informatics at the Medizinische Hochschule Hannover (MHH) and became first professor of Medical Informatics at MHH. Initially, Reichertz established the German Society for Medical Documentation and Statistics, now named "Deutsche Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie e.V. (GMDS)". Together with Grémy, Reichertz deserves much credit for the spread of the term "Medical Informatics" all over the world (1-3).

Development of Medical informatics in other parts of Europe and in the world , including description of contributions of most influential academics, scientists and experts within this field of medicine, author described with 30 co-authors from all parts of the world, in the book "Contribution to the History of Medical Informatics" (published in 2015), and two monographs - "Honorary Fellows of EFMI" and "Honorary Fellows of IMIA" (published in 2017 and 2018). Also some other authors, most influental medical informatics academics and experts described some important historical facts about development of Medical informatics in the past (21-39).

A short review of important facts about it is written in next two chapters (1-4).

THE ROLE OF IMIA IN THE DEVELOPMENT OF MEDICAL INFORMATICS

Why IMIA was established?

The IMIA is the most important organisation for health and biomedical informatics. IMIA has a key role to play in anticipating new challenges for informatics in the most important trends of future medicine (regenerative, genomic, longevity, patient-centred, preventive). In terms of health care perhaps the most important challenge for

Figure 5. Inaugural Fellows of IAHSI at meeting in Gothenburg, during MIE 2018 Conference

biomedical informatics is to facilitate a fast and reliable translation of the biomedical research findings into real-use clinical solutions (3, 4).

From this perspective a major goal is to facilitate "translational research", improving the diagnostic arsenal with new imaging systems and micro devices suitable for "point of care" solutions, promoting rational drug design and supporting the development of personalized therapeutic strategies that can guarantee efficacy and patient safety. New experimental approaches (cell therapy, tissue engineering) raise important issues to be addressed by ICT in health. Informatics can substantially contribute to the advance of these fields. This knowledge must be applied not only at an individual level, in terms of patient care, but also to improve the health of populations, through new public health studies and programs.

The aggregation of electronic health records and informatics infrastructures to facilitate longitudinal and bio-bank-based association studies poses new opportunities for health informaticians.

The most important mandate for International Medical Informatics Association (IMIA) is to contribute, through the use of Information and Communication Technology (ICT), to the improvement of biomedical research, clinical practice and public health. In the future a more complete knowledge on the different factors that contribute to the development of disease (genetics, environment) will be increasingly available for developing new preventive, diagnostic and therapeutic solutions.

Knowledge is the core for IMIA's existence. IMIA's role will be to stimulate and connect researchers to enable their research.

IMIA has numerous roles to play in providing leadership in the development and delivery of education, and where appropriate through collaborating with other organizations in contributing to the development of education across the entire spectrum of people impacted by informatics.

IMIA's direct role in education relates to education for biomedical informaticians, but it also has important indirect roles in ensuring the highest quality of education for all other groups of individuals who have a direct or indirect interaction with the practice of biomedical informatics. IMIA has a role in developing educational and research opportunities within biomedical informatics, and mechanisms for fostering the development of 'the next generation' and discovering the currently unrecognised and underdeveloped talent of existing biomedical informatics students.

The IMIA acts as a bridging organisation, bringing together the constituent organisations and their members and provides leadership and expertise to the multidisciplinary, health focused community and to policy makers, to enable the transformation of healthcare in accord with the world-wide vision of improving the health of the world population (7).

The role of IMIA

IMIA was originally established in 1967 as Technical Committee 4 of the International Federation for Information Processing (IFIP) (1-5). IFIP is a non-governmental, non-profit umbrella organization for national societies working in the field of information processing (2). IMIA was established in 1960 under the auspices of UNESCO as a result of the first World Computer Congress held in Paris in 1959. In 1979, it evolved from a Special Interest Group of IFIP to its current status as a fully independent organization (1, 5).

IMIA continues to maintain its relationship with IFIP as an affiliate organization. IMIA also has close ties with the World Health Organization (WHO) as a NGO (Non Government Organization), and with the International Federation of Health Information Management (IFHIMA). IMIA is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large.

The basic goals and objectives of the association are to (1): a) promote informatics in health care and research in health, bio and medical informatics; b) advance and nurture international cooperation; c) to stimulate research, development and routine application; d) move informatics from theory into practice in a full range of health delivery settings, from physician's office to acute and long term care; e) further the dissemination and exchange of knowledge, information and technology; f) promote education and responsible behaviour; g) represent the medical and health informatics field with the World Health Organization and other in-ternational professional and governmental organiza-tions (1).

In its function as a bridge organization, IMIA's goals are (1): a) moving theory into practice by linking academic and research informaticians with care givers, consultants, vendors, and vendor-based researchers; b) leading the international medical and health informatics communities throughout the 21st century; c) promoting the cross-fertilization of health informatics information and knowledge across professional and geographical boundaries; d) serving as the catalyst for ubiquitous worldwide health informati (1).

IMIA has Society members, Academic Institutional members, Corporate members, Corresponding members and Affiliate members and its bodies and documents. (Figures 5-7).

IMIA Represented Regions are: APAMI: Asia Pacific Association for Medical Informatics; EFMI: European Federation for Medical Informatics; Helina: African Region; IMIA LAC: Regional Federation of Health Informatics for Latin America and the Caribbean; IMIA North America; and MENAHIA: Middle East and North African Health Informatics Association. The most of them organize scientific conefrences, separatly of IMIA's MEDINFO conferences.

Working and Special Interest Groups of IMIA

Current and future activities of the Working and Special Interest Groups are posted on the IMIA website and a summary is included in the IMIA Yearbook (6). IMIA Working Groups and Special Interest Groups (WG and SIG) are the primary mechanism through which IMIA pursues its scientific activity in specific fields of the wider domain of health and biomedical informatics. Each WG or SIG has a designated leadership (Chair and Vice Chair, and sometimes other officers). The Chair is the main link to the IMIA General Assembly and to the IMIA Vice President for Working Groups and Special Interest Groups. IMIA Working Groups and Special Interest Groups are: Accident and Emergency Informatics – IMIA A and EI WG; Data Mining and Big Data Analytics WG; Ethics, Privacy and Security in Health Informatics – IMIA EPSHI WG; Exposome Informatics WG; Francophone SIG; Health and Medical Informatics Education WG; Health Informatics for Development – IMIA HI4D WG; Health Informatics for Patient Safety WG; Health Information Systems – IMIA HIS WG; Health Record Banking – IMIA HRB WG; History of BioMedical and Health Informatics WG; Human Factors Engineering for Healthcare Informatics WG; IMIA NI SIG; Informatics in Genomic Medicine – IMIA IGM WG; Language and Meaning in Bio-

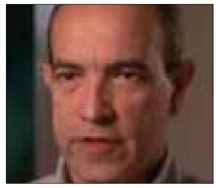
Figure 6. Official journals of the International Medical Informatics Association (IMIA)

Medicine – IMIA LaMB WG; Open Source Health Informatics WG; Organizational and Social Issues WG; Participatory Health and Social Media WG; Pediatric and Child Health Informatics WG; Primary Health Care Informatics WG; Smart Homes and Ambient Assisted Living WG; Standards in Health Care Informatics WG; Student and Emerging Professionals Special Interest Group – IMIA SEP SIG; Technology Assessment and Quality Development in Health Informatics – IMIA TAQD WG; Telehealth WG, and Wearable Sensors in Healthcare WG.

IMIA, from time to time, appoints taskforces to undertake specific, sometimes time-limited, pieces of activity that are not readily amendable to being undertaken by other parts of IMIA. Taskforce members are appointed according to the skills and expertise needed to undertake the mandated activity, and seek to draw on the knowledge and skills of IMIA's members around the world.

2018 – 2022: Christoph Lehmann (USA)

2015 – 2018: Hyeoun-Ae Park (South Korea)



2013 – 2015: Lincoln de Assis Moura Jr (Brasil)

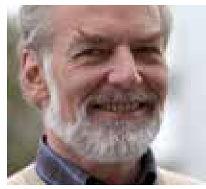
2010 – 2013: Antoine Geissbuhler (Switzerland)

2007 – 2010: Reinhold Haux (Germany)

2004 – 2007: Nancy Lorenzy (USA)

2001-2004: KC Lun (Singapore)

1998-2001: Jan van H. Bemmel (The Netherlands)



1995 – 1998: Otto Rienhoff (Germany)

1992 - 1995: Marion J. Ball (USA)

1989 – 1992: Jos L. Willems (Sweden)

1986 – 1989: Hans Peterson (Norway)

1983 – 1985: Shigekoto Kaihara (Japan)

1980 – 1983: David B. Shiers (USA)

1975 – 1980: Jan Roukens (The Netherlands)

1968 – 1975: Francois Gremy (France)

Figure 7. Former Presidents of the European Federation for Medical Informatics 1976-2020. Source: Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2019 (7).

IMIA MEDINFO's Conferences

IMIA organises the internationally acclaimed triennial "World Congress on Medical and Health Informatics"–commonly know as MEDINFO. IMIA's triennial world congresses for biomedical and health informatics became the centerpiece of a board range of IMIA conferences. The event, currently triennial, but biennial after 2013, provides both a high quality scientific exchange of current research and thinking in health and biomedical informatics and an opportunity for formal meetings and informal networking of IMIA's members. The event is jointly hosted by IMIA and one of its Member Societies. The selection of the host society is determined through a vote of the IMIA General Assembly.

From the year 1974 until 2019 MEDINFO conferences had been organized in: Sockholm (Sweden, 1974), Toronto (Canada, 1977), Tokyo (Japan, 1980), Amsterdam (The Netherlands, 1983), Washington (USA, 1986), Beijing/Singapore (Singapore, 1989), Geneva (Switzerland, 1992), Vancouver (Canada, 1995), Soeul (South Korea, 1998), London (UK, 2001), San Francisko (USA, 2004), Brisbane (Australi, 2007), Cape Town (South Africa, 2010), Copenhagen (Denmark, 2013), Sao Paolo (Brasil 2015), Hangzhou (China, 2017), and Lyon (France, 2019). In 2021 IMIA will host MedInfo online due to the global COVID -19 pandemic. Future MedInfo's will be held in Australia and Tawain.

IMIA publications

IMIA publishes the annual IMIA Yearbook of Medical Informatics and, also, has other four official Medical informatics journals. Applied Clinical Informatics; Informatics for Health and Social Care, International Journal of Medical Informatics; and Methods of Information in Medicine (Figure 6).

Since its inception in 1992, the IMIA Yearbook of Medical Informatics has been one of the most visible and valuable "products" that IMIA provides - not only to its members but to the health and biomedical informatics community at large. It is designed to present an overview of the most original, excellent state-of-the-art research in the area of health and biomedical informatics of the past year; to provide surveys about recent developments, and comprehensive reviews on relevant topics in this field; and to provide information about IMIA.

Beginning in 2014, the IMIA Yearbook had been published in an online open access format and the print version discontinued.

The Objectives of IMIA Yearbook are: a) to present an overview of the most excellent original state-of-the-art research in the area of health and biomedical informatics of the past year; b) to provide surveys about the recent developments, and comprehensive reviews on relevant topics in the field of health and biomedical informatics; c) to provide original papers on the history of Medical Informatics as well as Research and Education organized in the field; d) to provide syntheses about the most valuable outputs of IMIA Working Groups activities; e) to provide information about IMIA.

IMIA Honorary Fellows

In the past IMIA General Assembly has been elected 31 Honorary Fellows (4): Al-Shorbaji Najeeb (Lebanon), Bakker R. Albert (The Netherlands), Ball J. Marion (USA), Bergemann Dieter (Germany), Cesnik Branko (Australia), Collen F. Morris (USA), de Assis Moura Lincoln (Brasil), Forsythe Malcolm (USA), Geissbuhler Antoine (Swetzerland), Gremy Francois (France), Hammond E. William (USA), Haux Reinhold (Germany), Huesing Steven (Canada), Kaihara Shigekoto (Japan), Kulikowski A. Casimir (USA), Lindberg A. B. Donald (USA), Lorenzi M. Nancy (USA), Lun Chan Kwok (KC) (Singapore), Mc Cray T. Alexa (USA), Moghaddam Ramin Iran), Murray J. Peter (United Kingdom), Peterson Hans (Sweden), Rienhoff Otto (Germany), Roukens Jan (The Netherlands), Sedick Isaacs (South Africa), Shires B. David (Canada), Shortliffe Ted Edward (USA), Symonds Ian (New Zealand), Van Bemmel H. Jan (The Netherlands), Willems L. Jos (Belgium), and Yácubsohn Valerio (Argentina).

International Academy of Health Sciences Informatics (IAHSI)

The International Academy of Health Sciences Informatics, established in 2017 through the auspice of IMIA, the International Medical Informatics Association, and as a component of this Association, is similar to other national academies of sciences. It will seek to nominate and elect those whose contributions in informatics are recognized internationally.

The goal is to promote the dissemination of knowledge and best practices, foster new ideas, and encourage worldwide collaboration and sharing of expertise and resources. International leadership in biomedical and health informatics has the opportunity to encourage best practices in biomedical sciences and in the practice of health care, as well as in global and population health, education and research. The forming of an Academy in 2017 of international leaders who focus on health sciences informatics can stimulate and guide future directions in the aforementioned areas.

The Academy through its members can advise governmental and non-governmental organizations about the contribution of informatics professionals and the importance of informatics-based knowledge and provide problem solving strategies (Figure 5) (37)

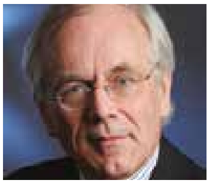
Lacramioara_Stoicu-Tivadar (2019-2020), (Romania)

2017-2018: Christian Lovis (Switzerland)

2015-2016: Anne Moen (Norway)

2013 – 2014: Patrick Weber (Switzerland)

2011 – 2012: John Mantas (Greece)



2009 – 2010: Jacob Hofdijk (The Netherlands)

2006 – 2008: George Mihalas (Romania)

2004 – 2005: Robert Baud (Switzerland)

2002 – 2003: Assa Reichert (Israel)

2000 – 2002: Rolf Engelbrecht (Germany)

1998 – 1999: Attila Naszlady (Hungary)

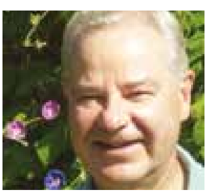
1996 – 1997: Jean-Raoul Scherrer (Switzerland)

1994 – 1995: John Briant (United Kingdom)

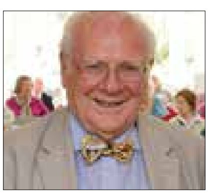
1993: Rolf Hansen (Norway)

1991 – 1992: Stellan Bengtsson (Sweden)

1987 – 1990: Rory O'Moore (Ireland)



1984 – 1986: Francis Roger France (Belgium)



1981 – 1983: Barry Barber (United Kingdom)

1977 – 1981: Peter L. Reichertz (Germany)

1976 – 1977: Antoine Remond (France)

Figure 8. Former Presidents of the European Federation for Medical Informatics 1976-2020. Source: Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2019 (7).

IAHSI Fellows elected from 2017 until 2020

Abu-Hanna, Ameen – 2017 Inaugural Fellow
Adlassnig, Klaus-Peter – 2017 Inaugural Fellow
Al Barrak, Ahmed – 2017 Inaugural Fellow
Al-Shorbaji, Najeeb – 2017 Inaugural Fellow
Alexander, Gregory – 2020 Fellow
Altmann, Russ Biago – 2019 Fellow
Altuwaijri, Majid – 2017 Inaugural Fellow
Ammenwerth, Elske – 2017 Inaugural Fellow
Andersen, Stig Kjaer – 2017 Inaugural Fellow
Aronsky , Dominik – 2017 Inaugural Fellow
Ash, Joan – 2019 Fellow
Bagayoko, Cheick Oumar – 2020 Fellow
Bakken , Suzanne – 2017 Inaugural Fellow
Bakker , Ab – 2017 Inaugural Fellow
Ball , Marion – 2017 Inaugural Fellow
Bates , David W. – 2017 Inaugural Fellow
Bellazzi , Riccardo – 2017 Inaugural Fellow
Berner, Eta – 2019 Fellow
Blobel , Bernd – 2017 Inaugural Fellow
Bodenreider, Olivier – 2019 Fellow
Borycki , Elizabeth – 2017 Inaugural Fellow
Brennan , Patricia Flatley – 2017 Inaugural Fellow
Brown, Steven – 2020 Fellow
Carr , Robyn – 2017 Inaugural Fellow
Chang , Polun – 2017 Inaugural Fellow
Cheung, Ngai Tseung – 2020 Fellow
Chute , Christopher – 2017 Inaugural Fellow
Cimino , James – 2017 Inaugural Fellow
Coiera , Enrico – 2017 Inaugural Fellow
Day, Karen J. – 2020 Fellow
de Keizer, Nicolette – 2019 Fellow
De Moor , Georges – 2017 Inaugural Fellow
Degoulet , Patrice – 2017 Inaugural Fellow
Demiris, George – 2019 Fellow
Detmer , Don E. – 2017 Inaugural Fellow
Dissanayake, Vajira – 2020 Fellow
Dykes, Patricia – 2020 Fellow
Elkin, Peter – 2019 Fellow
Embi, Peter J – 2020 Fellow

Engelbrecht , Rolf – 2017 Inaugural Fellow
Espinosa Lobato , J. Amado – 2017 Inaugural Fellow
Fatehi, Farhad – 2020 Fellow
Fieschi , Marius – 2017 Inaugural Fellow
Fox , John – 2017 Inaugural Fellow
Fraser, Hamish S.F. – 2019 Fellow
Friedman , Charles P. – 2017 Inaugural Fellow
Gardner , Reed M. – 2017 Inaugural Fellow
Geissbuhler , Antoine – 2017 Inaugural Fellow
Georgiou, Andrew – 2019 Fellow
Gogia , Shashi Bhushan – 2017 Inaugural Fellow
Gonzalez Bernaldo de Quiros , Fernan – 2017 Inaugural Fellow
Grain, Heather – 2020 Fellow
Grainger, Rebecca – 2019 Fellow
Greenes , Robert – 2017 Inaugural Fellow
Gutierrez, Marco Antonio – 2020 Fellow
Hammond , Ed – 2017 Inaugural Fellow
Hanmer , Lyn – 2017 Inaugural Fellow
Hannah , Kathryn – 2017 Inaugural Fellow
Hannan , Terry – 2017 Inaugural Fellow
Harris, Paul – 2019 Fellow
Hasman , Arie – 2017 Inaugural Fellow
Haux , Reinhold – 2017 Inaugural Fellow
Hersh , William – 2017 Inaugural Fellow
Holmes , John H. – 2017 Inaugural Fellow
Househ, Mowafa – 2020 Fellow
Hovenga , Evelyn – 2017 Inaugural Fellow
Hripcsak , George – 2017 Inaugural Fellow
Hu, Jianying – 2020 Fellow
Huebner, Ursula – 2019 Fellow
Hullin , Carol – 2017 Inaugural Fellow
Hurlen, Petter – 2019 Fellow
Humphreys , Betsy L. – 2017 Inaugural Fellow
Hussein , Rada – 2017 Inaugural Fellow
Ito, Marcia – 2020 Fellow
Jaulent, Marie-Christine – 2019 Fellow
John, Oommen – 2020 Fellow
Kalra, Dipak – 2019 Fellow
Kaminker, Diego – 2020 Fellow
Kijsanayotin, Boonchai – 2020 Fellow

Kimura , Michio – 2017 Inaugural Fellow
Koch , Sabine – 2017 Inaugural Fellow
Kohane , Isaac – 2017 Inaugural Fellow
Kouematchoua Tchuitcheu , Ghislain – 2017 Inaugural Fellow
Kouroubali, Angelina – 2020 Fellow
Kulikowski , Casimir – 2017 Inaugural Fellow
Kushniruk , Andre – 2017 Inaugural Fellow
Kuziemsky, Craig – 2020 Fellow
Leao , Beatriz de Faria – 2017 Inaugural Fellow
Lehmann , Christoph – 2017 Inaugural Fellow
Leong , Tze-Yun – 2017 Inaugural Fellow
Leslie, Heather – 2019 Fellow
Li , Yu-chuan Jack – 2017 Inaugural Fellow
Liaw , Siaw-Teng – 2017 Inaugural Fellow
Lindberg , Donald – 2017 Inaugural Fellow – Eulogy 2019
Lopetegui, Marcelo – 2020 Fellow
Lorenzi , Nancy – 2017 Inaugural Fellow
Lovis , Christian – 2017 Inaugural Fellow
Luna , Daniel – 2017 Inaugural Fellow
Maeder, Anthony – 2019 Fellow
Malin, Bradley – 2020 Fellow
Mandil , Salah Hussein – 2017 Inaugural Fellow
Mantas , John (Ioannis) – 2017 Inaugural Fellow
Maojo , Victor – 2017 Inaugural Fellow
Marcelo , Alvin – 2017 Inaugural Fellow
Margolis , Alvaro – 2017 Inaugural Fellow
Marin , Heimar de Fatima – 2017 Inaugural Fellow
Marschollek, Michael – 2019 Fellow
Martin-Sanchez , Fernando – 2017 Inaugural Fellow
Martins, Henrique Manuel – 2020 Fellow
Masic , Izet – 2017 Inaugural Fellow
McCray , Alexa – 2017 Inaugural Fellow
McDonald , Clem – 2017 Inaugural Fellow
Mendonca, Eneida – 2020 Fellow
Meystre, Stephane – 2020 Fellow
Middleton, Blackford – 2019 Fellow
Mihalas , George – 2017 Inaugural Fellow
Miller , Randolph (Randy) – 2017 Inaugural Fellow
Moehr , Jochen – 2017 Inaugural Fellow
Moen , Anne – 2017 Inaugural Fellow

Moghaddam , Ramin – 2017 Inaugural Fellow
Moura Jr , Lincoln de Assis – 2017 Inaugural Fellow
Murray , Peter – 2017 Inaugural Fellow
Musen , Mark – 2017 Inaugural Fellow
Nohr , Christian – 2017 Inaugural Fellow
Novaes, Magdala – 2020 Fellow
Ohno-Machado , Lucila – 2017 Inaugural Fellow
Otero , Paula – 2017 Inaugural Fellow
Overhage, Joseph Marcus – 2019 Fellow
Park , Hyeoun-Ae – 2017 Inaugural Fellow
Patel , Vimla – 2017 Inaugural Fellow
Peleg, Mor – 2019 Fellow
Peterson , Hans – 2017 Inaugural Fellow
Pinciroli , Francesco – 2017 Inaugural Fellow
Procter, Paula – 2019 Fellow
Protti , Denis J. – 2017 Inaugural Fellow
Quaglini, Silvana – 2019 Fellow
Rector , Alan – 2017 Inaugural Fellow
Rienhoff , Otto – 2017 Inaugural Fellow
Roberts , Jean – 2017 Inaugural Fellow
Roger France , Francis – 2017 Inaugural Fellow
Sabbatini , Renato Marcos Endrizzi – 2017 Inaugural Fellow
Safran , Charles – 2017 Inaugural Fellow
Saranto , Kaija – 2017 Inaugural Fellow
Satomura, Yoichi – 2020 Fellow
Schaper, Louise – 2020 Fellow
Schneider , Werner – 2017 Inaugural Fellow
Séroussi , Brigitte – 2017 Inaugural Fellow
Shvo , Amnon – 2017 Inaugural Fellow
Shahar , Yuval – 2017 Inaugural Fellow
Shortliffe , Edward – 2017 Inaugural Fellow
Sittig , Dean F. – 2017 Inaugural Fellow
Stead , William W. – 2017 Inaugural Fellow
Szolovits , Peter – 2017 Inaugural Fellow
Tachinardi, Umberto – 2020 Fellow
Takeda , Hiroshi – 2017 Inaugural Fellow
Talmon , Jan – 2017 Inaugural Fellow
Tanaka , Hiroshi – 2017 Inaugural Fellow
Tara, Mahmood – 2020 Fellow
Tierney , William – 2017 Inaugural Fellow

Figure 9. EFMI Council dinner during MIE '14 Conference (at Bosporus, the Strait of Istanbul), Istanbul, Turkey, August 30th, 2014

Toyoda , Ken – 2017 Inaugural Fellow
van Bemmel , Jan – 2017 Inaugural Fellow
Van der Lei , Johan – 2017 Inaugural Fellow
Verbeke, Frank – 2019 Fellow
Vimarlund, Vivian – 2020 Fellow
Weber , Patrick – 2017 Inaugural Fellow
Weng, Chunhua – 2020 Fellow
Were, Martin – 2020 Fellow
Westbrook , Johanna – 2017 Inaugural Fellow
Westbrooke , Lucy – 2017 Inaugural Fellow
Wilson, Marisa – 2020 Fellow
Wong , Chun-Por (CP) – 2017 Inaugural Fellow
Wright, Adam – 2019 Fellow
Wright , Graham – 2017 Inaugural Fellow
Wu , Ying – 2017 Inaugural Fellow
Wyatt , Jeremy – 2017 Inaugural Fellow
Zhang, Jiajie – 2020 Fellow
Zweigenbaum, Pierre – 2019 Fellow
Zvarova , Jana – 2017 Inaugural Fellow – Eulogy 2017

IMIA awards

In the year 2001 the IMIA approved the establishment of a Medical Informatics Award of Excellence named "Morris Collen Award" to be given every three years to an individual, whose personal commitment and dedication to medical informatics has made a lasting contribution to medicine and healthcare through her or his achievements in research, education, development or applications in the field of medical informatics. The awards were given to François Grémy in 2004 (Inaugural Recipient), Jan van Bemmel in 2007, Marion Ball and Hans Peterson in 2010, Reinhold Haux in 2013, Enrico Coiera and Patrice Degoulet in 2015, Fernán Gonzalez Bernaldo de Quirós and K C Lun in 2017, and Suzanne Bakken in 2019 (36)..

THE ROLE OF EFMI IN THE DEVELOPMENT OF MEDICAL INFORMATICS

Establishment of EFMI

The first World Congress of Medical Informatics/MEDINFO was organized by IF-IP-TC4 in Stockholm (1, 5), 1974 (SPC Chair: John Anderson). The success of the congresss triggered the initiative of establishing an association of national MI societies in Europe.

On September 10-11, 1976 in Copenhagen at the Office for Europe of the World Health Organization, hosted by M. Sedeuilh and Albert Weber, representatives of ten national MI societies (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Holland), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) adopted the statutes of new European Medical Informatics Assocation, - EFMI.

Officers on the first EFMI Executive board were Antoine Remond (France), as a chairman, Barry Barber (UK), as secretary and Peter Leo Reichertz (FR Germany), as treasurer (1, 2).

The History of EFMI has been described in my books published during the last 10 years, and in books and papers of other authors, some available in Researchgate and Academia.edu for those intersted in more details (4-6).

IFIP-TC4 followed this trend and evolved in 1979 from a IFIP Technical Commitee to the independent International Medical Informatics Association (IMIA).

Today EFMI is the leading nonprofit organization in biomedical and health informatics in Europe. EFMI comprises 28 national societies and includes an exceptional network of experts and stakeholders in health, care, IT and its societal dimensions; supported by 14 topic working groups ranging from human factors, to security and translational health informatics (5). EFMI has two governing bodies: EFMI Executive Board (President, Vice-President WGs, Vice-President IMIA, Secretary, Treasurer, Executive officer, Publication officer, Institutional members officer) and the EFMI Council. Council members represent national societies and WGs (Figure 8 and 8).

EFMI Working Groups

EFMI has a long tradition in working groups (WG) which are organising and supporting events and projects on a European basis but also worldwide in close co-operation with national and international WGs and institutions (36). EFMI Working Groups are: EDU – Education, EHR – Electronic Health Records, EVAL – Assessment of Health Information Systems, HIIC – Health Informatics for Interregional Cooperation, HIME – Health Information Management Europe, HOFMI – Human and Organisational Factors of Medical Informatics, IDeS – Information and Decision Support in Biomedicine and Health Care, LIFOSS – Libre/Free and Open Source Software, NI – Nursing Informatics, PCI – Primary Health Care Informatics, PPD – Personal Portable Devices, SSE – Security, Safety and Ethics, MIP – Medical Image Processing, THI – Translational Health Informatics, CHD – Citizen and Health Data, and yEFMI – Young EFMI.

EFMI MIE and EFMI STC Conferences

To advance its mission, EFMI started organizing the Medical Informatics Europe Congress (MIE) in 1978. So far 29 MIEs have been organized by EFMI: Cambridge (1978), Berlin (1979), Toulouse (1981), Dublin (1982), Brussels (1984), Helsinki (1985), Rome (1987), Oslo (1988), Glasgow (1990), Vienna (1991), Jerusalem (1993), Lisbon (1994), Copenhagen (1996), Thessaloniki (1997), Ljubljana (1999), Hanover (2000), Budapest (2002), Saint Malo (2003), Geneva (2005), Maastricht (2006), Gothenburg (2008), Sarajevo (2009), Oslo (2011), Pisa (2012), Istanbul (2014), Madrid (2015), Munich (2016), Manchester (2017), Gothenburg (2018), Geneva (2020) was cancelled due to the COVID-19 pandemic (5).

EFMI Special Topic Conferences (STC) are typically 2-day events organized by member societies with 100+ participants in conjunction with their annual meeting, on a topic defined by the member society, and relevant EFMI Working groups are engaged for the content. EFMI Council and Board meetings are hosted by the STC.

Past STC conferences took place in: Bucharest (2001), Nicosia (2002), Rome (2003), Munich (2004), Athens (2005), Timisoara (2006), Brijuni (2007), London (2008), Antalya (2009), Reykjavik (2010), Lasko (2011), Moscow (2012), Prague (2013), Budapest (2014), Paris (2016), Tel Aviv (2017), Zagreb (2018). STC 2020 is planned to be organized in Kuopio by the Finnish society.

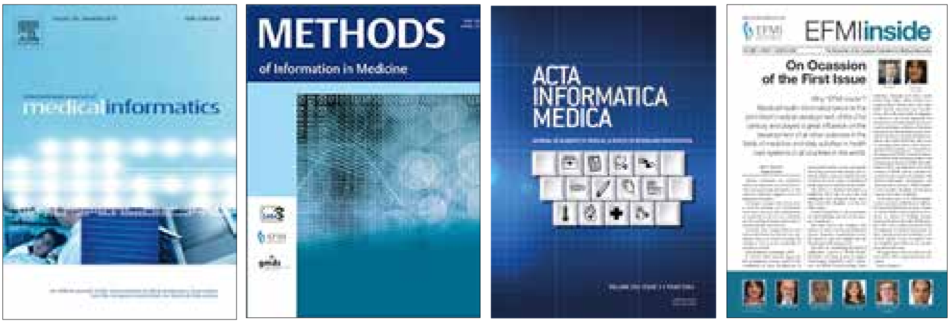


Figure 10. Official journals of the European Federation for Medical Informatics (EFMI)

Remembrence on the first MIE conferences

In a rather short time after it was established, EFMI succeeded to launch its first big meeting - MIE '78 in Cambridge, organized by the Medical Specialist Group of the British Computer Society. In 1978, EFMI consisted of 12 constituent societies. John Anderson, an esteemed expert in medical data processing education, edited the Proceedings of MIE '78. The MIE '78 Proceedings contains 80 papers: a) Papers from 11 EFMI member countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, UK; b) Papers from 3 non-EFMI member European countries (4): Czechoslovakia (1), E. Germany (1), Poland (2); c) Papers from 3 non-European countries (6): Canada (1), Japan (1), USA (4); d) Paper with the address: WHO (1, 5).

The MIE '78 conference program covered 19 topics: Medical records, Text processing, General practice, Image processing, Informatics technologies, Medical decision making, Training in Medical informatics, Implementation and user education, Modelling, Data bases, Clinical laboratories, Signal processing, Health care planning, Transferability, Treatment, Special interest papers, Evaluation, Nursing, Indexing and administrative systems.

John Anderson in his welcome noted: *"Medical informatics has established itself as an important area of medical activity and its growing application, as this conference illustrates, suggests a very rich potential for the future. Sociological changes have taken place to meet this challenge and developments in the issues of privacy and confidentiality are important, as also are user education, and the teaching of medical informatics to medical students and to doctors. Inevitably these changes illustrate that medical informatics has already had a significant impact on medical teaching and training as well as in the relationship of medicine to society."* (5).

The 13th MIE, in Copenhagen, on August 19-22, 1996 celebrated 20 years of EFMI and the 30th Anniversary of the Danish Society for Medical Informatics. MIE '96 was chaired by Prof Peter McNair and was main Medical informatics and Telematics event in 1996. Motto of MIE '96 Congress was *"Human facets in information technologies" with intention "that leading people in the field of Medical informatics will explore its role in the new Information Society and highlight user requirements and be presented with the capabilities".* Total amount of 224 papers were selected from 309 submissions, a clear sign of the popularity of MI research topics. The reviewing procedure by independent and impartial referees was extended by introducing 5 five selection criteria: (1) significance to medical informatics, healthcare and/or medicine, (2) quality of scientific and/or technical content, (3) originality and innovativeness, (4) references to related prior work, and (5) organization and clarity of presentation. The editors of MIE '96 Proceeding, Jytte Brender (Denmark, Chief Editor), Jean-Raoul Scherrer (Switzerland), Jens Pihlkjaer Christensen (Belgium) and Peter McNair (Denmark), pointed out: *"It was amazing that we could find little reuse of the topics from the previous MIE and MEDINFO Congresses, indicating that medical informatics is a discipline in a process of change."* (5). .

In retrospect, the MIE congresses has always been a great motivation for medical informaticians, both scientists and health professionals. They are recognizing them as places most favorable for the presentation of own work, for exchange of ideas with colleagues and for learning what is new in Medical informatics in Europe and the world.

EFMI publications

The most important EFMI publication, indexed in Medline is Studies in Health Technology and Informatics, which publishes papers presented at MIE Conferences. EFMI also publishes several sub-specialty official journals covering the spectrum of medical informatics subdisciplines. Currently, EFMI has three officially endorsed general journals, Methods of Information in Medicine, International Journal of Medical Informatics and Acta Informatica Medica. Until the year 2020 official journal of EFMI was also International Journal of Biomedical Informatics (EJBI), but excluded this year. From the year 2020 EFMI started to pubish EFMI Inside magazine (Figure 10).

Through its work, EFMI provides leadership and expertise to the multidisciplinary, health IT community and to policy makers, enables the transformation of healthcare in accord with the world-wide vision of improving the health of the world population. EFMI is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large.

EFMI Honorary Fellows

During past period EFMI Council has been elected 31 Fellows as most influential Medical informatics experts for their contribution in development of this academic and scientific field (3). In alphabetical order

EFMI Honorary Fellows are: Abbott “Bud” William (United Kingdom), Andersen Stig Kjaer (Denmark), Anderson John (United Kingdom), Barber Barry (United Kingdom), Baud Robert (Swetzerland), Blobel Bernd (Germany), Bryden John (Scotland, UK), Engelbrecht Rolf (Germany), Gell Günther (Austria), Gremy Francois (France), Hansen Rolf (Norway), Hasman Arie (The Netherlands), Hofdijk Jacob (The Netherlands), Jorgensen Mogens (Denmark), Mantas John (Greece), Masic Izet (Bosnia and Herzegovina), McNair Peter (Denmark), Mihalas George (Romania), Moen Anne (Norway), Nordberg Ragnar (Sweden), O’Moore Rory (Ireland), Peterson Hans (Sweden), Reichert Assa (Israel), Reichertz Leo Peter (Federal Republic of Germany), Remond Antoine (France), Roger France Francis (Belgium), Rossing Niels (Denmark), Scherrer Jean-Raoul (Swetzerland), Wagner Gustav (Germany), Weber Albert (Swetzerland) and Zvárová Jana (Czech Republic).

EFMI awards

In the year 2015, during MIE conference in Madrid, the EFMI Council approved the establishment of a Medical Informatics Award of Excellence named “Leo Peter Reichertz Young Scientist’s Award” and “Rolf Hansen Memorial Award” to be given to an individual, whose personal commitment and dedication to medical informatics has made a lasting contribution to medicine and healthcare through her or his achievements in research, education, development or applications in the field of medical informatics. Also, during MIE conferences Mantas’ Prize for Best Paper on Education in Biomedical and Health Informatics is giving to presenter for “Outstanding paper about Education in Biomedical and Health Informatic” (37).

CONCLUSION

In considering a ‘history’ of Medical/Health Informatics it is important to be aware that the discipline encompasses a wide array of activities, products, research and theories. Medical nformatics is as much a result of evolution as planned philosophy, having its roots in the histories of information technology and medicine. The process of its growth continues so that today’s work is tomorrow’s history. A ‘historical’ discussion of the area is its history to date, a report rather than a summation. As well as its successes, the history of Health Informatics is populated with visionary promises that have failed to materialise despite the best intentions. For those studying the subject or working in the field, the experiences of others' use of Information Technologies for the betterment of health care can provide a necessary perspective. In promotion and spreading out of knowledge and experiences of the Medical informatics as scientific and academic discipline in the world great impact was given by IMIA and EFMI associations and its members.

REFERENCES

1. Masic I, Mihalas G. (Eds.) et al.. Contributions to the History of Medical informatics. Avicena, Sarajevo, 2014: 439 pp. ISBN: 978-9958-720-56-7.
2. Masic I. Biographical Lexicon of Medical Informatics. Avicena. Sarajevo, 2017: 546 pp. ISBN: 978-9958-720-62-8.
3. Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2019: 50: pp. ISBN: 978-9958-720-64-2.
4. Masic I. Honorary Fellows of the International Association of Medical Informatics. Avicena. Sarajevo, 2018: 49: pp. ISBN: 978-9958-720-70-3.
5. Masic I. Historical Backgrounf of EFMI in Development of Medical Informatics. EFMI Inside. 2020; 1(1): 3-9.
6. Dezelic G. After three decades of Medical Informatics Europe congresses. Stud Health Technol Inform. 2009; 150: 3-7.
7. Mihalas G, Zvarova J, Kulikowski C, Ball M. et al. History of Medical informatics in Europe - a short review by different approach. Acta Inform Med. 2014 Feb; 22(1): 6-10.
8. Zvarova J, Masic I. Medical informatics - an interdisciplinary approach. Med Arh. 1996; 50(3-4): 107-109.
9. Available at: https://en.wikipedia.org/wiki/Philippe_Dreyfus. Accessed: March 20th, 2022.
10. Adlassnig KP, Blobel B, Mantas J, Masic I. (Eds). Medical Informatics in a United and Healthy Europe. Proceedings of MIE 2009. IOS Press. Amsterdam, 2009: pp. 1064.
11. Masic I. The History and New Trends of Medical Informatics. Donald School Journal of Ultrasound in Obstretics and Gynecology,2013;; 7(3): 313-322.
12. Masic I, Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-48. doi: 10.5455/aim.2014.21.44-48..
13. Collen MF. Origins of Medical Informatics. The Western Journal of Medicine. 1986 December: 778-785.
14. Detmer DE. BSMCUL. Clinical Informatics Board Certification: History, Current Status, and Predicted Impact on the Clinical Informatics Workforce. Applied Clinical Informatics. 2010.

15. Park S, Parwani AV, Aller RD, et al. The history of pathology informatics: A global perspective. Journal of Pathology Informatics. 2013.

16. Detmer D, Munger B, Lehmann C. Medical Informatics Board Certification: History, Current Status, and Predicted Impact on the Medical Informatics Workforce. Applied Clinical Informatics. 2010; 1(1): 11-18.

17. Masic I, Novo A. History of Medical Informatics in Bosnia and Herzegovina. Acta Inform Med. 2007; 15(1): 49-61.

18. Masic I, Ridjanovic Z, Pandza H, Masic I. Medical Informatics (second edition). Avicena. Sarajevo, 2010: 13-36. ISBN: 978-9958-720-39-0.

19. Eysenbach G, Jadad AR. Evidence-based patient choice and consumer health informatics in the Internet age. Journal of medical Internet research. 2001; 3(2): e19.

20. Hersh W. A stimulus to define informatics and health information technology. BMC Medical Informatics and Decision Making. 2009; 9(1): 24.

21. O'Carroll PW, Yasnoff WA, Ward ME, Ripp LH, Martin EL (Eds.). Public health informatics and information systems. 2003.

22. Shortliffe EH, Cimino JJ. (Eds.) Biomedical informatics: computer applications in health care and biomedicine. Springer Science & Business Media. 2013.

23. Magnuson JA, Fu PC. Public health informatics and information systems. London, UK: Springer. 2014.

24. Lorenzi NM, Riley RT. Organizational aspects of health informatics: managing technological change. Springer Science & Business Media. 2013.

25. Whetton S. Health informatics: A socio-technical perspective. 2005.

26. Zheng YL, Ding XR, Poon CCY, Lo BPL, Zhang H, Zhou XL, Yang GZ, Zhao N, Zhang YT, Unobtrusive sensing and wearable devices for health informatics. IEEE Transactions on Biomedical Engineering, 2014; 61(5): 1538-1554.

27. Pilemalm S, Timpka T. Third generation participatory design in health informatics - making user participation applicable to large-scale information system projects. Journal of biomedical informatics. 2008; 41(2):.327-339.

28. Georgiou A. Data, information and knowledge: the health informatics model and its role in evidence-based medicine. Journal of evaluation in clinical practice. 2002. 8(2):.127-130.

29. Jones M. Learning the lessons of history? Electronic records in the United Kingdom acute hospitals: 1988-2002. Health Informatics Journal. 2004; 10(4): 253-263.

30. Hersh W, Margolis A, Quirós F, Otero P. Building a health informatics workforce in developing countries. Health Affairs. 2010; 29(2): 274-277.

31. Goldberg L, Lide B, Lowry S, Massett HA, O'Connell T, Preece J. Quesenbery, W, Shneiderman B. Usability and accessibility in consumer health informatics: current trends and future challenges. American journal of preventive medicine. 2011; 40(5): .S187-S197.

32. Kun LG. Telehealth and the global health network in the 21 st century. From homecare to public health informatics. Computer methods and programs in biomedicine.2001; 64(3): 155-167.

33. Bath PA. Health informatics: current issues and challenges. Journal of Information Science. 2008; 34(4):.501-518.

34.. Hersh WR. Medical informatics: improving health care through information. JAMA. 2002; 288(16): 1955-1958.

35. Masic I, Pandza H. Medical Informatics Education Past, Today and Future. European Journal for Biomedical Informatics. 2018; 14(2): 40-45.

36. https://imia-medinfo.org/wp/regional-members/. Accessed on June 15th, 2020.

37 .https://mie2020.org/en/submission/awards/#:~:text=%20MIE2020%20Awards%20%20 1%20Peter%20L%20Reichertz,available%20for%20a%20poster.%20The%20award...%20 More%20. Accessed on June 15th, 2020.

38. Masic I, Ridjanovic Z, Pandza H, Masic Z. Medical Informatics, second edition. Avicena. Sarajevo. 2010: 13-36. ISBN: 978-9958-720-17-0.

39. Masic I. Medical Informatics Education un Bosnia and Herzegovina. IMIA Yearbook. 2004: 204-208.

05

Francis Roger France

ABOUT THE BEGINNINGS OF MEDICAL INFORMATICS IN EUROPE

The first computer, Mark I, "Bessie" for intimates, is born in 1944 from a collaboration of the US Navy and Harvard University, under the leadership of Howard Aiken. They conceived and realized a machine that could work "automatically" by following programs introduced in advance (1).

The term "Informatics" was created in 1962 (Académie Française) from two words, information and automatic, and covers all techniques, information concepts and applications of computers. Among them, medicine is the field where we will describe some factors of development in Europe since the late sixties.

It took some time for obtaining the acceptance of this new terminology in the USA. When American industrialists or researchers asked in 1970 what I was doing, they almost always wished to know what was "medical informatics", a European new word that did not correspond exactly to computer sciences. Donald Lindberg, as Director of the National Library of Medicine (Bethesda) played a key role for the adoption of the medical informatics label in the USA and elsewhere in the world.

An American industrial supremacy, with worldwide applications

In the seventies, IBM was called "White Snow" and the other computer manufacturers "the Seven Dwarfs". IBM benefited of an existing multinational network of vendors for typing machines, and had an appropriate development of computers. Their suc-

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

cess was also linked to useful accounting and administrative programs. It was the time of the Hollerith card that everyone had to carry to the computer center. There, each work had to be classified and located like books in a Library, before being processed.

The development of computer applications in medicine followed all over the world industrial and financial projects with some delay. The first applications in Europe after 1965 were clinical laboratories and hospital administrative tasks. Most often existing software had to be adapted locally (2). Other fields were often seen with apprehension. Medical informatics creates a mixture of human and mechanical factors, with a danger of commercial exploitation. Some health professionals had a fear to be replaced by machines.

As postgraduate student in the USA (1970-1972) at the University of Minnesota (School of Public Health, Division of health computer sciences in Minneapolis and internal medicine at the Mayo Clinic in Rochester) a good exercise was to write a report on differences between Europe and the USA in medical informatics. The main difference was an integration of development projects by the computer industry with research projects in American Universities. Europe did not have a similar environment as, apart from Siemens, there were very few computers factories. Furthermore, the USA had a serious advance due to the NIH (National Institutes for Health, Bethesda) policy of grants for research projects and fellowships in health informatics since 1961, which resulted in a rapid extension to the Federal level already in 1970.

EUROPEAN FACTORS OF DEVELOPMENT

Individual initiatives and commitments

a) There were so many individual initiatives in the numerous Western European countries that we can describe only a few examples.

At that time, some of the most advanced hospitals in medical informatics were Geneva (Jean Raoul Scherrer), Paris La Pitié-Salpêtrière (François Grémy), Hannover (Peter Reichertz), but there were already developments in communities like in Sweden (Hans Peterson), in general practice (for example J. R. Möhr in Germany) as well as signal analysis (O. Wigertz) or hospitals evaluation (Barry Barber, UK), etc.

The first world Congress of Medical informatics organized in Stockholm by IFIP-TC-4, MEDINFO 74, testifies the rapid growth of this new field in Europe (3), as well as MIE European Congresses proceedings, since 1978 (4) up to now. Eastern Europe followed with an important delay.

International medical informatics congresses were organized according to an agreement between European Federation of Medical Informatics, EFMI (5), and International Medical Informatics Association, IMIA (6): a triennial world congress - MEDINFO, and European congresses - MIE's in the years without MEDINFO. I will mention here only the first six MIE's, which started in Cambridge in 1978 (7), Berlin 1979 (8), Toulouse 1981 (9), Dublin 1982 (10), Brussels 1984 (11) and Helsinki 1985 (12).

In order to better understand the large variety of factors that played a role, allow me to take the factors of development to which I was associated in my country, Belgium. Other European countries might have very different experiences and could have reached better results.

The difficulty for a historical overview is the variety of experiences, country by country. Europe is a Union of States, not United States. We might have common projects and even common standards, but we have rarely a central decision point.

In the next section, I will describe my own experience. It has been partly developed in a book that shows the particular development in various European countries in order to obtain DRGs (13).

b) Example of factors for the development of medical informatics, in a European country

In Belgium, the political decision was made in 1968 to separate the University of Louvain created in 1425 in two parts, one, Flemish, remaining in Leuven (Louvain), the other, French speaking having to quit the Flemish territory. This decision obliged the academic authorities to think to long term issues. A new hospital was built (Cliniques Universitaires St-Luc) in the South of Brussels. It was decided to computerize the medical record in complement to many other applications (admissions, billing, laboratories, electrocardiogram, intensive care unit etc)

The medical director, Prof. Paul Lacroix appointed me to found the "Center for Medical Informatics" in 1968, under the authority of Prof. J. J. Haxhe. They accepted my proposal to unify the medical record (create a unique patient number) and to make mandatory in all specialties a "Medical Record Summary" that would list all diagnoses and interventions at discharge. In order to allow international comparisons and linkage with billing data, the ICD9-CM code was chosen, with local extensions, when needed for cases retrieval or for clinical and epidemiological research.

The model developed in St-Luc in a Department of Centralized Medical Archives was visited regularly by hospital delegations from Belgium and many European countries that adopted a similar system.

A national scientific policy

There are two models of health care systems in Europe: one inspired by Otto von Bismarck, based on social security", a bottom up approach" taking an amount from workers salary for solidarity after agreement between workers and employers, the other being the national health service, where the State takes an amount of revenues through taxes decided by the government, a "top down" approach, such as William Beveridge plan. Each European country has created a specific Committee that fits in their model of health care delivery system.

In Belgium, where we have a social security system like in Germany and in France, Minister Theo Lefèvre was in charge of Scientific Policy in the early seventies. In 1968, Cardionics, a private company put on the market a program that made protocols for computerized electrocardiograms. The Belgian Society of Cardiology expressed a big concern and discovered the lack of scientific policy in medical informatics. I was associated to their request for educating physicians in this new field by attributing Fellowships and by developing national voluntary projects in medical informatics, among which interhospital comparisons by using the medical record summary such as in St Luc, and by developing applications for the pharmacy and intensive care units. As funds had to be obtained to employ coders and to pay researchers, the Minister (who was also Prime Minister) decided to take unused special funds for major disasters that did not happen. All these activities were placed under the control of the Scientific Policy Committee.

EUROPEAN DEVELOPMENT OF COMMON PROJECTS ENLARGING LOCAL OBJECTIVES

Training program in Toulouse (UNESCO, 1968)

The first international Seminar taken in charge by an international organization in order to offer courses in French on all aspects of medical informatics was held in Toulouse, where several Congresses had been already organized. The UNESCO, located in Paris, financed intensive lessons given by the most up to date University teachers during three weeks. We especially remind the presence of Prof. J. Martin from Nancy, and, as other student, Liliane Dusserre who became teacher in Dijon and played an important role in defining recommendations on security and other ethical questions in the French National Order of Physicians.

The "Biomedical Working Group" in Luxembourg (European Commission) EEC-BMWG)

After my return from the USA where I worked as Research Fellow in the Minnesota Coronary Survey (that was followed by MRFIT, Multiple Risk Factors Intervention Trials) and learned the functioning methods of clinical research and patient management at the Mayo Clinic, I was appointed as member of the "Biomedical Working Group of the EEC" by the Minister of Scientific Policy in Belgium. He nominated me also as a member of the Belgian group dealing with health informatics projects for the Scientific Policy.

The EMD (Electronic Medical Record) was one of the projects to be defined by the EEC-BMWG, with a plan of development. This justified my presence there. The President of the EEC-WG was Prof. Peter Reichertz (Hannover University) and the Secretary Mr. Jean Rodesch, a civil servant working for the Commission. There were two representatives by country, for 15 countries in the EU (European Union) at that time. Three of them became later President of EFMI Peter Reichertz (GE), Rory O'Moore (IRL) and myself (BE).

Allow me to describe the atmosphere when I arrived in this WG. The first evening I was invited by the French members, Prof. Henry Ducrot (Paris) and Mrs. Wolf-Terroine (Strasbourg) in order to better know each other. I had already made the proposal to create a "European MBDS" (Minimum Basic Data Set) for all hospital discharges, that could be linked with billing and costs. They were quite concerned by such project that would allow data transparency. Each hospital would become "une cage de verre" (a cage of glass allowing linkage of medical data to financial data). Who was this young Belgian Fellow, coming back from the US, to make such a dangerous proposal? We ate a delicious lobster. At the end of the meal, they did not seem to be reassured, having learned that I was determined and that my father was a distinguished Economist (University teacher and top civil servant). The next morning, I shared my breakfast with Dr. John Radcliffe, delegate from UK. His first question was: How was the dinner yesterday evening? I answered "excellent". He then said: "don't be impressed by French meals!" I was back in Europe.

The sinuous road to reach a standard, the European MBDS

It took two years to obtain that the MBDS figures on the list of projects of the EEC-BMWG. As a matter of fact there were multiple activities (supervising funding of cancer research, intensive care, access to literature etc) but the main objective was to create a European network that could serve the pharmaceutical industry.

This ambitious and costly project was initiated and supported by a French-German agreement, with the hope that the pharmaceutical industry could contribute also financially, better than any other medical sector.

One of the major results expected was a more unified terminology or an easy access to an equivalent name for a same product in all European countries.

This required a list of each active principle for each drug. The EEC obtained to have access to some data banks from several Ministries of Health like Italy and Belgium. Such possible access blocked the project. The pharmaceutical industry had accepted that Committees of experts get more details in order to register a product for its reimbursement, country by country. It felt jeopardized if anyone, mainly another industrial group could obtain easily through the EEC network secrets of drugs manufacturing. As this project was stopped there was some money left for other EEC projects.

I was approached in the corner of a corridor by Prof. Wolf-Terroine who announced me that there was a new agreement in the BMWG to put the hospital MBDS as one of the main objectives of the group and that I would be charged to do a "feasibility" study.

My mission was to elaborate a detailed questionnaire on each purpose and each item of a Minimum Basic Data Set to be sent and answered by all member countries. I had then to visit all 15 European countries (several leading hospitals and delegates from Ministries of Health) in order to discuss the answers and to identify ways for agreement on the purposes and content of the MBDS.

This work took four years, from 1976 to 1980, but I learned me a lot on all European member countries. I have been told that a one man study to assemble the opinion of everyone in Europe is probably unthinkable nowadays. This was not the end. Results had to be submitted to an international Conference on Hospital Statistics for population-based health care and epidemiology (9-11 September 1981) in Brussels. An agreement was obtained in the evening of the 10/9/81 in my living room in Uccle, between Directors or Representatives from the EEC (General Directions of Innovation, Industry, Social Affairs) the European Office of WHO (World Health Organization) and IMIA (International Medical Informatics Association). It was approved by fifty experts from 14 countries the next day (14, 15).

Use of the MBDS in European countries

Thereafter, I was appointed as Advisor to several governments that implemented the MBDS and had to deliver many explanatory speeches.

Among them, let's quote:

- Portugal that made a special agreement with Bob Fetter to use DRGs, with financial support from the US, provided a NATO base could be installed near Lisbon.
- France, where I was associated to the foundation of the PMSI (Projet de Médicalisation des Systèmes d'Information), under the leadership of François Gremy and Mr. Stephan.
- Belgium accepted the MBDS in order to change the hospital financing system.

  This important reform was initiated by Minister Jean-Luc De Haene.
- Italy and Spain expressed the wish to make this information system uniform in the country, but they were regional variations in implementation.
- UK, Ireland , Denmark, Sweden and the Netherlands modified their hospital statistics in order to correspond to the European standard and used it for hospital care management.
- Luxemburg and Germany took some delay before adopting the system.
- Greece was reluctant to use the MBDS.

THE IMPACT OF EFMI (EUROPEAN FEDERATION FOR MEDICAL INFORMATICS)

Besides these official developments through national policies and international projects supported by the European Commission, scientific societies were created voluntarily in most European countries, most often under the impulsion of IFIP-TC4 (International Federation for Information Processing, Technical Committee 4) that was chaired by Jan Roukens, an EEC civil servant coming from a Dutch Industry. This TC4 was replaced by IMIA, the International Medical Informatics Association.

The European Federation for Medical Informatics (EFMI) was conceived at a meeting, at the Regional Office for Europe of the World Health Organization (WHO), in Copenhagen in September 1976. The representatives of national Health/Medical Informatics societies from ten European countries signed a declaration of intent stating: "The Federation shall be constituted as a nonprofit organization concerned with the theory and practice of Information Science and Technology within Health and Health Science in a European context."

We wish to underline the key role of Albert Weber, from WHO-EUR, to provide advice to the delegates among which Barry Barber was one of the most dynamic.

The objectives of the European Federation for Medical Informatics are:

- To advance international co-operation and dissemination of information in Medical Informatics on a European basis;

- To promote high standards in the application of medical informatics;
- To promote research and development in medical informatics;
- To encourage high standards in education in medical informatics;
- To function as the autonomous European Regional Council.

We can consider that the European Federation had three main impacts:

- EFMI used the same limits for Europe as WHO . It has to be remembered that in 1976, Western and Eastern Europe were completely separated. This decision allowed to open medical informatics to Eastern countries as well as to assimilated countries like Israêl.
- In order to apply to become a country member, there should be only one scientific society by country. This statement obliged several countries like Italy and Greece to modify their internal structure.
- A major role of EFMI has been the diffusion of scientific information through MIE Conferences (4) as well as MEDINFO, as during many years the majority of members of IFIP-TC4 followed by IMIA was European.

About international policy, we had a special role after the events of April 1989 on Tien An Mien square in Beijing. MEDINFO 1989 was planned to be held in Beijing and a large number of IMIA and EFMI representatives were asking to dismiss this meeting under the argument that the government did not respect Human Rights.

As former President of EFMI and as Vice-President of IMIA in charge, I defended, on the contrary, that the best way to disseminate Human Rights is to open the door to scientific communications and exchanges. My argument was accepted by the Americans, among which Morris Collen. MEDINFO 89 was held in two locations: Beijing and Singapore. Shigekoto Kaihara, former IMIA President, told me in Hiroshima in 2009 how happy he was, as well as other Asians that MEDINFO 89 could be held in Beijing because of my strong position.

EEC RESEARCH AND DEVELOPMENT PROGRAMS

The European Union (Niels Rossing) initiated research projects in medical informatics called BICEPS-EUROAIM, to which we participated in 1986. However, guidelines had to be provided, taking in account weaknesses as well as strong aspects of medical informatics in Europe.

The AIM Requirements and Strategic Review Board was created by the EEC in 1989.

AIM is an acronym for Advanced Informatics in Medicine. The experts were appointed from the industry and from university research centers. I was chosen as chairman and Gerald Santucci as secretary. We worked during eight months and published the results in a book published by Springer-Verlag (8) entitled Perspectives of Information Processing in Medical Applications in 1991.

We considered challenges and opportunities, dreamed of modernization that could lead to high quality medicine, crossing national frontiers, requiring a collaborative international work and a common infrastructure. Integration, modularity and security were among the key words used. These ideas are still applied, nearly 25 years later, first in the numerous AIM projects and now in eHealth.

OTHER INITIATIVES

Education and Training

Apart from the UNESCO one shot session of courses in 1968, the Council of Europe issued recommendations in 1991 for the development of European strategies in health information Systems (16, 17).

Hospital Management

PCS-E (Patients Classification Systems-Europe) was created in order to diffuse and to adapt DRGs in European countries. A major impact of all these efforts has been the creation of networks of experts that is practically very useful (18).

CONCLUSION

There are various ways to describe history. We could have been more systematic, by application or by progress in technology. I was asked to tell more about my story in a large European development process at its beginning. This is why I tried to explain that our actions are influenced, not only by our ideal, our views, our ethic and our competences, but also by human interrelations and dialogue in order to make the appropriate choices.

There are fascinating domains that I did not touch, such as quality of care, patient autonomy by using informatics, equity of care by using telemedicine, medical record structure and terminology to aid diagnosis, training and evaluation of care. This is part of the future of medical informatics.

In a way, I limited my description to areas that were felt realistic enough to be financed through research projects. When a country or an international organization agrees to pay for new developments, this is also a sign of social priority.

REFERENCES

1. Dinter H. Problems for computer solution. Macmillan, London, 1973.
2. Gremy F. Informatique Médicale. Flammarion, Paris, 1987.
3. Anderson J, Forsythe JM. MEDINFO 74, First World Conference on Medical Informatics, Stockholm, IFIP-TC4, North-Holland, 1974.
4. Lindberg DAB, Reichertz PL. (eds). Medical Informatics Europe (MIE). Proceedings, book series. Springer Verlag, Berlin, 1978.
5. www.efmi.org (as on 23 Jan 2014)
6. www.imia.org (as on 23 Jan 2014)
7. Anderson J. (ed). MIE'78 Cambridge. Springer Verlag, Berlin, 1978.
8. Barber B, Gremy F, Überla K, Wagner G. (eds). MIE'79, Berlin.. Springer Verlag, Berlin, 1979.
9. Gremy F, Degoulet P, Barber B, Salamon R. (eds), MIE'81, Toulouse, Berlin: Springer Verlag, 1981.
10. O'Moore R, Barber B, Reichertz PL, Roger F. (eds). MIE'82, Dublin. Berlin: Springer Verlag, 1982.
11. Roger F, Willems JL, O'Moore R, Barber B. (eds). MIE'84, Brussels. Berlin: Springer Verlag, 1984.
12. Roger F, Gronroos P, Tervo-Pellika R, O'Moore R. (eds). MIE'85, Helsinki. Berlin: Springer Verlag, 1985.
13. Kimberly JR, de Pouvourville G. et al. The migration of Managerial Innovation. Diagnosis Related Groups and Health Care Administration in Western Europe. New-York: Jossey-Bass, 1993.
14. Roger FH. The Minimum Basic Data Set for Hospital Statistics in the EEC, Office for Official Publications of the European Commission, Luxembourg, 1981.
15. Lambert PM, Roger FH. Hospital Statistics in Europe. Amsterdam, North-Holland, 1982.
16. Roger France FH, Santucci G. (eds). Perspectives of Information Processing in Medical Applications. Strategic Issues, Requirements and Options For The European Community. Heidelberg: Springer Verlag, 1991.
17. Thayer C, Fabrice B, Roger France F. European Strategies for Training in Health Information Systems. Council of Europe. Int J Biomed Comput. 1991; 28: 117-25.
18. Roger France FH, Mertens IFH, Closon HC, Hofdijk J. (eds). Case mix: global views, local actions. Evolution in twenty countries. Amsterdam: IOS Press, Technology and Informatics, vol 86, 2001.

06

Hans E. Peterson

THE EARLY HISTORY OF EUROPEAN FEDERATION OF MEDICAL INFORMATICS

In 1957, Isaac L. Auerbach, USA sent a proposal to UNESCO on behalf of the American Federation of Information Processing Societies to sponsor one international conference on information processing. The first international conference on information processing was held in 1959 in Paris with 1800 participants from 37 countries. Representatives of some national societies had submitted statutes and sent them out to the national societies and had them approved. A provisional executive with Mr. Auerbach and Academician Anatol A. Doronicyn, Union of Socialist Republics was elected (1-10).

The first council meeting was held in Rome in June 1960 and that is the beginning of the International Federation for Information Processing (IFIP). Already at that meeting 15 countries were members: Belgium, Canada, Czechoslovakia, Denmark, Finland, Germany, Japan, The Netherlands, Spain, Sweden, Switzerland, the Union of Soviet Socialist Republics, United Kingdom and United States of America. Mr. Auerbach was elected President, Professor Alwin Walter (Germany), vice-president and Dr. Ambrose Speiser (Switzerland), secretary-treasurer. The work within IFIP was organized in Technical Committees (TC) and they in turn could have Working Groups (WG). Already in 1963 the first 3 were established: TC 1 - Glossary, TC 2 - Programming Languages and TC 3 - Education (11-19).

In 1967 TC 4 - Health Care and Biomedical Research was established with Professor Francois Gremy (France), as Chairman and J. M. Forsythe (United Kingdom) as Secre-

---

*This text is republished from the book “Contributions to the History of Medical Informatics” (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Figure 1. From left to right: Francois Gremy, the first chairman of the IFIP Tc 4, 1967-1973., Hans E. Peterson, IMIA President (1983-1986), Marion Ball, IMIA President (1992-1995), Otto Rienhoff, IMIA President (1995-1998), David Shires, IMIA President (1980-1983), Kwok Chan (KC) Lun, IMIA President (2001-2004).

tary. The first Working group (WG1) was Education of Medical and Paramedical Personnel. In 1973 a new chairman Jan Roukens (Holland) was elected. He was Chairman until the date when the TC ended and the new International Medical Informatics Association (IMIA) was accepted by IFIP in 1980. A new secretary Jan van Egmond (Belgium) was elected 1971. He passed away in 1978.

Many member countries of TC 4 wanted more freedom from IFIP and that resulted in that TC 4 got the status of Special Interest Group and to organize the first World Congress of Medical Informatics in parallel with the IFIP Congress in Stockholm, Sweden 1974 and a second one in Toronto, Canada 1977. In 1980 IMIA became independent from IFIP. The inaugurate meeting took place on May 11, 1979 in Salle Capituami, Paris with speeches of Professor Bailey, WHO, Professor Pierre A. Bobillier, President of IFIP, Professor Francois Gremy and Dr. Jan Roukens, chair TC 4. At the General assembly meeting the following new board was elected: Dr. David Shires (USA), President, Dr. Hans Peterson (Sweden), vice-president and chair By-Laws Committee, William Abbott (UK), Secretary, Dr. Shigekoto Kaihara (Japan), chair of Newsletter Committee and Professor Peter L. Reichertz (Federal Republic Germany), chair of Publication Committee (Figure 1).

THE START OF EUROPEAN FEDERATION OF MEDICAL INFORMATICS (EFMI)

The interest to establish a European federation of national medical informatics societies started already one year after the Medinfo Congress in Stockholm (1974). There were three persons that in 1975 had the first discussions and they were Jan Roukens (Holland), Jan van Egmond (Belgium), and Mogens Jorgensen (Denmark). They started to write statute and discuss these with a few other interested representatives from other European countries. These persons were called the Preliminary executive group and they held a meeting in Paris in June, 1976, where they decided to invite all known European societies to be represented at a constituent meeting of the Federation of the European Medical Informatics Societies. It was proposed that one delegate with voting right from each Society be present in Copenhagen on September 10 and 11, 1976.

The members present were:

- Barry Barber (UK);
- Antonio Perens de Talens, (Italy);
- Francois Gremy (France);
- Rolf Hansen (Norway);
- Mogens Jorgensen (Denmark);
- Hans Peterson (Sweden);
- Peter L. Reichertz (Federal Republic of Germany);
- Jan Roukens (Holland);
- Jan van Egmond (Belgium);
- Ilkka Vaananen (Finland.

In addition two representatives from WHO was invited as they had shown interest for the new Federation and had offered the meeting to be held in the WHO European headquarters premises in Copenhagen and invitation for lunch. They were the head of the headquarters M. Sedeuilh and A. Weber.

Dr. Sedeuilh welcomed the delegates to the Regional Office of WHO hoping that the meeting would prove to be an historic new starting point in the development of activities in the field of medical informatics. He outlined a number of ways in this field and described its continuing interest in joint collaborative action in the development of new initiatives in Health Care. He wished the delegates success in stabling a suitable

European Federation. At the meeting Dr. Jorgensen was elected as Chairman and Dr. Barber as Secretary.

It was unanimously agreed that a Federation of European National Societies should be established. The Federation should have a Council consisting of one delegate from each member and one Executive committee elected by the Council. The Council should be responsible for accepting or rejecting of applications for membership.

In order to finish the work with the statutes and other outstanding work a Preliminary Executive was appointed as officers and members:

- Dr. Antoine Remond (France), Chairman;
- Dr. Barry Barber (UK), Secretary;
- Prof. Peter L. Reichertz (Federal Republic Germany), Treasurer.

The members of the preliminary executive had been:

- Dr. Mogens Jorgensen (Denmark);
- Dr. Jan Roukens (Holland);
- D. Jan van Egmond (Belgium).
- The most important directions of work which have been developed referred to history of health and patient record systems are security, nursing informatics, communication standards and a common terminology.

REFERENCES

1. Ball MJ, Hannah KJ, Gerdin Jelger U, Peterson HE. Nursing Informatics: Where Caring and Technology Meet (Computers in Health Care). New York: Springer Verlag. 1988.
2. Blum BI, Duncan KA. A History of Medical Informatics. ACM Press, USA, 1990.
3. Gerdin-Jelger U, Peterson HE. The Difference between Expected and Actual Effects of Computer Support in the Nursing Environment. In: Nursing Uses of Computers and Information Science. Amsterdam: North Holland, 1985: 51-5.
4. Peterson HE. From Punched Cards to Computerized Patient Records: A Personal Journey. IMIA Yearbook of Medical Informatics, Stuttgart, Schattauer. 2006: 180-6.
5. Fenna D. Abrahamsson S. Lööw SO. Peterson HE. The Stockholm County Medical Information System. Lecture Notes in Medical Informatics: Berlin: Springer Verlag, 1978.
6. Peterson HE. Improving Patient administration in Hospitals. In: Anderson TJ, Forsythe JM (eds). MEDINFO 74, Amsterdam: North Holland, 1974: xxv-xxvi.

7. Peterson HE. Hospital and Health System. In: van Bemmel JH, Ball MJ, Wigertz (eds). MEDINFO 83. Amsterdam: North Holland, 1983: 2-5.

8. Peterson HE. Ten Years' Experience with a Large Regional Health Care Data Base. In: AAMSI Congress Proceedings, 1984: 3-12.

9. Peterson HE, Gerdin-Jelger U. A Method on How to Improve Effective Use of Informatics in Healthcare. In: Salamon R, Blum B, Jorgensen M (eds). MEDINFO 86. Amsterdam: North Holland, 1986: 335-7.

10. Peterson HE, Isaksson AI (eds). Communication Networks in Health Care. Amsterdam: North Holland, 1982.

11. Peterson HE, Schneider W. (eds). Human-Computer Communications in Health Care Amsterdam: North Holland, 1985.

12. Peterson HE, Lundin P. Documenting the Use of Computers in Swedish Health Care up to 1980. IMIA Yearbook of Medical Informatics, Stuttgart: Schattauer, 2011: 169-74.

13. Masic I. History of Informatics and Medical Informatics. Avicena. Sarajevo, 2013: 71-112.

14. Hayes G, Barnett D. (eds). UK Health Computing. Recollections and Reflections, BCS, Swindon, UK, 2008.

15. Mihalas GI. An attempt to define major stages of Medical Informatics development, CD Proceedings IMIA-LAC Conference, Guadalajara, Mexico, 2011.

16. Masic I. Review of Informatics and Medical informatics History. Acta Inform Med, 2007; 15, 178-88.

17. Yacubsohn V. A Short History of the Beginnings of Hospital Information Systems in Argentina, IMIA Yearbook of Medical Informatics, Schattauer, Stuttgart, 2012: 163-8.

18. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics, IMIA Yearbook on Medical Informatics, Schattauer, Stuttgart, 2007: 165-75.

07

Barry Barber, Maureen Scholes

REFLECTIONS ON THE DEVELOPMENT OF MEDICAL INFORMATICS

The recording of numbers appears to pre-date the emergence of writing and excavations of the clay tablets of civilisations in the Middle East have shown that clay tablets were used to keep account of activities undertaken in a systematic fashion. Correspondingly, various forms of abacus have been used types of calculation from the Sumerian abacus dating from about 4 ½ thousand years ago to the Chinese abacus (Suanpan) from around 2 thousand years ago. As time passed various forms of writing were developed using animal hides, which were developed as vellum and papyrus which eventually developed into paper. Wood block printing, also, was a very ancient art and movable type printing had been utilised in the far East but the development of movable type page setting in Europe transformed the process of printing. It led to the explosion of printing presses and printed material which transformed the cultural environment by facilitating the transmission of ideas and information. However, paper systems were an essential part of any significant project, accounting or the work performed by individuals.

Caesar Augustus decreed that a census should be taken (1) and there is no doubt that this was part of his system of control. Similarly the Magna Carta (2), commissioned by William the Conqueror of England, was a key component of his system of control and taxation of his conquered land. These activities were expensive and were not undertaken for fun but were active information systems in the modern sense of the term. However, it might be argued that the Jacquard loom (3)] and the use of punched cards in engineering control systems was the next step from paper systems towards modern, computer-based, information systems. Indeed, the fast, 5-hole, paper tape readers and

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

printers developed during World War II at Bletchley Park might be seen as the next logical step along the road. When The London Hospital, now the Royal London Hospital, took delivery of an Elliott 803 computer in November 1964 (4) nearly 50 years ago, it was the first hospital in the United Kingdom to purchase its own computer.

INITIAL LIMITATIONS OF COMPUTERS

The computer that we purchased had 8k of 39-bit words as immediate access memory with a cycle time of 256μsec and it used three 35mm magnetic film handlers as the backing store. It used 5-hole paper tape as the input and output medium, although we did not know at that time where these facilities had been first developed. The instruction code comprised 6-bit function code operating on an 13-bit address code - which enabled the instruction to thus address the whole store directly. Two machine code instructions could be held in a single word and this allowed for a B-line modifier-bit between them.

The 1000 foot reels of magnetic tape could hold 4096 blocks of 64 39-bit words but all this complicated technology only held just over a megabyte per reel. Data and program input was achieved using a Teletype machine to both print the information on paper as well as on the 5-hole tape. The paper tape reader could input information at 500 char/sec. Correspondingly, the computer printed out paper tape at 100 char/sec which was then run through a printer. Interestingly, we all got quite good at winding up large rolls of paper tape and at deciphering - and sometimes adjusting with a Uni-punch - the symbols on the tape!

In purchasing the computer, the Board of Governors of The London Hospital were advised that the financial systems at the heart of the case made out for the computer would only take up half of the computer's time. Accordingly, they decided that the rest of the time should be made available for medical and scientific research as was appropriate for a Teaching Hospital. This directive enabled many projects to be undertaken within both the hospital and the medical college. Thus, computing time was available but the programming, systems development and operating of the non-financial programs was almost exclusively carried out by the users themselves.

The Operational Research Unit, a sister Unit of the Computer Unit, that had developed out of the work carried out in the Medical Physics Department was able to take full advantage of these facilities for the exploration of the use of Operational Research techniques developed during WWII to improve the operation of the hospital. Among the projects it explored were Queueing in Out-Patient clinics, staffing of emergency anaesthetic services, admission and discharge arrangements, planning the haemodialysis programme, running obstetric surveys, examining the nurse training programme, establishing a microfiche nurse record system as well as an assessment of computerised radiotherapy treatment planning systems.

As with much university computing on large batch machines, this work was helped by the availability of "High Level Programming Languages". In the case of the Elliott 803 we had 803 Autocode and, at a later stage, we had 803 Algol although this was really designed for the Elliott 503, which was about 60 times faster although only twice as expensive!

Although these facilities were an amazing improvement on the use of a mechanical calculator or the punched card equipment of the finance department, a quick comparison with the personal computers now readily available in many homes shows how limited they were in comparison with the tasks that began to be tackled. However, the work undertaken did enable staff to begin to explore the data that was routinely handled in the hospital and in the research work of the Medical College and this expertise formed the basis for subsequent developments in the use of "Real Time" hospital systems.

The three Annual Reports from the Computer and Operational Research Units covering the first three years of use of the Elliott 803 showed how the computer had been used and what the next steps in computerisation of the hospital might be. The average weekly running time grew from 50.7 hours in the first full year to 74.4 and 104.6 hours in the following two years.

The third report outlined the next step in which a "batch processing system" could be used to handle the basic "Patient Administration" of the hospital (5). It should be noted that at this same time Elliott Medical Automation Ltd was established under the direction of Dr L C Payne and he made an arrangement with University College Hospital to install an Elliott 803 on their premises as a means of exploring a wide variety of health computing problems, which included laboratory computing with auto-analysers and radiotherapy treatment planning but his ideas went much further into the areas of medical informatics (6).

CULTURAL LIMITATIONS

Unlike the present day, computers were housed in large airconditioned rooms which could only be accessed by authorised people. Frequently, there was a viewing window for visitors but these were soon discontinued for security reasons. There was little or no public or professional understanding of:

- The uses and limitations of computers;
- How information could be entered into computers;

- How information systems could provide information;
- No teaching about computers in schools.

Culturally, it was thought that typing was a “secretarial skill” beneath the dignity of professional people like doctors and nurses and collating information was a job for clerical staff.

These ideas have only slowly changed as more and more people have had access to more and more powerful computers. Like journalists before them who found that typing was an important skill for their profession, many professional staff, especially at Universities, where there was access to large computer systems, found that they could draft their research papers and reports by typing into computer systems and that errors could be easily corrected as their ideas were developed.

This drift in work patterns was accelerated as many organisations moved away from providing personal secretaries towards typing pools and then to providing computing facilities instead.

Although the culture was changing solutions had to be found to achieve data input to computer systems that did not involve memorising complex systems of codes. As ideas developed different approaches were explored and tested it was found that:

- A tree-branching approach in which the users selected options from short lists enabled them to locate appropriate parts of a record for data entry or inspection.
- More powerful computer systems could assist the data entry process with basic validation checks and spell checking.
- Staff were no longer “afraid” of using computers.
- Some early systems envisaged data entry being handled by a core of individuals like telephone operators but it quickly became apparent that the only way to capture reliable information was for it to be entered directly by those involved in creating it.
- For this to happen, the process had to be made easy and fast. One of the major reasons for the termination of Prof John Anderson’s Kings College Hospital Medical Records System was the appearance of a paper by his colleagues claiming that it took longer to enter the medical record into the computer system than when the recording was done by hand (7).

OPPORTUNITIES OFFERED

On the other side of the equation computers offered amazing opportunities for the communication and analysis of information and for improvements in the functioning of organisations. At one go they could overcome the limitations of a single medical record located in one place. In an increasingly distributed health care system up-to-date medical records can be available wherever they are needed crossing whatever organisational boundaries are necessary, subject only to the issues of patient confidentiality. By collecting information about the passage of patients through their care the medical information systems can automatically provide information about the functioning of a hospital or other care system in order to facilitate improvements in the delivery of care both from the patients' perspective of avoiding non-clinical delays and worry as well as from the organisation's perspective in terms of the efficiency of the delivery of care. It should be noted too, that almost every aspect of clinical care has been transformed over the last 50 years with dedicated information systems and devices which assist clinicians in the processes of diagnosis, therapy and recording of clinical findings - quite apart from the larger systems for hospitals as a whole. However, these advances have only been possible as a result of the improvements in the speed and size of computer systems, the ease of computer usage and data input, the the clinical and organisational research that has been incorporated into modern information systems.

SOME KEYS TO SUCCESSFUL INFORMATION SYSTEMS

The early computing systems tended to use a "batch processing" approach in which information was recorded and analysed for later use but the advent of much faster and more powerful computer systems began to enable computers to accept information that has been input and provide an almost instant response. This "Real Time" approach provided opportunities for the direct interaction of doctors and nurses with the computer systems for the first time. However, it was very demanding of the computing facilities because, if the computer's responses were too long in coming, the users would simply walk away and get on with other work - and the system as designed would be an evident failure. The total system of hardware, software and user activity must be fast enough in providing results for the users to complete their tasks without any perceptible delay.

The Management of Change in any organisation requires serious attention and all the key disciplines must be brought into the process at the right organisational level and with experienced individuals. In setting up the Real Time System at The London Hospital, an Executive was established chaired by a senior administrator and which included a senior doctor and nurse as well as the Directors of the Computer and Operational Research Units - which provided the technical input. Although the technical staff were engaged full time, they were often involved in many other activities than the process of building the Hospital's Real Time Computer System. The other staff simply had the routine oversight of the process of building the system added to their other professional activities. At the start, the five initial members of this Executive had, between them, over 100 person years of experience at the hospital. This Executive was responsible for all the decision-making in the project. Once the outline of the project was clear, it established "Training and Consultation" sessions, initially with the senior medical, scientific and nursing staff but then focussing later on user training with more junior staff as various parts of the system were moving towards implementation. The Executive, decided to address the areas of activity that we described as Patient Administration in order to gain experience of these systems before tackling the more life threatening issues of the full medical record.

Although, even then once a part of the system had been introduced and was running routinely, any interruption or failure to deliver results could cause considerable organisational problems - and would have the senior doctor and nurse out on the wards trouble shooting the clinical issues. The whole process was that of exploring an area of systems activity with surveys or Operational Research techniques, developing a feasible computer-based system, testing the users reactions and making changes as needed, establishing an appropriate training programme and then proceeding to full implementation - and reviewing problems and progress some weeks after implementation. During the development of the project, the hospital Chairman, Sir Harry Moore, provided us with a copy of an early paper outlining why computer systems fail (8) and he advised us that he did not expect us to fail for any of the reasons outlined in that early paper! That paper listed many of the reasons why so many computer systems have failed and still continue to fail! An early

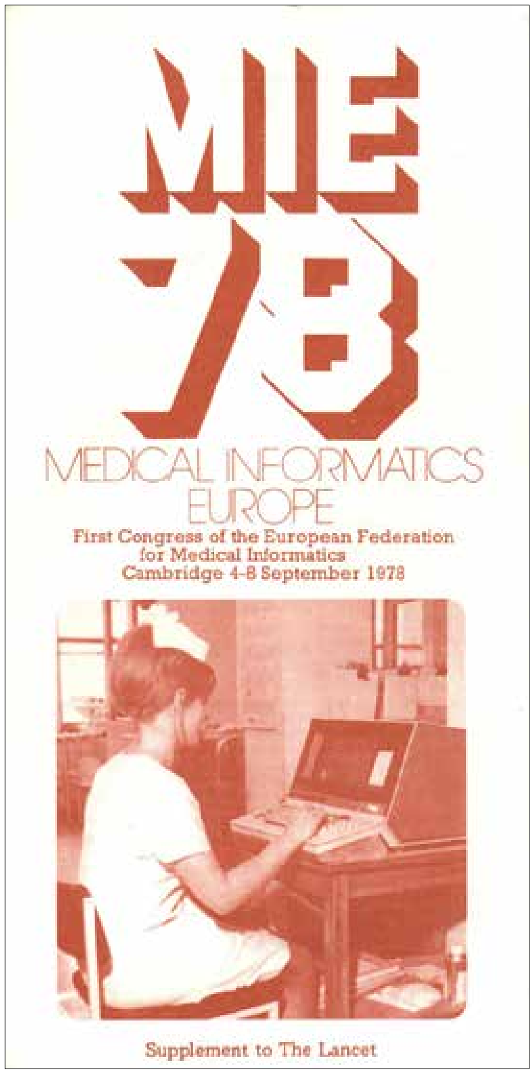


Figure 1. Poster of MIE 1978 Conference

review of the project was given in (9); the basic software developed "in-house" for the system was ported from the initial Univac 418/III fast message-switching hardware to two other platforms before finally being decommissioned after some 36 years a few years ago. The reason for the original choice of computer system was that it was a very fast message switching system with a 750ns cycle time, 80k of 18-bit words of RAM and two fast drums holding 3m 6-bit characters with 4 ¼ms access time backed up with a Fastrand II holding 132m characters with a 90ms access time. The whole scheme was designed to facilitate the fast menu selection process (10). Although the system came with a basic RTOS operating system, it was necessary for the staff to write all the "middleware" to enable the system to function a needed by the designers and the hospital staff.

THE EMERGENCE OF NURSING INFORMATICS

Although the term medical informatics was frequently used, it was inevitable that nurses should become heavily involved in the use and design of health care information systems. Indeed at the foundation of EFMI there was considerable discussion about the name but it was finally decided that the term "medical" should be interpreted as including all aspects of health care - instead of specifically including the words "health" or "health care" in the title.

The issues of nurse allocation were an early interest of mathematicians and some computer solutions followed but a more important issue surfaced in the handling of the records of nurses in training and the development of training programmes. If the allocation programs were somewhat too complex for the early computers, it became clear that as "nurses looked after patients who were visited from time to time by doctors", they would be closely involved in the acceptance or rejection of medical information systems both on the hospital ward and in the community. Successful projects invariably involved nurses who could focus on the systems aspects with their colleagues and ensure that they were designed to help their colleagues carry out their activities. The recording of these activities became integral with the activities themselves rather than an additional task added at the expense of providing care for their patients. As with doctors, the important issue was to find some acceptable means of data capture "in real time" instead of creating additional time-consuming work. It appears to be true today that some systems still absorb far too much nursing time and take nurses away from the basics of patient care.

The first conference of the pre-cursor of the International Medical Informatics Association was MEDINFO 74 (11) and already there were were a number of papers on nursing issues and systems in the first conference raising issues relating to the processes of caring for patients (12), drug administration (13), intensive care (14) and education (15). However, following increasing interest in nursing systems at MEDINFO 80 (16) in Tokyo with the Japanese nurses the British Computer Society's medical computing groups agreed to host a special conference on nursing systems that aimed to bring together the first international meeting concerned with Nursing Informatics to pull together what was known and going on in the field. Maureen Scholes co-ordinated and chaired this activity and the resultant conference in London and Harrogate is recorded in reference (17). The success of this effort led to the formation of IMIA WG8 on Nursing Informatics, with Maureen Scholes as the first chairman who was then followed by Prof Kathy Hannah.

BUILDING AN INTERNATIONAL COMMUNITY

Prof François Grémy's initiative from led to the formation of Technical Committee 4 of the International Federation for Information Processing [IFIP]. When we received his invitation to participate in this activity we were surprised that anyone would contemplate "going overseas" for a committee meeting but his insight and forward thinking led to the amazing world-wide series of activities of the International Medical Informatics Association (IMIA). In the process of participating in and contributing to these IMIA and EFMI events, we have all developed a network of friends and colleagues across the world who have helped us sharpen our ideas and helped us find solutions to problems as a result of their different perspectives and types of expertise. This globalisation began long before e-mail and the internet but the Group 4 fax machine did mean that, for the first time, it was possible to contact colleagues where one's poor language skills made it impossible to get past our colleague's telephone operator! This international community who manage happily to turn up at very unlikely locations across the world to attend committee meetings and to participate in conferences is the most precious asset that we have in medical informatics.

The British Computer Society (BCS) had established a Medical Specialist Group in 1967 to explore the growing ways in which computer systems were beginning to be used in a variety of hospitals and health care organisations but we were able to find limited funding that enabled us to participate in the activities of IFIP/TC4 - an obscure designation that lasted for the first 10 years until we were able to gain independence as IMIA. The first major activity was the development of the MEDINFO conference in Stockholm on August 5–10, 1974 (11) which started the three-year series of world-wide conferences. In addition, various working groups were established to explore particular issues in detail - Education was a major issue but so was Data Protection and Security which was initiated as WG4 under Prof Gerd Griesser. The second MEDINFO (18) was held in Toronto on August 8–12, 1977 against a backdrop of strikes which made attendance problematic and the third was, as already noted in Tokyo in 1980 (16) from

29 September to 4 October thus circling the globe. Prof John Anderson and Dr Hans Peterson were closely involved in these early developments with Prof Francois Grémy but MEDINFO 74 brought together a remarkable collection of people who went on to change the world and develop Medical Informatics as a subject and introduce that subject to the world as a whole.

Bud Abbott and John Flint worked hard to stabilise the finances after the Toronto MEDINFO. Profs Francis Roger France, Peter Reichertz, Jan van Bemmel, Jean-Raoul Scherrer and Otto Rienhoff together with Stellan Bengtsson, Jan Roukens and Dr Jana Zvárová provided substantial European input, while Shigekoto Kaihara brought Japan into the IMIA orbit and, of course, there were many distinguished Americans who brought the USA into the world-wide activities - Morris Collen, Donald Lindberg, Marion Ball - to name but a few! The MEDINFO congresses continued as the main showcase of medical informatics with the sequence etched in the mind much more clearly than the dates of the kings of England that we learned at school! Each MEDINFO was memorable for different things but many of us remember Jean-Raoul Scherrer riding an elephant into the circus one evening in Geneva at MEDINFO 92. MEDINFO 89 was intended to be held in Beijing and the programme committee were meeting colleagues who had not spoken english for thirty years. It was sad that events outside our control led to a split conference where the main part was moved to Singapore while the mainly Chinese participants met as originally planned in Beijing. However, I succeeded Peter Reichertz as editor and, with Gustav Wagner's help, we produced the proceedings of MEDINFO 89 (19) exactly as the programme committee had planned the meeting rather than as it eventually turned out - it was the meeting as it never was and our Chinese colleagues were very pleased with that result! In addition to the large conferences, IFIP/TC4 established a series of working groups. There was an early interest in the issues of education with the establishment of WG1 and the issues of confidentiality were developed in WG4. Prof Gerd Griesser and then David Kenny, chaired the first activities of WG4 leading to monographs on the issues (20, 21). These early working conferences were successfully re-initiated in conjunction with Prof Ab Bakker with follow-up conferences in 1992 every two years with working conferences in Heemskerk (22), Helsinki (23), Osaka/Kobe (24), Victoria (25) and Varenna (26). Ab Bakker, Tervo Pellikka, François-Andre Allaert, Kiyomo Ishikawa, Joechen Mother and Francesco Pinciroli all played their part in making these working conferences happen. Another working conference on Hospital Information Systems held in Cape Town (27) led to another working group but everyone's experience is clouded by their specific interests as the field is so wide and so expanding that no-one can embrace the totality of these developments.

The Journées d'Informatique Médicale were held in Toulouse for some 10 years providing an international meeting place for many interested in Medical Informatics but eventually it became clear to many in Europe that IFIP TC4 and its Working Groups would not be able to address all the needs of the developing European Medical Informatics community and the Toulouse meetings needed to be built upon by an organisation that embraced all European countries. Thought was given to the development of a European Medical Informatics body that would complement the world-wide body - although many of the participants in IFIP TC4 were worried that this might detract from the world-wide activities. A meeting was convened at WHO Headquarters in Copenhagen on 10–11 September 1976 that led to the establishment of the European Federation for Medical Informatics (EFMI). The need for this European dimension was underlined by a very successful Medical Informatics conference, MEDCOMP 77 (28), organised in Berlin by Online Conferences Ltd based at Uxbridge University. Further conferences were considered but when the BCS offered to host the first EFMI conference it firmly put in place a professional organisation providing these events instead of a private commercial but friendly and interested commercial concern. The first EFMI conference took place in Cambridge on 4–8 September 1978 (29). (Figure 1). These, MIE, conferences followed thereafter in the years between MEDINFO conferences. The second conference followed in Berlin and the third in Toulouse. MIE 79 (30) successfully confirmed EFMI as the key European professional conference organisation in Medical Informatics. Correspondingly, MIE-81 (31) in Toulouse provided a flourish to a very successful sequence of Journées d'Informatique Medicale that provided the initial European platform for medical informatics - the world community taking on the French concept of Informatics!!! The Medical Informatics Europe conferences continued to flourish and Special Interest Conferences were added to the repertoire as the needs of particular subject areas developed. EFMI developed some working groups particularly so that it could interface directly with the developing activities of the European Commission and European Standardisation Bodies.

The Council of Europe and European Union

One of the successes of the immediate post-World War II era was the development of the Council of Europe and the Convention for the Protection of Human Rights and Fundamental Freedoms in 1950 (32). As computer systems for holding Personal Data were developed the issues of data protection and privacy became important. The Convention "For the Protection of Individuals with regard to Automatic Processing of Personal Data was developed in 1981 (33) together with a Recommendation on "Automated Medical Data Banks (34) which was developed further in 1997 as a Recommendation "On the Protection of Medical Data" (35). These issues were taken much more seriously in Europe than elsewhere and the European Union based its Directive "On the Protection of Individuals with Regard to the Processing of Personal Data and on the Free Movement of such Data" (36) in 1995 on the previous work of the Council of

Europe and the needs of the Single Market. Unfortunately, many of the freedoms established in these documents have been eroded by the significant but often over-exaggerated fear of "terrorism" in a fashion reminiscent of the religious wars of the middle ages.

At the start of the European Union's programme of Advanced Informatics in Medicine (AIM) a conference was organised in Brussels to explore the current issues of data protection within the health care arena (37) which set the scene for how these issues should be handled by the various projects within the programme. Even while these initial projects were running the secretariat established an AIM Requirements Board to explore generic issues for AIM and future programmes in the wider medical area (38) and published this more widely (39). Amongst this work there was developed a series of "Six Safety First Principles" for medical information systems (40, 41) which required that systems should be:

- Safe for Patients and Users;
- Secure for Patients, Users and Others;
- Convenient for Users;
- Legally Satisfactory for Users and Suppliers;
- With Legal Protection of Software Products;
- Multi-Lingual.

Perhaps for the first time thought was being given to systems safety inthe light of emerging problems of safety (42) as opposed to simplydata protection and of external systems control (43). The AIM programme and subsequent programmes included a number of medical data protection and security projects such as SEISMED (overview 44 & final Guidelines 45), ISHTAR (46) and MEDSEC (47) among many others. Some of these issues were presented to the annual British Computer Society Healthcare Computing conference in 1992 exploring the "Worst Case Scenarios" or "What happens when it all goes wrong?" (48). These issues were raised again under the heading of "Info Vigilance" at MEDINFO 2001 (49). The issue of safe information systems is a subset of the wider issue of the delivery of safe health care and it needs to be tackled in that context. The AIM programme was looking towards new standards for health information systems as well as new systems. The MEDSEC project was exploring these issues and the European Standards Organisation (CEN) had established a Technical Committee 251 to develop appropriate standards for medical information systems (CEN/TC251) and working group 6 had been addressing information safety and security and a number of draft standards were developed including prENV 12924 which attempted to categorise Healthcare Information Systems and prescribe the protection that each category needed (50). The fundamental conclusion that we reached was that we needed a safety standard developed in the context of IEC 61508 for medical systems and devices (51). Meanwhile, the clinicians were becoming concerned about safety issues in medicine more generally. The British Medical Journal ran an issue specifically on this topic in March 2000 "Reducing Errors; Improving Safety" (52) with 5 editorials on various aspects of these issues, 4 major papers and a clinical review. Sir Brian Jarman raised the these issues in his Harveian Oration at the Royal College of Physicians in London in 1999 (53) and and this had extensive coverage in the British press at the time. In America Kohn et al raised these safety issues in their book with the eye-catching title of "Too Err is Human: Building a Safer Health System" (54).

The Department of Health in London published its approach to these issues in "Building a Safer NHS for Patients" (55) and then established the National Patient Safety Agency to provide a continuing focus for advice and guidance (56). This work developed to the point where the BMA and the Royal College of Physicians set up a major two day conference to address various aspects of the matter on 21-22 October 2004 with the proceedings released later on a CD-ROM (57). The conference included a positively glittering array of medical and legal speakers including experts from other countries and industries. There was even a "mock legal negligence trial" presided over by a retired Lord Justice of Appeal in which the claimant succeeded in her appeal whereas the audience, comprising mostly of medical practitioners, thought that the appeal would fail! The issue of patient safety - and the safety of health information systems - is a cultural one of continual learning and improvement and, if some of the news from our hospitals today is correct, there is still a great deal to rectify and to learn. The adoption by IMIA of the Code of Ethics for Health Informatics Professionals developed by Eike-Henner Kluge in conjunction with IMIA WG4 could be a major step along the way to clarifying some of the issues involved (58).

REFERENCES

1. The Holy Bible, Luke 2, verse 1.
2. Magna Carta, 15 June 1215, copy in British Library, London.
3. Jacquard JM, Improved weaving loom exhibited at Paris Industrial Exhibition 1801,[http://en.wikipedia.org/wiki/Jacquard_loom]
4. Barber B, Abbott W. Computing and Operational research at The London Hospital. Butterworths, London, 1972, ISBN 0407-51700-6
5. Ref 4, pp 47–54,
6. Hayes G, Barnett D. UK Health Computing: Recollections and Reflections. British Computer Society London 2008, ISBN 978-1-902505-99-2 p44 [pages 27–100 outline much of this early work and reference detailed internal hospital reports now in The London Hospital Archive].

7. Opit LJ, Woodruffe EJ. BMJ. 1971; 4: 76-9. & 80-82 [see also ibid 67–69].

8. Brocks BJ. "What Went Wrong? An Analysis of Mistakes in Data Processing Managment", Accountancy, 1969 Sep; 66-75 [also ref 62 on page 96 ref 6].

9. Barber B, Cohen RD, Scholes M. "A Review of The London Hospital Computer Project". In: Laudet M, Anderson J and Begon E (eds) Proceedings of Medical Data Processing, Toulouse, 1976: 327-38, Taylor and Francis, London, ISBN 0 850661 06 4 [also ref 70 on page 97 ref 6]

10. Ref 4, pp 55–78

11. Anderson J, Forsythe M, (eds) 1974 MEDINFO 74, Stockholm, North Holland, Amsterdam, ISBN 0 444107 71 1.

12. Ashton C. "Caring for patients within a computer environment". 1975: 105-14, in ref 11.

13. Ashton C. "A computer system for drug prescribing and its impact on drug administration". 1975: 175-96, in ref 11.

14. Ashcroft JM, Berry JL. "The introduction of a realtime patient display system into the cardio-thoracic department at Wythenshawe Hospital". 1975: 101-7, in ref 11

15. Scholes M. "Education of health staff in computing". 1975: 213-5, in ref 11.

16. Lindberg DA, Kaihara S. (Eds), "MEDINFO 80" (Tokyo), 1980, ed, 2 volumes, North Holland, Amsterdam, ISBN 0 444860 290.

17. Scholes M, Bryant Y, Barber B. (eds) for IMIA. "The Impact of Computers on Nursing: An International Review", North-Holland, Amsterdam, 1983. ISBN 0 444866 82 5.

18. Mihalas G, Zvarova J, Kulikowski K, Ball M, van Bemmel J, Hasman A, Masic I, Whitehouse D, Barber B. History of Medical Informatics in Europe - a Short Review by Different Approach. Acta Inform Med. 2014 Feb; 22(1): 6-10. doi: 10.5455/aim.2014.22.6-10.

19. Shires DB, Wolf H. (Eds) "MEDINFO 77", Toronto. North Holland, Amsterdam, 1977.

20. Barber B, Dexian Cao, Dulie Qin, Wagner G, MEDINFO 89, 2 vols, North Holland Amsterdam, 1989.

21. Griesser G. et al (Eds) for IMIA WG4 "Data Protection in Health Information Systems: Considerations and Guidelines", North Holland, Amsterdam, 1980.

22. Griesser G. et al (eds) for IMIA WG4 "Data Protection in Health Information Systems: Where do we Stand?", North Holland, Amsterdam, 1980.

23. Barber B, Bakker AR, Bengtsson S, "Caring for Health Information: Safety, Security and Secrecy", 1994, (IMIA WG4 conference at Heemskerk), Elsevier, Amsterdam pub as supplement to Int J Biomedical Computing, 1994 Feb; 35: 1-281.

24. Bakker AR. et al, "Communicating Health Information in an Insecure World", 1996, (IMIA WG4 conference in Helsinki), Elsevier Science pub as supplement to Int J Biomedical Computing. 1996; 43: 1-152.

25. Bakker AR. et al, "Common Security Solutions for Communicating Patient Data", 1998, (IMIA WG4 conference in Osaka & Kobe), Elsevier Science pub as supplement to Int J Biomedical Computing. 1998; 49: 1-137 & 71-237.

26. Bakker AR, Barber B, Moehr J. "Security of the Distributed Electronic Patient Record (EPR)", 2000, (IMIA WG4 conference in Victoria) pub as supplement to Int J Biomedical Computing. 2000; 60: 71-237.

27. "Realising Security in the Electronic Record", 2003, (IMIA WG4 conference in Varenna) pub as supplement to Int J Biomedical Computing. 2003.

28. Shannon RH. (ed) for IMIA, "Hospital Information Systems", 1979, North Holland, Amsterdam inline Conferences, "MEDCOMP 77", Berlin, 1977. ISBN 0 903796 16 X

29. Anderson J. (ed). 1978 "MIE Cambridge 78": Lecture Notes 1 Springer Verlag, Berlin, 1987, SBN 3 540089 16 0.

30. Barber B, Grémy F, Uberla K, Wagner W, (eds), "Medical Informatics Europe MIE79 (Berlin)", vol 5 in Lecture Notes in Medical Informatics, Springer Verlag 1979. ISBN 3 540095 4 97.

31. Grémy F, Degoulet P, Barber B, Salamon R. (eds), "Medical Informatics Europe MIE78 (Toulouse)", vol 11 in Lecture Notes in Medical Informatics, Springer Verlag, 1981.

32. Council of Europe 1950, Convention for the Protection of Human Rights and Fundamental Freedoms 4 November 1950, and Protocols 1 [20/3/52], 2[6/5/63] and 4 [16/9/63], Strasbourg, ISBN 92 871 0064 0

33. Council of Europe 1981, Convention "For the Protection of Individuals with regard to Automatic Processing of Personal Data", Convention 108, January 1981, ISBN(1982)92- 871-0022-5.

34. Council of Europe Recommendation, R(81)1, on Automated Medical Data Banks, Strasbourg, 23 January 1981.

35. Council of Europe Recommendation, R(97)5, On the Protection of Medical Data, Council of Europe, Strasbourg, 12 February 1997.

36. European Community Directive 95/46/EC, "On the Protection of Individuals with Regard to the Processing of Personal Data and on the Free Movement of such Data", OJ L281/31–50, 24 October 1995.

37. European Commission DG XIII/F AIM "Data Protection and Confidentiality in Health Informatics: Handling of Health Data in Europe in the Future, Research and Technology Development on Telematic Systems", vol 1 Health Studies in Informatics, IOS Press, Amsterdam 1991.

38. AIM Requirements Board, Impact Assessment and Forecasts of Information and Communications Technologies Applied to Health Care, Volumes I-!V, ref XHI/F/A10966C, AIM Secretariat, 61, Rue de Treves, Brussels, 1989.

39. Roger-France FH, Santucci G. "Perspectives in Medical Information Processing: Strategic Issues, Requirements and Options for the European Community", Springer Verlag, Berlin, 1991.

40. Barber B, Jensen, OA, Lamberts H, Roger F, de Schouwer P. Zöllner H. "The Six Safety First Principles of Health Information Systems: A Programme of Implementation Part 1: Safety and Security", pp 608-613 in MIE90 (eds) O'Moore R, Bengtsson S, Bryant J R, Bryden JS, vol 40 in Lecture Notes in Medical Informatics, Springer Verlag 1990.

41. de Schouwer P, Barber B, Jensen OA, Lamberts H, Roger France FH, Zöllner H. "The Six Safety First Principles of Health Information Systems: A Programme of Implementation Part 2 The Environment, Convenience & Legal Issues", pp 614-619 in above ref.

42. Fatal Defect: Chasing the Killer Computer Bugs, Peterson, P, Vintage Books, New York, 1995. ISBN 0-8129-2023-6.

43. Stoll C. "The Cuckoo's Egg", Pan Books, London, 1991, ISBN 0-330-31742-3.

44. Barber B, Teacher A, Louwerse CP. "Towards Security in Medical Telematics", vols 27, IOS Press, Amsterdam.

45. SEISMED consortium, "Data Security for Health Care", vols I Management Guidelines, vol II Technical Guidelines and vol III User Guidelines, Health Studies in Informatics vols 31–33, IOS Press, Amsterdam 1996. ISBN 90 5199 263 7.

46. ISHTAR consortium, "Implementing Secure Telematics Applications in Europe", Health Studies in Informatics vol 66, IOS Press, Amsterdam 2001, ISBN 90 5199 489 3.

47. Allaert FA, Blobel B, Louwerse CP, Barber B. "Security Standards for Healthcare Information Systems" the MEDSEC project, 2002, Health Studies in Informatics vol 69, IOS Press, Amsterdam, 2002. ISBN 1 58603 000 0.

48. Barber B, Vincent R, Scholes M. "Worst Case Scenarios: the Legal Consequences,, pp 282–288, in "Current Perspectives in Healthcare Computing 1992", ed. Richards B. et al, pub for British Computer Society by BJHC Weybridge, 1992. ISBN 0 948198 12 5.

49. Barber B, Allaert FA, Kluge EH. Info-vigilance or safety in health information systems. In MEDINFO 2001 Patel, V.L., Rogers R, Haux R. (Eds), London, North-Holland, Amsterdam. 2001:. 1229–33.

50. Medical Informatics–Security Categorisation and Protection for Healthcare Information Systems, TC251 WG6 [PT0121 ENV 12924, June 1997, CEN, Brussels, EUROMED-ETS 1996.

51. International Electro-Technical Commission [IEC], 61508, Functional Safety of Electrical/Electronic/Programable Electronic Safety Related Systems, Geneva.

52. BMJ, "Reducing Error & Improving Safety", BMJ, No 7237, 18 March 2000.

53. Jarman B, "The quality of care in hospitals", Journal of the Royal College of Physicians of London. 2000; 34(1): 75-91.

54. Kohn IT, Corrigan JM, Donaldson MS. "Too Err is Human: Building a Safer Health System", National Academy Press, Washington, 1999.

55. English Department for Health (England), "Building a Safer NHS for Patients", April 2001, London, ref 23720.

56. National Patient Safety Agency, "Seven Steps to Patient Safety: An Overview Guide for NHS Staff", 2004 website www.nrls.npsa.nhs.uk

57. British Medical Association/Royal College of Physicians, "Making Health Care Safer 2004", conference 21–22 October 2004 at RCP, London, published as CD-ROM by BMA

58. IMIA, "Code of Ethics for Health Informatics Professionals", pub for IMIA by BCS 2003, ISBN 1-902505-52-2.

08

Arie Hasman, John Mantas, Tatyana Zarubina

AN ABRIDGED HISTORY OF MEDICAL INFORMATICS EDUCATION IN EUROPE

The history of medical informatics is relatively short. The field started in the fifties of the last century. EFMI was established in 1976 and educational programs in medical informatics in Europe were not introduced much earlier. We were asked to sketch the history of medical informatics education in Europe. Different names with sometimes (slightly) different meanings have been suggested for our field of medical informatics. We will use the terms medical informatics, biomedical informatics and health informatics in this contribution interchangeably as umbrella terms.

When we started writing, we realized that we were not fully aware of all educational developments that took place in other European countries other than our own. That is why we called our contribution an abridged history with apologies that we probably do not refer to all important developments. On the other hand, we also realized that writing such a history does not mean that all developments have to be traced back and be mentioned. It is more important to look for trends that can be inferred from the various developments and to provide examples of those trends. That is what we have done in the following where we distinguish five different themes.

The questions whether medical informatics is a discipline separate from informatics or even whether it is a scientific discipline and whether it is necessary to develop specialized curricula for this field have often been posed. Especially in the beginning much of the research carried out by medical informaticians focused on the development of

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

systems, like for example hospital information systems, departmental systems, database systems, signal and image processing systems and expert systems. These systems had as goal to support physicians and nurses in their work. Later on questions about the quality of the systems and the general design principles on which they have to be based became more important. It was also realized that a technically perfect system does not warrant that such a system will be automatically accepted in practice. Since the implementation of an information system is a process of mutual transformation, the organization and the technology transform each other during the implementation process. Therefore, also sociological aspects play an important role and should be taken into account.

Medical informatics was considered by some as computer science applied to medicine, others were of the opinion that medical informatics was more than computer science and medicine together (because the body of knowledge in medical informatics also contained knowledge coming from a number of other disciplines like epidemiology, cognitive psychology, sociology, biostatistics, etc.) and therefore, they considered it as a medical discipline closely linked to but separate from informatics. However, in both views education in medical informatics would lead to graduates that were medical informatics professionals and not medical professionals (although some of these new professionals could initially have been educated as a medical specialist). Also, in order to be accepted by physicians, medical informatics specialists should be educated at an academic level.

Medical informatics is both an engineering discipline (design and development of information systems for example) and an applied science (aspects related to information science). Since medicine and healthcare are the domains of study of medical informatics, studies in medical informatics can lead to new knowledge that is pertinent to these domains. But the research outcomes are always about the computational and informational aspects of medicine and healthcare and therefore, also contribute to the field of medical informatics.

Research in medical informatics gradually changed. The development of information systems for example was increasingly left to industry.

We will not discuss the question about the scientific character of medical informatics further but refer to a panel discussion held during the IMIA working conference in Heidelberg/Heilbronn where it was concluded that medical informatics is a separate discipline with its own methodology (1).

Specialists in medical informatics were needed for a number of reasons. It was realized that because more and more medical knowledge was generated it would become very difficult for medical practitioners to stay well informed about new developments. In order to cope with the increasing knowledge base computers would be helpful.

Also in medical research the use of computer systems became very important. In education computers would be needed to teach medical students how to access knowledge and to become independent life long learners. For computer-aided learning medical informatics specialists would be needed next to medical experts. Computer-aided instruction was used on a larger scale after PCs were introduced that were less costly than the mainframes used before (e.g. in the Plato (Programmed Logic for Automatic Teaching Operations) project of the University of Illinois (2)).

There was another reason that medical students should be taught medical informatics: only with such a background they would become proficient users of information systems.

In several medical faculties academic units for medical informatics were created. These units carried out research and also started education in medical informatics or medical information science as it was then often called, especially in the US. The name 'medical informatics' originated in Europe where it was first used by Francois Grémy and Peter Reichertz. The term informatics was used to distinguish the discipline from computer science as it was called in the US. The hardware was not the distinguishing aspect of this discipline, the processing of data into information was the aim. Later the terms health informatics and biomedical informatics came into use. The first theme we recognized in medical informatics we called the 'initiation stage' with a wink to Nolan's life cycle. In the next section we will discuss the characteristics of a number of early educational programs.

Almost simultaneously with the first endeavours of individual departments to design courses in medical informatics, leaders in the field began reflecting about how to design courses and curricula in medical informatics that would lead to graduates with similar capabilities. Questions about the functions these graduates would take and which subjects they therefore should be taught passed in review. We will present this theme of 'guiding stage' in section 3.

In EFMI and IMIA working groups on Education and Training were established. The Education working group of EFMI organized workshops during MIE conferences. The IMIA Education working group organized a number of conferences. At a later stage, IMIA and EFMI working groups coordinated their activities in a more productive way by organising common workshops or by working together on the educational recommendations.

In the late eighties the European Commission started with financially supporting research and development of ICT applications in medicine. It was soon realized that the products delivered by the funded programs would only be used when the potential users would have enough knowledge and skills with respect to ICT. Therefore, several projects to stimulate education of health professionals were funded. We shall discuss developments of this 'contagion stage' in section 4.

Over the years new medical informatics educational programs were established all over the world. Since not only the technology but also the character of applications was changing, education should take these developments into account. IMIA felt the need to initiate the development of recommendations about the content of curricula in medical informatics. These recommendations should help to establish education in the field, to further develop existing educational activities in the various nations and to support international initiatives concerning education in health informatics. In principle this was a continuation of the efforts described in section 3. The Recommendations were published in the year 2000. Because of new developments in the field an updated version of the Recommendations was published in 2010 (3). This trend of 'consolidation' will be discussed in section 5.

Having recommendations for designing curricula, the next question becomes: how can one monitor the quality of medical informatics programs? IMIA decided to start the process of accrediting medical informatics programs. This theme of 'quality control' will be discussed in section 6. Section 7 contains some conclusions.

THE INITIATION STAGE

Technical Committee Four (TC4) of IFIP was established by Francois Grémy. Under his leadership TC4 became independent from IFIP in 1977 and was then called IMIA. In 1974 for the first time medical informatics education was discussed at a meeting in Lyon organized by the international working group TC4.1. During this meeting the competences required by health professionals were identified. The meeting set the scene for application-oriented education at different levels of demand ranging from an orientation of users of information systems to the level of contributors to the advancement of system development (4).

At that time there were already some educational curricula in medical informatics. Francois Grémy for example already in 1969 initiated a curriculum in medical applications of computer techniques at Pitié-Salpêtrière. A second conference held in Chamonix followed in 1983. In the remaining part of this section we present some of the educational programs that were reported in Chamonix (5). In France and the United Kingdom some universities provided education and training to medical students and/or physicians. John Anderson at King's College Hospital Medical School reported about his experience with research and education in medical informatics. Learning medical students and doctors to type was one example of a training that enabled them to enter data into the medical record part of the hospital information system. This course was given during six years. Also computer-aided learning programs in several areas of medicine were being developed. However, according to John Anderson, these learning programs were hardly shared between institutions, and the wheel was re-invented regularly (6).

Computer technology was changing very rapidly in those days. First only mainframes were available, restricting the introduction of computing considerably. Then relatively cheap mini-computers came on the market, resulting in systems that could be installed even in individual departments. This situation changed even more after the introduction of micro-computers in the eighties. Now individual physicians could afford to use them. Since computer technology was usually a subject in medical informatics courses, the courses had to be updated regularly. But it was increasingly realized that the principles of computer technology have to be taught only superficially to medical students. Instead the methodology behind applications was important and the benefits but also the limitations of the use of computers should be explained.

The establishment in the Soviet Union of medical informatics as a discipline (called medical cybernetics) began in the late fifties of the twentieth century. Like in other countries in Europe also in the Soviet Union the following questions were posed and discussed:

- Is medical cybernetics a mere combination of medicine and cybernetics or something more - a separate scientific discipline and educational subject?
- Should medical cybernetics education be a separate area of high-level specialty training?
- Should all medical students be trained in medical informatics?

The first attempt in the Soviet Union to establish a medical informatics department in a medical school was undertaken in 1961 by the Leningrad Military Medical Academy. There was a small Medical statistics and cybernetics department led by professor L.E. Polyakov. A year later the department and its course were taken over by the larger Organization and tactics of medical service department.

In 1973 a new direction to produce medical cyberneticists (medical informaticians) was introduced at the Medicobiologic faculty of the Second Pirogov Moscow Medical Institute (now - Pirogov Russion National Research Medical University, PRNRMU, named after N.I. Pirogov) on the initiative of professor S. A. Gasparyan and the first students were admitted. As a result the department of Medical and Biological Cybernetics (now the department of Medical Cybernetics and Informatics) was established in 1974, headed by S. A. Gasparyan until 2002.

Salamon and Dusserre (7) reported that in the seventies and half of the eighties medical informatics was not part of the usual medical curriculum in France. For students who wished to become medical informaticians medical schools offered an optional course (Biologie Humaine) leading to a Master of Science degree. Also a PhD in Medical Informatics could be obtained. The authors mention that relatively many students followed the Master course. They also indicated that there were enough opportunities for graduates to find a job.

In Belgium Roger France introduced a course for medical students in which medical information processing, using an informatics methodology was taught to facilitate decision making (8).

In the Netherlands at the Free University in Amsterdam in 1973 the department of Medical Informatics started under the chairmanship of Jan van Bemmel. Apart from research the department became involved in education in Medical Informatics both for medical and informatics students.

To provide more insight in the character of applications and the way to implement them Jan van Bemmel developed a comprehensive model for ordering computer applications in medicine. It consisted of six levels of complexity with the higher levels being more and more human dependent. He showed that there were many more applications at the lower levels of the model, due to the fact that at these levels the dependence on the human is relatively small and therefore the chance of being able to create a successful application relatively large. Applications on the higher levels are more difficult to develop because usually the processes that these applications have to support are not well understood. One can learn from the model that when human dependence is high interactive applications should be designed. The model was widely used for teaching (9).

At the Free University medical students in the second year of their study followed lectures in medical informatics with a compulsory written examination. In addition elective courses could be followed in the third and fourth year. In the fifth year elective block courses were organized four times a year. The duration of the block course was five days and each day the student was confronted with topics from one of the complexity levels of the earlier mentioned model of van Bemmel. Each topic was introduced by a lecture and then followed by practical work in which the ideas presented in the lectures were further elaborated.

In the following an example of one day of the block course devoted to the level 'recognition and diagnosis making' is presented. In a lecture the students were confronted with concepts like sensitivity, specificity, predictive value, decision trees, Bayes' rule, ROC, etc. In the practical part the student was among others introduced to the differential diagnosis between neonatal hepatitis, biliary atresia and normality. A pre-programmed decision tree was presented to the student. To each node a logical statement was connected, consisting of one or two conditions regarding one or two of four parameters (for example the results of laboratory tests), Each condition contained the name of one parameter followed by one of the operators 'greater than', 'equal to' and 'smaller than' followed by unknown threshold values. In case there were two conditions they were combined with one of the logical operators AND, OR and NOT. The student had to determine the threshold values that optimized the classification performance of the decision tree. A database with patient data was available to determine the thresholds (10).

The student could also work with Bayes' rule to get familiar with the concepts sensitivity, specificity and predictive value by actually calculating them. In addition this rule was used to determine which of seven congenital heart diseases a patient was suffering from. A database was available with the necessary probabilities and the data of a number of patients. Also the students could construct ROC curves to better understand its meaning (11).

Informatics students could also specialize in medical informatics. During their study they had to spend a year specializing in medical informatics. Students had to study basic physiology and anatomy, biostatistics, pattern recognition, signal analysis and image processing, networks and communication and the structure of healthcare. In addition they were confronted with special medical informatics subjects. The informatics study was finished with a thesis in medical informatics (12).

At the University of Leiden students were offered the possibility of obtaining a degree in Medical Informatics. In the beginning of the nineties a separate four year program in Medical Informatics was established by the University of Amsterdam. This program is still in existence and is now the only bachelor/master program in medical informatics in the Netherlands (13).

In Germany a degree in medical informatics could be obtained in several ways: via an application subject Medicine in an informatics study or via a postgraduate course. Since 1974 several universities offered courses in informatics with application subject Medicine. In total 20-25% of the study was devoted to the application subject. A certificate in Medical Informatics (not issued by a university but by the German Informatics Society and the Association for Medical Documentation, Informatics and Statistics (GMDS)) could be obtained by graduates from different disciplines after 5 years of on-the-job training (comparable to the requirements for becoming a clinical chemist). The requirements for the certificate were specified. The five years of on the job experience for example needed to focus on either or all of the following fields in a medical environment: information management, (computer-aided) management of healthcare delivery and technical informatics and software production. Also, as was the case in The Netherlands, non-physicians could obtain a doctoral degree presented by the Medical Faculty when they completed work and a thesis within the medical environment and with relevance to the theory or practice of medicine. In 1978 medical informatics became compulsory for medical students. Moreover an additional qualification in medical informatics could be obtained by physicians. The qualification required a minimum of 2 years of clinical work and a minimum of 1½ years of work in medical informatics, normally under the supervision and direction of a holder of the certificate for medical informatics (14).

Already in 1972 a medical informatics program was established. This program was a collaboration of the University of Heidelberg and the University of Applied Sciences Heilbronn. The names of Franz Leven, Jochen Möhr and, later, Reinhold Haux are associated with this program. Initially the idea was to create a curriculum at the polytechnical school level (equivalent to an undergraduate curriculum). But in order to guarantee that graduates from the program would be accepted in the medical professional world cooperation with the University of Heidelberg was sought and obtained and a university level program was made, leading to a University diploma, corresponding to an MSc degree (15).

The philosophy behind the curriculum was that informatics is a methods-oriented science concerned with applications of computer systems to solve concrete, existing problems rather than with research about and teaching the principles of computer systems. This meant that formalization and modelling of the problem field, selection and implementation of methods for solution and the application of methods in information processes should be part of the curriculum.

Conveyance of skills, attitudes and reliable judgment are of great importance in practical sciences, while knowledge and rational reasoning may suffice in a theoretical discipline. The incorporation of practical training before, during or after university education is a recurring characteristic of curricula for practical disciplines. Since the program was of the opinion that medical informatics was a practical science the practical training was deemed very important (16).

The education took 4.5 years and the program usually had an intake limited to 35 students per semester. Foundations of the natural sciences and technology covered 25% of the curriculum, informatics 40% and medical informatics 35% (15). Theoretical informatics was less emphasized; the focus was on practical informatics. The medical lectures provide the basic concepts of human biology, terminology and medical methodology so that the graduates were able to understand, to analyze and to solve application problems in the medical area. But medicine should not only be presented by the subset of human biology which tended to overload the student with irrelevant detail. Instead of these irrelevant details it should include the healthcare system: organizations and social structures and institutions and methods to analyse, model and modify them.

A key element was the practical course on “Systems engineering in the health care field”. Fifteen hours per week in the beginning were allocated to this course which took place in the actual work environment of the healthcare field during the end of the second year.

Students developed scientific concepts via literature seminars and via lectures of invited experts. In 1983 20% of the students graduating from informatics curricula with medicine as application subject worked in the healthcare field as compared to 60% of the graduates from Heidelberg/Heilbronn. The Heidelberg/Heilbronn program now exists for about forty years (17. 18, 19, 20). The curriculum was revised several times during its existence among others to keep up-to-date with the developments in the field (21).

In Greece in the late seventies only a few hospital based seminars and courses were taught on the principles of computer science to a healthcare professionals’ audience as part of their continuing education, preparing them for the acceptance of the political decision of the early hospital information systems implementations. At that time no formal academic courses existed. Related formal courses were those included in the traditional Medical Physics courses already implemented a decade ago before that time in most Medical and Nursing Schools.

The programs mentioned in this section were usually not based on existing model curricula. Exception was the medical informatics program of Heidelberg/Heilbronn. During the years several model curricula were proposed in Germany. These model curricula influenced the Heidelberg/Heilbronn curriculum but also the other way around. This will be the subject of the next section.

THE GUIDING STAGE

In May 1969 in Germany a model curriculum for informatics was prepared with support of the then existing learned societies for mathematics and communication technology (the German Informatics Society was founded in the fall of 1969). Three types of informatics were defined: theoretical, technical and practical informatics. About 75% of the curriculum was devoted to these subjects. The remaining 25% was assigned to an application field, like engineering, commerce, mathematics or medicine (22).

In 1973 Peter Reichertz together with the Informatics Society and the GMDS organized a workshop to define a framework for education in medical informatics. This meeting was held at the Reisensburg in Ulm, Germany. Several types of education were defined for medical students, physicians, informatics students and informaticians: medicine as an application subject in an informatics study, informatics education for medical students, an additional qualification Medical Informatics for medical specialists and a certificate Medical Informatician for both informaticians and physicians were the suggested possibilities. From these educational variants it can be concluded that medical informatics was considered a combination of medicine and informatics. Yet a number of topics were included in the curriculum that were not regularly taught in either the core informatics or the core medical education: Methods critique of medical thought and decision processes, Man and environment, Hospital organization and management, Organizational structures in Healthcare and Legal issues. It was expected that these topics had to be taught by medical informaticians because these topics were rarely found in either informatics or medical curricula. According to Möhr the inclusion of these topics proved that medical informatics was more than the union of medicine and informatics and that one of the most important contributions of the conference was the creation of a vision of a new type of professional, the health informatician and the specification of an integrated curriculum which was more than a union of a subset of medicine and informatics. This provided a welcome framework for the Heidelberg/Heilbronn program.

Jochen Moehr reported about this meeting in the IMIA Yearbook of 2004 (23) and also discussed the effects of the Reisensburg meeting, especially for Germany (22).

The symmetry between medical informatics education for informaticians and physicians as expressed in the Reisensburg meeting was put into practice. From 1978 on medical informatics became a compulsory part of medical education. Immediately after the meeting several university programs in informatics started offering medicine as an application subject. The Certificate Medical Informatician was introduced in 1978. Also several institutions started offering courses leading to the additional qualification Medical Informatics.

In 1991 the Recommendations for Education and Training in Medical Informatics of the GMDS appeared (24). It elaborates the Reisensburg framework. The recommendations distinguish an informatics-related approach and a medicine-related approach to medical informatics. But contrary to the Reisensburg framework the recommendations considered medical informatics as a separate medical discipline with specific methodological approaches and with distinguished fields and not as just a combination of informatics and medicine. This shows that the Heidelberg/Heilbronn curriculum influenced the recommendations. Concerning the informatics-based approach the recommendations also mention medical informatics as an 'integrated' applied subject within informatics curricula. This referred among others to the informatics curriculum of the University of Hildesheim together with the medical school of Hannover: this informatics curriculum started in 1988 with medical informatics as a core part of the curriculum.

The recommendations also stated that an informatics study with an applied subject should be called applied subject medical informatics instead of medicine. A mere educational offering of medical fundamentals was not enough as an applied subject. Also it is stated that the number of hours devoted to medical informatics as recommended by the Informatics Society should be increased. The recommendations explicitly mention the subjects that were regarded as medical informatics subjects: structure of the healthcare system, medical documentation, information systems in healthcare, biosignal processing, image processing, medical linguistics, knowledge based methods and systems in medicine.

In 1981 a report about a model curriculum for doctoral-level programs in what was called health computing was published in the USA by the Association for Computing Machinery (ACM) (25). The health care industry in the United States was a $220 billion a year industry (about 10% of the Gross National Product), with information handling accounting for about 30% of the health care dollar. Although computing could play a major role in facilitating health care information flow to reduce costs and improve the quality of care, the health care industry lagged behind most other major U.S. industries in its utilization of information technology. According to the report this was due to a great extent to the scarcity of adequately trained health computing professionals who can design and develop appropriate uses for the technology. The health computing profession's development and its ability to attract bright and creative young professionals, in turn, was hampered by the poorly specified and diverse career paths, the lack of a well organized peer structure for information exchange, and unspecified goals for the education of health computing professionals.

The authors noticed that there is a need for leadership and that in order to be accepted by the medical profession they should have a comparable preparation as MDs have. Therefore they proposed a model doctoral level curriculum. This acceptance problem was also the reason that in the Reisensburg framework a university level for the graduates was deemed necessary together with five years of on the job training for those who wanted to work as leaders in the healthcare sector.

In the report the subjects that all health computing specialists should master is specified: computer science, health sciences, integrative studies and contributing studies. The remaining part of the curriculum is divided in four tracks: health information systems, health research computing, health educational computing and health computing administration. They suggest that students will be attracted from a diversity of disciplines, ranging from computer science and mathematics to engineering to biology. According to Möhr and Leven a comparison of the Heidelberg/Heilbronn curriculum with the ACM curriculum shows that a large set of concepts is covered in both curricula.

In the Netherlands in 1987 recommendations for education and training in medical informatics education and training were formulated by the Subcommittee Medical Informatics of the Committee for Medicine of the Royal Netherlands Academy of Arts and Sciences under the chairmanship of Jan van Bemmel. In the report 'Medical Informatics - Renewal in Medicine' it is noted that professionals in healthcare were increasingly confronted with computer systems (26, 27). Since the professional will always be responsible for the consequences of the use of the results of medical information processing, it is important that the student in medicine (or health sciences) will be taught both the fundamentals of medical information processing and the essentials of existing applications. Another reason to introduce students to the field of medical informatics was the fact that medical education requires the students to accumulate a multitude of facts. Because of the explosive growth of biomedical knowledge more and more of this knowledge was crammed into the curriculum. The report of the Panel on the General Professional Education of the Physician and College Preparation for Medicine (GPEP) of the Association of American Medical Colleges entitled 'Physicians for the Twenty-First Century' was taken as starting point (28).

The perception that medical education too much emphasized the acquisition of knowledge was taken as one of the starting points of the GPEP report. The Panel recommended that in the general education of the physician medical faculties should emphasize the acquisition and development by students of skills, values and attitudes at least to the same extent that they do their acquisition of knowledge. Medical faculties should limit the amount of factual information that students are expected to memorize. The Panel realized that the acquired knowledge rapidly would become obsolete by the advances in biomedical knowledge and technology. Moreover students were passive recipients of information rather than active participants in their own intellectual growth. Medical faculties should encourage students to learn independently. The development of skills that support independent self-directed learning should therefore be emphasized. Students who learn independently develop abilities to seek out information and to analyze and apply it to the solution of problems. Computers are powerful tools for education, information management and analysis. The Panel concluded that basic research is needed on the use of electronic information systems in medical education. They therefore recommended that Medical Schools should designate an academic unit for institutional leadership in the application of information sciences and computer technology to the general professional education of physicians and promote their effective use. These latter recommendations were based on the Subgroup report on Medical Information Science Skills, chaired by Nina Matheson and Donald A. B. Lindberg (29). They observed that only a handful of American medical schools have the personnel and computer resources to provide education in the principles and operation of medical information systems.

The subgroup described seven levels of understanding of the principles of information handling: (1) Using basic information handling tools; (2) Independent learning about computers and information management; (3) Using computer systems and accessing databases; (4) Knowledgeably using systems and specialized databases; (5) Perceiving new applications; (6) Building systems for personal applications and (7) Tool building.

The Dutch report 'Medical Informatics, Renewal in medicine' proposed the content for the introductory education in Medical informatics, based on levels 1 to 4 of the GPEP report. Also it was stressed that the medical students should get practical experience so that they would understand the possibilities and limitations of information systems. Although the education of medical students was extensively elaborated, the report also mentions the need for educating medical informatics specialists via PhD studies and informatics graduates with a major in medical informatics. The recommendation that all medical faculties should designate an academic unit was taken over in the Dutch report.

The Information for Health programme (IfH) of the NHS had as purpose to put in place the people, resources, culture and processes necessary to ensure that the NHS clinicians and managers had the information needed to support the core purposes of the NHS in caring for individuals and improving public health. To successfully implement IfH at the local level the NHS Information Authority in 2001 developed competency profiles that identified skill and knowledge levels for NHS staff. The profiles provided guidance and baseline data for local staff training (30).

In Russia Medical Cybernetics is a full-blown health care specialty. Education is provided by the Siberian State Medical University, the Penza State University and the Voyno-Yasenetsky Krasnoyarsk State Medical University, in addition to the education provided by the Pirogov Russian National Research Medical University.

At present training is carried out in accordance with the third version of the Federal State Higher Educational Standards (FSHS), approved in 2010. It is a full-time program with a study load of 60 credits per year. One credit corresponds to 36 academic hours. The specialty training is carried out continuously during 6 years.

The medical cybernetics program at the university level comprises the study of several tracks: humanitarian, social and economical, mathematics and natural science, the professional, educational practice and practical training, research and the final state certification, with the main component being the preparation and defence of a diploma thesis. Each track has mandatory and elective parts.

The mathematics and natural science track includes the subjects: differential and integral calculus, mathematical statistics, computer science and medical informatics, morphology (anatomy, histology, and cytology), physiology, general pathology (pathological anatomy and pathological physiology), pharmacology, biochemistry, genetics and immunology.

The professional track consists of clinical and medical cybernetics subjects. The clinical subjects are internal medicine, clinical and experimental surgery, neurology and psychiatry, pediatrics, radiology, radiotherapy and clinical cybernetics. The subjects of medical cybernetics include the theory of cybernetics, medical electronics, physiological cybernetics, systems analysis and health system organization and health information systems.

Learning outcomes of the medical cybernetics program are: the mastery of knowledge of and skills in automation of data entry, physiological signal processing, methods of experimental design and statistical analysis of data, applications of mathematical and heuristic image analysis methods for solving problems of differential diagnosis and prediction of the patient state, methods of model construction and analysis (from the sub cellular level to health care systems), purpose and principles of the design and construction of automated health information systems, mathematical tools of systems analysis, etc. Graduate work is done during the last semester. It is a complete research or design project carried out under the supervision of a medical cybernetics specialist. The knowledge and skills of medical cybernetics graduates are described in the FSHS.

In Russia the term medical cybernetics denotes the specialty, whereas the term medical informatics denotes the discipline that is taught to students majoring in the specialties Clinical Medicine, Pediatrics and Dentistry. Medical informatics education to medical students started in 2000 in Russia. In that year the Russian Ministry of Health approved a program for this discipline, prepared by the Second Pirogov Moscow Medical Institute (now PRNRMU). It was regarded as a separate discipline. The education in medical informatics covered 38 hours, 12 for lectures and 26 for workshops, and was given in the middle of the six years of the medical study. In all workshops the students had to work individually on the computer.

During the first five years of training the first experience with teaching medical informatics was obtained and weak points were detected. To improve the training of the medical informatics discipline the First All-Russian Training and Methodological Conference on Medical Informatics was organized in 2005 on the initiative of the PRNRMU. The main objectives of the conference were to present solutions to problems of teaching the discipline and to exchange experiences. During the preparation of the conference a special questionnaire for assessing the situation of medical informatics education in medical schools was developed and dispatched. In 2009, after repeated questioning, the Second All-Russian Training and Methodological Conference on Medical Informatics was held.

The most common suggestions and proposals mentioned in the returned questionnaires included the need for advanced training of teachers of the medical informatics course, the establishment of a model set of special software (computer programs that will help students to study how to develop medical models, to acquaint themselves with medical information systems in practice or to design, for example, expert systems for medical decision support), the availability of a database of test questions for students to test their knowledge and the necessity to increase of the number of classroom hours.

The third version of the Federal State Higher Educational Standards included the recommendations of the Russian medical information society. For instance, the training of the medical informatics course for students majoring in Clinical Medicine, Pediatrics and Dentistry now equals 3 credits, which corresponds to 72 and 36 academic hours of classroom and self-study, respectively.

Due to this significant increase in training time for the medical informatics course, the range of topics could be extended and the requirements could include skills and abilities that should be developed during the study. It allowed a transition from familiarizing students with the aims of the discipline to being able to pass on a notion of the medical informatics theory and of modern computer technology applications in medicine and health care. After a typical course a student needs to know:

- Types, structure and characteristics of medical information systems;
- Principles of automated medical institution management, using modern information technologies;
- Basic approaches to formalize and structure various medical data types used to find solutions during the diagnostic and treatment process.

A student has to be able to:

- Perform textual and graphical processing of medical data using standard software;
- Use statistical and heuristic algorithms for diagnosis and treatment monitoring;
- Use the modern internet resources to search for professional information as part of self-training and advanced training in specific topics of medical knowledge;
- A student has to master the basic skills of using medical information systems to efficiently carry out physician duties.

In Greece during the early 1980's formal courses started to appear in curricula in the Nursing School of the University of Athens. The lack of computer skills made it appropriate to introduce Introduction to Informatics as a first officially taught course combined with a laboratory practicum. At a later stage a separate course was introduced: that of medical informatics. As there was a strong objection by most of the conservative faculty members to accept new subjects as courses within the official curriculum of a traditional Nursing academic programme, it was difficult to have both above mentioned courses accepted as obligatory within the curriculum, so one course was accepted as obligatory and the other as optional. Due to the lack of computer skills among the fresh students in the first years of this initiation, the obligatory course was the Introduction to Informatics and the optional one was the Medical Informatics course later renamed as Health Informatics. Exactly the opposite occurred in early 1990's when the computer skills of the incoming students were at an appropriate level. Both Medical Schools of the University of Athens and the Aristotle University of Thessaloniki introduced Informatics courses as optional modules for a rather selected but limited audience of undergraduates in the late 1980's. This tendency improved after the late 1990's.

It is worth mentioning for historical reasons that in 1988 the taught course within the undergraduate curriculum of the Nursing School of the University of Athens changed from Medical Informatics to Health Informatics. It is the first time in the literature that we encounter in an official course the term, which was accepted very late at the end of the 1990's and beginning of the 2000's as the appropriate generic term reflecting our field.

CONTAGION STAGE

In 1976 EFMI was established and in 1979 TC4 of IFIP became an independent organization named IMIA. IFIP-TC4 and later IMIA's working group on education organized a number of working conferences dedicated to education in medical informatics. The first conference was held in 1974 in Lyon where it was discussed how to respond to the need for medical informatics education (4). In 1983 the second conference was held in Chamonix (5). Here several existing programs in medical informatics were discussed that were presented in section 2. Then next conferences were held in Victoria, Canada in 1989, in Prague, Czech Republic in 1990 (31), in Heidelberg/Heilbronn, Germany in 1992, in Newcastle, Australia in 1997, in Portland, USA in 2003, in Athens, Greece in 2005 and in Buenos Aires, Argentina in 2008.

Medical informatics education was also covered in EFMI meetings. The education working group organized a workshop at each MIE meeting. In 2005 an EFMI special topic conference on Education in Medical Informatics was held in Athens attracting more than 200 attendees. This conference was also an IMIA meeting as indicated above. These conferences showed the interest that existed in medical informatics education, both to educate specialized professionals but also to educate medical students in the field.

The importance of information systems for healthcare was recognized by the European Community. Large amounts of money were funded to develop information systems of various kinds that could support professionals in their work. The AIM (Advanced Informatics in Medicine) initiative was a research and development activity of the European Community managed through Directorate General XIII of the European Commission. The programme focused on the possibilities of information and telecommunication technologies in the healthcare sector. It was realized that the developed systems would only be accepted and used when physicians and nurses had enough knowledge about and skills in the use of these new tools. The three year Concerted Action Education and training in health informatics (EDUCTRA) therefore started in 1992 as part of the AIM programme. Since the topic Education and Training in health informatics was considered too broad to be covered by one concerted action it was decided to focus on education and training in health informatics of professionals (including physicians, nurses, managers, etc.). The goal of EDUCTRA was to:

- obtain an overview of existing educational and training programmes in the area of health informatics;
- identify potential gaps in the training and education of healthcare professionals and patient groups in the various countries;
- propose, on the basis of this investigation, actions to remedy these gaps; and to
- investigate the potential of transferring existing training programmes to other countries.

Representatives of the member states surveyed the status of training and education in IT in their country. It appeared that in almost all countries health professionals lacked knowledge regarding the possibilities and limitations of information systems. It was concluded that the situation concerning health informatics at the universities was also far from ideal. Only some courses in health informatics were provided in medical and nursing schools. The courses that were offered were frequently devoted to the technical use of computers. In a large number of countries medical faculties did not have health informatics departments. Graduate students entered professional life without having had an introduction to the possibilities and limitations of information systems. Post-graduate level courses in IT and health informatics were of variable content and quality, probably due to the limited number of health informatics teachers (32).

Since hardly any curricula in health informatics existed it was concluded that one of the tasks of EDUCTRA had to be to define guidelines for developing curricula for various groups of professionals. The objective of the guidelines was to provide trainers with a framework according to which they can design their courses. These guidelines were produced and published in 1995 (33, 34).

An Erasmus Inter-University Cooperation Programme (also a programme funded by the European Commission) had as target education in Health Informatics at the MSc level. The programme was funded (from 1989 to 1998) by Erasmus in two phases. The first phase developed a curriculum in the field of Health Informatics at an MSc level after an international workshop organised in Athens, and the second phase was the implementation of the programme by exchanging both professors and students among six European Universities in the beginning of the implementation to 20 European Universities at the mature stage of the programme. The first six European Universities/Institutions were: University of Athens, Polytechnical University of Madrid, University of Gent, City University London, University of Pavia, and the University of Manchester. The programme was coordinated by the University of Athens, was given at the Nursing School, and the overall evaluation merited it as a very successful coordinated effort despite the huge logistical overload and the very little funding support by Erasmus for a programme with no registration fees for the students. The MSc education was given until 1997/1998.The aim of this curriculum that started in 1990 was to give those working or intending to work in the health service a broad advanced postgraduate education in health informatics in order to develop the ability to understand and evaluate in detail the theoretical and practical requirements of informatics in medicine, nursing and healthcare. The course enrolled students from different European countries and also had lecturers from several European countries (35). It should be also mentioned that the official title of the Erasmus programme established in 1989 was MSc in Health Informatics. The term Health Informatics was for the first time used in an official academic programme and academic title to represent our field.

Another Erasmus programme funded the development of an educational self-learning software tool to study the application of the Bayes theorem. This program was developed initially as part of the block course at the Free University in Amsterdam mentioned above. The program was redesigned and translated also into English, German and French in a cooperation of the University of Maastricht, Freiburg and Gent (36). The program consisted of two parts. An instruction part could be used by the student to repeat already learned concepts. With the second part the student can test his/her knowledge in an exploratory way. The computer-aided instruction program was used at several universities as well as at the above mentioned Erasmus MSc in Health Informatics in Athens.

In 1993 the joint European project EuroMISE (European Education in Medical Informatics, Statistics and Epidemiology) started under the umbrella of the European TEMPUS-PHARE programme. The idea was to teach the teachers in among others health informatics. Faculty from various European countries was involved in the programme. The students came from central and eastern European countries (37).

The results of European funded projects like EDUCTRA, the ERASMUS MSc Programme, the EuroMISE, etc. were the starting point of the IT EDUCTRA (Information Technologies EDUCation and TRAining) project that was approved in the Fourth Framework programme of the EU in 1995 (38).

The main goal of the IT EDUCTRA program was to create a training program for healthcare professionals in the basics of information technology and IT medical applications. The final product was a CD-ROM containing the teaching materials and tools and used new information technologies for the dissemination of knowledge and skills required for new health care systems.

The NIGHTINGALE (Nursing Informatics Generic High-level Training in Informatics for Learning & Education) project, again an EU financed project, was also approved in 1995 (39). The project was considered essential for planning and implementing of a strategy to train the nursing profession in using and applying healthcare information systems. The project was based on previous experiences obtained in the Telenursing AIM project and on the EDUCTRA Concerted Action which partially touched the subject of education and training of the nursing profession. The main goal of the project was to bring to the surface, by means of a series of workshops, the user needs of the nursing profession with respect to telematics, to develop a nursing informatics curriculum for European nurses, and to develop educational tools and software assisting the educational process in nursing informatics. A number of European Conferences on Health Telematics education were also organized (40, 41, 42) and a textbook in health informatics for nurses was compiled (43).

CONSOLIDATION STAGE

Over the years the number of programs in Health Informatics increased steadily. Beginning in 1990 the University of Maryland at Baltimore began to enter information collected on health/medical informatics programs worldwide into a database (44). IMIA's Working Group 1 on Education and Training in Medical Informatics provided guidance on critical issues of policy and purpose. In 1993 the database was revised to improve the quality and quantity of information accessible by remote users. The database was accessible through Gopher. A few years later it was reported that the data were outdated or replaced by links to the Gopher sites of the respective programs. It was then decided to establish a website at the University of Heidelberg. The main goal was to give potential students easy access to a new version of the database (45).

Although there were different opportunities world-wide for obtaining education in health informatics many countries had not, or at least not sufficiently, established such opportunities. Therefore IMIA felt the need to develop international recommendations for health informatics education. The IMIA recommendations that resulted took into account the various existing, mainly national recommendations of which some were mentioned in section 3. The IMIA recommendations were published in 1999 and centred on educational needs for healthcare professionals to acquire knowledge and skills in information processing and information and communication technology as needed and used in medicine and healthcare (3). The educational needs are described as a three-dimensional framework with dimensions 'professional in healthcare', 'type of specialization in health informatics' and 'stage of career progression'. For the various educational needs learning outcomes were suggested. Two types of learning outcomes were documented: learning outcomes for all healthcare professionals in their role as IT users and learning outcomes for health informatics specialists. Three levels of knowledge and skills were distinguished: introductory, intermediate and advanced. The knowledge and skill levels were classified into three domain areas: (1) Methodology and technology for the processing of data, information and knowledge in medicine and healthcare; (2) Medicine, health and biosciences, health system organization; (3) Informatics/computer science, mathematics, biometry.

The programs that prepare graduates for careers in health informatics were divided into two types: health informatics courses as part of informatics/computer science programs and dedicated educational programs in health informatics.

The recommendations were received positively as can be concluded from the many references to them. Because of the tremendous progress in and the evolution of our field of health informatics, the contents of those recommendations were not fully up-to-date. Therefore a first revision of the Recommendations was published in 2010 (46). The name of the first domain area was changed into Biomedical and Health Informatics Core Knowledge and Skills, doing much more justice to our field than the earlier name: Methodology and technology for the processing of data, information and knowledge in medicine and healthcare.

QUALITY CONTROL

There is an increasing need for health informaticians and an increasing number of health informatics programs deliver health informaticians with different kinds of expertise. The IMIA recommendations define the knowledge and skills necessary for these different types of health informaticians.

In many countries the quality of educational programs is monitored via an accreditation procedure. As a first step the program writes a self-assessment report that serves as a reference for a site visit committee. The site visit committee visits the premises of a program and checks the contents of the curriculum, the adequacy of examinations, lecture rooms, computer facilities, the library, etc. In some countries there are no accreditation requirements for individual graduate programs, only for universities. In this case the university determines the quality of programs that it offers, once it is accredited.

In order to attract the best students, institutions with health informatics programs, be it vocational, bachelor or master programs, may want to convince potential students of the international level of their program. A program may also want to show to their university board that they indeed provide excellent education. The results of national accreditations are not always convincing since not always do the members of national site visit committees have a clear understanding of the level of international health informatics programs or of the international level of health informatics itself. This is especially true when the university itself determines the quality of the program.

IMIA developed an accreditation procedure as a support for institutions that want to prove that their program in health informatics is of an international level (47). Institutions interested in IMIA accreditation have to write a self-assessment report. In the self-assessment report an answer should be given to the following six main questions:

1. What are the goals of the program for which the institute asks for accreditation?

2. How are the goals implemented in a curriculum?

3. What is the size and quality of the staff?

4. Which facilities for teaching are available?

5. How does the institute guarantee the quality of the program?

6. Are the goals routinely achieved?

The self-assessment report will, in addition to a site visit, provide the members of the site visit committee enough information to judge the program.

The accreditation protocol is now tried out. In the mean time three programs have been accredited and another three are in the process of writing a self-assessment report.

DISCUSSION

In this contribution we have sketched the development of education in Health Informatics in Europe. We recognized a number of themes. Education in health informatics started in several European countries at the end of the sixties, beginning of the seventies. This education concerned health professionals, medical students and also students that wanted to become medical informaticians. In that same period also model curricula were defined as a guide for programs. A change can be observed from a focus on computer science to a focus on informatics.

In this contribution we did not mention the medical informatics educational literature. Several different textbooks on health informatics are available and several scientific journals in medical informatics also cover educational aspects.

The question whether health informatics is a separate discipline should, according to de Vries (philosopher at the University of Amsterdam; personal communication), be answered positively. In the first place in order to be a discipline institutional facilities are required. A discipline should at least have educational programs using its own textbooks. Furthermore, a discipline should consist of a population of researchers whose work has a larger chance to influence the work of others in the discipline than the work of researchers outside the discipline. According to de Vries the term discipline refers more to how education is organized than how the research is organized. Given the above survey of the history of health informatics we conclude that we can at least say that health informatics is a discipline. And in our opinion we can add that it is also an applied science.

Our contribution shows that the field of medical informatics has grown enormously. Medical informatics in itself is a very broad field and this means that there is a need for specialization. Because of the broadness of the field, medical informatics can be considered as an interdisciplinary field. The field is becoming mature as is evident from the last theme of this contribution.

REFERENCES

1. Protti DJ, Van Bemmel JH, Gunzenhäuser R, Haux R, Warner H, Douglas JV, Lang E. Can Health/Medical Informatics be regarded as a separate discipline? Meth Inf Med. 1994; 33: 318-26.

2. Levy AH. Experiences with PLATO in medical education. In: Pagès JC, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland. 1983: 201-6.

3. Recommendations of the International Medical Informatics Association (IMIA) on education in health and medical informatics. Methods Inf Med. 2000 Aug; 39(3): 267-77.
4. Anderson J, Grémy F, Pagès JC. (Eds.): Education in Informatics of Health Personnel. IFIP Medical Informatics Monograph Series 1. Amsterdam, North-Holland, 1974.
5. Pagès JC, Levy AH, Grémy F, Anderson J, (Eds.): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983.
6. Anderson J. Experiences with learning and teaching in medical informatics. In: Pagès JC, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 49-54.
7. Salamon R, Dusserre L. Is the teaching of medical informatics possible? The situation in France. In: Pagès J-C, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 143-7.
8. Roger FH. A structured clinical presentation of case to medical students. In: Pagès JC, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 193-9.
9. van Bemmel JH. A comprehensive model for medical information processing. Meth Inform Med. 1983; 22: 124-30.
10. van Bemmel JH, Hasman A, Sollet PCGM, Veth AFL. Training in medical informatics. Comput Biomed Res. 1983; 16: 414-32.
11. Hasman A. Training in medical informatics. The use of computers for diagnostic purposes. Int J Bio-Medical Computing. 1982; 13: 109-18.
12. van Bemmel JH, Gelsema ES, Hasman A, Schutte F, Sollet PCGM, Vet AFL. Curricula in medical informatics - experience during 10 years in Amsterdam. In: Pagès JC, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education, Amsterdam, North-Holland, 1983: 55-65.
13. Tuinstra CL, Verveen AA. Information science in the medical curriculum; principles and practice at Leiden University. In: Pagès J-C, Levy AH, Grémy F, Anderson J, (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 127-34.
14. Reichertz P. Curricula in medical informatics. Experiences in the Federal Republic of Germany. In: Pagès JC, Levy AH, Grémy F, Anderson J, (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 79-95.
15. Möhr JR, Leven FJ. The Heidelberg/Heilbronn curriculum of medical informatics. In: Pagès JC, Levy AH, Grémy F, Anderson J. (Eds): Meeting the challenge: informatics and medical education. Amsterdam, North-Holland, 1983: 97-106.
16. Möhr JR, Leven FJ, Rothemund M. Formal education in medical informatics. Review of ten years' experience with a specialized university curriculum. Meth Inform Med. 1982; 21: 169-80.
17. Haux R, Leven FJ. Twenty years medical informatics education at Heidelberg/Heilbronn: Evolution of a specialized curriculum for medical informatics. Meth Inform Med. 1994; 33: 285-9.

18. Leven FJ. Curriculum for medical informatics at the University of Heidelberg/School of Technology Heilbronn. Meth Inform Med. 1994; 33: 262-7.

19. Leven FJ, Haux R. Twenty five years of medical informatics education at Heidelberg/Heilbronn: discussion of a specialized curriculum for medical informatics. Int J BioMedical Computing. 1998; 50: 31-42.

20. Leven FJ, Knaup P, Schmidt D, Wetter T. Medical informatics at Heidelberg/Heilbronn: status evaluation - new challenges in a specialised curriculum for medical informatics after thirty years of evolution. Int J Med Inform. 2004; 73(2): 117-25.

21. Knaup P, Haag M, Leven FJ, Dickhaus H. Challenges in the Evolution of the Medical Informatics Program at Heidelberg/Heilbronn (Germany). Methods Inf Med. 2009; 48: 66-75.

22. Moehr JR. The quest for identity of health informatics and for guidance to education in it - The German Reisensburg Conference of 1973 Revisted. In: Haux R, Kulikowski C. (Eds.). Yearbook of Medical Informatics. Stuttgart, Schattauer, 2004: 200-9.

23. Moehr JR. English translation of the minutes of the invitational workshop Goals, contents and methods for education in medical informatics. In: Haux R, Kulikowski C. IEds.). Yearbook of Medical Informatics. Stuttgart, Schattauer, 2004: 210-19.

24. Haux R, Dudeck J, Gaus W, Leven FJ, Kunath H, Michaelis J, Pretschner DP, Sonntag HG, Thurmayr R, Wolters E. Recommendations of the German Association for Medical Informatics, Biometry and Epidemiology for education and training in medical informatics. Meth Inform Med. 1992; 31: 60-70.

25. Duncan KA, Austing RH, Katz S, Pengov RE, Pogue RE, Wasserman AI. A model curriculum for doctoral-level programs in health computing, Report of the ACM committee on curriculum for health computing education. Baltimore, Association for computing machinery, 1981.

26. van Bemmel JH, Festen C. (Eds.). Medical informatics renewal in medicine (in Dutch with English summary). Amsterdam, Committee for Medicine of Royal Netherlands Academy of Arts and Sciences, 1987.

27. Hasman A. Recommendations for medical informatics training in The Netherlands. Meth Inform Med. 1994; 33: 308-11.

28. Physicians of the twenty-first century (The GPEP Report). Washington, Association of American Medical Colleges, 1984.

29. Matheson N, Lindberg DAB. Subgroup Report on medical information skills. J Med Educ. 1984; 59: 155-9.

30. NHS Information Authority. Health Informatics Competency Profiles for the NHS. Reference No: 2001-IA-523: 2001.

31. van Bemmel JH, Zvarova J. Knowledge, information and medical education. Amsterdam, North-Holland, 1990.

32. Hasman A, Sosa M. Review of the state-of-the-art in education and training of health informatics in Europe. Comput Methods Programs Biomed. 1995; 48(1-2): 183-8.

33. Hasman A, Albert A, Wainwright P, Klar R, Sosa M. (Eds.). Education and training in healthcare informatics in Europe. Amsterdam, IOS Press: Studies in Health Technology and Informatics 25, 1995.

34. Hasman A, Albert A. Education and training in health informatics: guidelines for European curricula. Int J Med Inform. 1997; 45: 91-110.

35. Diomidus M, Mantas J. Assessing the progress of the MSc. course in health informatics under the ERASMUS programme. Int J Med Inform. 1998; 50: 159-63.

36. Hasman A, Donkers J, Roos S, Muijtjens A, Groothedde RT, Groothuis S, De Moor G, Klar R. International Coordinated Development of Educational Software. In: O'Moore R, Bengtsson S, Bryant JR and Bryden JS (Eds.). Medical Informatics Europe'90.Berlin, Springer 1990: 435-9.

37. Zvarova J. On development of medical informatics education via European cooperation. Int J Med Inform. 1998; 50: 219-23.

38. Hasman A. Education and training in health informatics: the IT-EDUCTRA project. Int J Med Inform. 1998; 50: 179-85.

39. Mantas J. The NIGHTINGALE project: an outline. In: J. Mantas (Ed.). Health Telematics Education. Amsterdam, IOS Press: Studies in Health Technology and Informatics 41, 1997: 7-25.

40. Mantas J. (Ed.). Health Telematics Education. Amsterdam, IOS Press: Studies in Health Technology and Informatics 41, 1997.

41. Mantas J. (Ed.). Advance in Health Telematics Education. Amsterdam, IOS Press: Studies in Health Technology and Informatics 51, 1998.

42. Mantas J. (Ed.). Health and medical informatics education in Europe. Amsterdam, IOS Press: Studies in Health Technology and Informatics 57, 2000.

43. Mantas J, Hasman A. Textbook in health informatics. A nursing perspective. Amsterdam, IOS Press: Studies in Health Technology and Informatics 65, 2002.

44. Ball MJ, Protti DJ, Douglas JV. An international health/medical informatics programs database. Meth Inform Med. 1994; 33: 327-9.

45. Haux R, Frank J, Knaup P. The IMIA WG1 database on health and medical informatics programs and courses: a cal for participation. Meth Inform Med. 1997; 36: 233-4.

46. Mantas J, Ammenwerth E, Demiris G, Hasman A, Haux R, Hersh W, Hovenga E, Lun KC, Marin H, Martin-Sanches F, Wright G. Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics. First Revision. Meth Inf Med. 2010; 49(2): 105-20.

47. Hasman A, Mantas J. IMIA Accreditation of Health Informatics Programs. Health Inform Res. 2013; 19(3): 154-61.

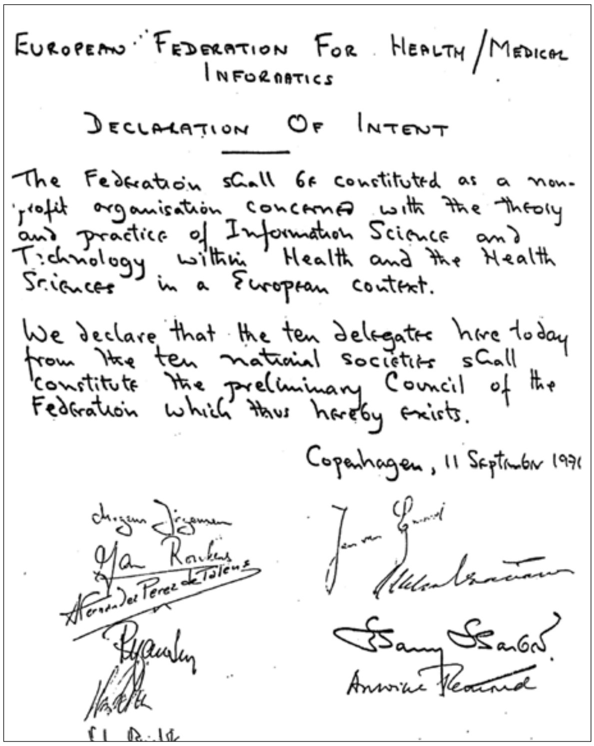
09

Izet Masic

EUROPEAN FEDERATION FOR MEDICAL INFORMATICS – THE MOST INFLUENTIAL PROMOTER OF MEDICAL INFORMATICS DEVELOPMENT FOR THE PAST 45 YEARS

Medical informatics, as much as it is a result of evolution as planned philosophy, have its roots in the history of information technology and medicine. Development of medical informatics started in the fifties of the 20th century. In the period after Second World War USA was the leading country in the field of Computer science and the leader in using the first computers in medicine and healthcare services. The development of information and communication technologies (ICT) during the last two decades of 20th century was particularly important for development of medical informatics, with great influence of Internet by medical professionals at every level of health care system. Comprehensive and essential contents on medical informatics, but also the aspects nurtured by the main „schools of Medical informatics“ - Anglo-Saxon (Abbot, Anderson, etc.), French (Gremy, Remond, etc.), German (Reichhertz). et al.), American (Collen, Green, et al.), Middle and East Europe (Dezelic, Masic, Zvarova, Naszlady, Mihalas, etc.), whose terms „Health Informatics“ (Abbot) and „Medical Informatics“ (Gremy and Reichertz) have entered the European and world medical literature. For those studying the subject or working in the field, the experiences of others who use Information and Communication Technologies (ICTs) for the better of health care can provide a necessary perspective. In promotion and spreading the

*This text is republished with permission of the journal Acta Inform Med. 2021; 29(2): 80-93. doi: 10.5455/aim.2021.29.80-93. Publisher: © Avicena, Sarajevo, Mis Irbina 11, 71000 Sarajevo, B&H. Some parts are corrected and edited by Editor of this book.



EUROPEAN FEDERATION FOR HEALTH/MEDICAL INFORMATICS

DECLARATION OF INTENT

The Federation shall be constituted as a non-profit organisation concerned with the theory and practice of Information Science and Technology within Health and the Health Sciences in a European context.

We declare that the ten delegates here today from the ten national societies shall constitute the preliminary Council of the Federation which thus hereby exists.

Copenhagen, 11 September 1976

Figure 1. Founders of EFMI, Copenhagen, Denmark, September 11th, 1976

knowledge and experiences of the medical informatics as scientific and academic discipline in the world, great impact was given by IMIA and its „branch associations“ at every continent. But, most influential association became European Federation for Medical Informatics (EFMI), established on September 11th 1976 in Copenhagen with members of 10 national representatives (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Netherlands), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) who adopted Statute of EFMI and other documents and prepared the first MIE Conference in Cambridge (UK) in 1978. Today EFMI represent leading European medical informatics professional organization representing 28 European countries and institutional members. EFMI is organized as a non-profit organization concerned with the theory and practice of Information Science and Technology within the Health and Health Sciences sector, in a European context. The goals set of EFMI are: a) To advance international co-operation and dissemination of information in Medical Informatics on a European basis; b) To promote high standards in the application of medical informatics; c) To promote research and development in medical informatics; d) To encourage high standards in education in medical informatics; and e) To function as the autonomous

Figure 2. Presidents of the European Federation for Medical Informatics (EFMI) - 1976-2021

European Regional Council of IMIA. Author of this article described the facts about important events which EFMI, with contribution of national societies, members of EFMI, organized during 45 years of existence, including important facts about the influential medical informatics experts. Finally, author shortly described important facts about history of development of Health informatics in Bosnia and Herzegovina and South-Eastern Europe, including facts about his activities during long period of his participation in IMIA General Assembly and EFMI Council. There he was very actively involved in a lot of activities, including organization of 22nd MIE Conference in Sarajevo in 2009.

BACKGROUND

The European Federation for Medical Informatics (EFMI) (1-5) is the leading organisation in medical informatics in Europe and represents 28 countries. EFMI is organized as a nonprofit organisation concerned with the theory and practice of Information Science and Technology within Health and Health Science in a European context. All European countries are entitled to be represented in EFMI by a suitable Medical Informatics Society.

The term Medical informatics is used to include the whole spectrum of Health/Public health Informatics and all disciplines concerned with Health/Socialcare and Informatics (1-5).

Development of Medical informatics started in the fifties of the 20th century. In the period after Second World War USA was the leading country in the field of Computer science and the leader of using the first computers in medicine and healthcare services.

The development of information and communication technologies (ICTs) during the last two decades of 20th century was particularly important for developmnt of Medical informatics, with great influence of Internet by medical professionals at every level of health care systems. Internet caused a new information revolution since medical information became available to the public and ceased to be in exclusive control of health professionals. The development and global spreading of ICT brought also new medical fields, interdisciplinary connected to medical informatics: telematics, telemedicine, teleducation, and cybermedicine. Auerbach L, USA, on behalf of the American Federation of Information Processing Societies sent in the year 1957 proposal to UNESCO to sponsor one international conference on information processing. The conference on Information processing was held in 1959 in Paris with 1800 participants from 37 countries. Representatives of some national societies had submitted statutes and sent them out to the national societies and had them approved. A provisional executive with Mr. Auerbach and Academician Anatol A. Doronicyn, Union of Socialist Republics was elected. (1-3. The first council meeting was held in Rome in June 1960 and that is the beginning of the International Federation for Information Processing (IFIP). Already at that meeting 15 countries were members: Belgium, Canada, Czechoslovakia, Denmark, Finland, Germany, Japan, The Netherlands, Spain, Sweden, Switzerland, the Union of Soviet Socialist Republics, United Kingdom and United States of America. Mr. Auerbach (USA) was elected as President, Professor Alwin Walter (Germany) was elected as Vice-president and Dr. Ambrose Speiser (Switzerland), was elected as secretary and treasurer. The work within IFIP was organized in Technical Committees (TC) and they in turn could have Working Groups (WG). Already in 1963 the first 3 were established: TC1 Glossary, TC2 Programming Languages and TC3 Education (4-9).

New established Working Group was TC4 - Health Care and Biomedical Research, established with Professor Francois Gremy (France) in 1967. He was elected as Chairman and J. M. Forsythe (United Kingdom) was elected as Secretary. The first Working group (WG1) was Education of Medical and Paramedical Personnel. In 1973 Jan Roukens (Holland) was elected as Chair and he chaired this WG until the date when the TC ended and the new International Medical Informatics Association (IMIA) was accepted by IFIP in 1980. A new secretary Jan van Egmond (Belgium) was elected 1971. Many member countries of TC 4 wanted more freedom from IFIP and that resulted in that TC4 got the status of Special Interest Group and to organize the first World Congress of Medical Informatics (MEDINFO) in parallel with the IFIP Congress in Stockholm, Sweden in 1974. The Second MEDINFO congress was organized in Toronto, Canada in 1977. In 1980 IMIA became independent Medical informatics association from IFIP. The inaugurate meeting took place on May 11, 1979 in Salle Capituami, Paris with speeches of Professor Bailey (WHO representative), Professor Bobillier, President of IFIP, Professor Francois Gremy (Paris) and Dr. Jan Roukens (Holland) as Chair of TC4. At the General assembly meeting the following new board was elected: Dr. David Shires (USA) as President, Dr. Hans Peterson (Sweden) as Vice-president and Chair By-Laws Committee, William Abbott, (UK) was Secretary, Dr. Shigekoto Kaihara (Japan) was Chair Newsletter Committee and Professor Peter Reichertz (Federal Republic Germany) was Chair of Publication Committee.

One year after the MEDINFO Congress in Stockholm (1974) (Chair of SPC was Professor John Anderson, UK), several European Medical informatics societies started with establishing of European Federation for Medical Informatics (EFMI). There were three persons that in 1975 had the first discussions and they were Jan Roukens (Holland), Jan van Egmond (Belgium) and Mogens Jorgensen (Denmark). They started to write Statute and discuss these with a few other interested representatives from other European countries. These persons were called the Preliminary Executive Group (PEG) and they held a meeting in Paris in June, 1976, where they decided to invite all known European societies to be represented at a constituent meeting of the Federation of the European Medical Informatics Societies. It was proposed that one delegate with voting right from each Society be present in Copenhagen on September 10 and 11, 1976.

ESTABLISHMENT OF EFMI

On September 10-11, 1976 in Copenhagen at the Office for Europe of the World Health Organization, hosted by M. Sedeuilh and Albert Weber, representatives of ten national Medical informatics societies (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Holland), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) adopted the Statute of the European Federation for Medical Informatics (EFMI) (Figure 1).

As the first Presidency of EFMI (Executive board) were elected: Antoine Remond (France), as a chairman, Barry Barber (UK), as secretary and Peter Leo Reichertz (FR Germany), as treasurer (1, 2).

The objectives of EFMI are (1-3):

a) advance international co-operation and dissemination of information;

b) promote research and development;

c) promote high standards in the application;

d) encourage high standards in education in this field;

e) EFMI publishes scientific papers from its conferences in EFMI official journals.

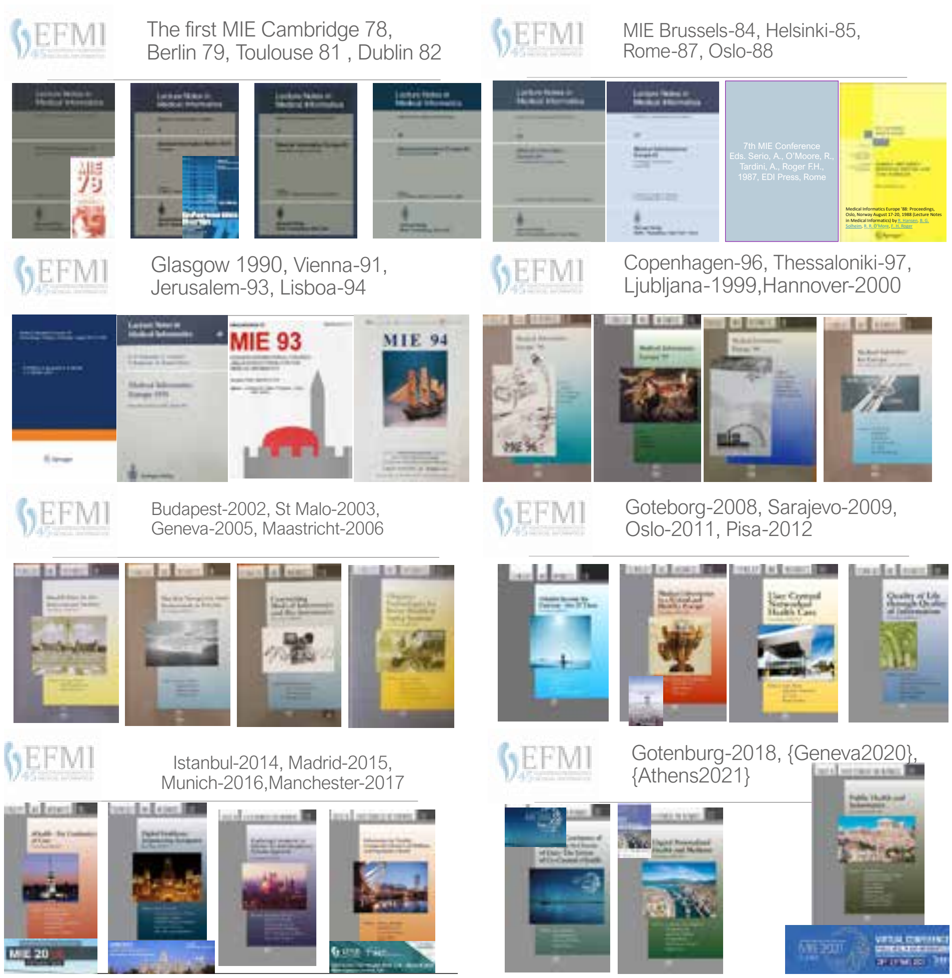


Figure 3. Cover pages of the EFMI Proceedings of the MIE Conferences from 1978 until 2020

Today EFMI is the leading nonprofit organization in biomedical and health informatics in Europe. EFMI comprises 28 national societies and includes an exceptional network of experts and stakeholders in health, care, IT and its societal dimensions; supported by 14 topic working groups ranging from human factors, to security and translational health informatics (5). EFMI has two governing bodies: FMI Executive Board (President, Vice-President WGs, Vice-President IMIA, Secretary, Treasurer, Executive officer, Publication officer, Institutional members officer) and the EFMI Council. Council members represent national societies and WGs. Former Presidents of EFMI during past 45 years are presented in Figure 2.

EFMI WORKING GROUPS

EFMI has a long tradition in working groups (WG) which are organising and supporting events and projects on a European basis but also worldwide in close co-operation with national and international WGs and institutions. EFMI Working Groups are: EDU – Education, EHR – Electronic Health Records, EVAL – Assessment of Health Information Systems, HIIC – Health Informatics for Interregional Cooperation, HIME – Health Information Management Europe, HOFMI – Human and Organisational Factors of Medical Informatics, IDeS – Information and Decision Support in Biomedicine and Health Care, LIFOSS – Libre/Free and Open Source Software, NI – Nursing Informatics, PCI – Primary Health Care Informatics, PPD – Personal Portable Devices, SSE – Security, Safety and Ethics, MIP – Medical Image Processing, THI – Translational Health Informatics, CHD – Citizen and Health Data, and yEFMI – Young EFMI.

EFMI MIE AND EFMI STC CONFERENCES

To advance its mission, EFMI started organizing the Medical Informatics Europe Conference (MIE) in 1978. So far 31 MIEs have been organized by EFMI (Figure 3): Cambridge (1978), Berlin (1979), Toulouse (1981), Dublin (1982), Brussels (1984), Helsinki (1985), Rome (1987), Oslo (1988), Glasgow (1990), Vienna (1991), Jerusalem (1993), Lisbon (1994), Copenhagen (1996), Thessaloniki (1997), Ljubljana (1999), Hanover (2000), Budapest (2002), Saint Malo (2003), Geneva (2005), Maastricht (2006), Gothenburg (2008), Sarajevo (2009), Oslo (2011), Pisa (2012), Istanbul (2014), Madrid (2015), Munich (2016), Manchester (2017), Gothenburg (2018), Geneva (2020) was cancelled due to the COVID-19 pandemic, and Athens (2021).

EFMI Special Topic Conferences (STC) are typically 2-day events organized by member societies with 100+ participants in conjunction with their annual meeting, on a topic defined by the member society, and relevant EFMI Working groups are engaged for the content. EFMI Council and Board meetings are hosted by the STC. Past STC conferences took place in: Bucharest (2001), Nicosia (2002), Rome (2003), Munich (2004), Athens (2005), Timisoara (2006), Brijuni (2007), London (2008), Antalya (2009), Reykjavik (2010), Lasko (2011), Moscow (2012), Prague (2013), Budapest (2014), Paris (2016), Tel Aviv (2017), Zagreb (2018). Kuopio (2020). STC 2021 is planned to be organized in Sevilla (Spain). In retrospect, the MIE congresses has always been a great motivation for medical informaticians, both scientists and health professionals. They are recognizing them as places most favorable for the presentation of own work, for exchange of ideas with colleagues and for learning what is new in Medical informatics in Europe and the world.

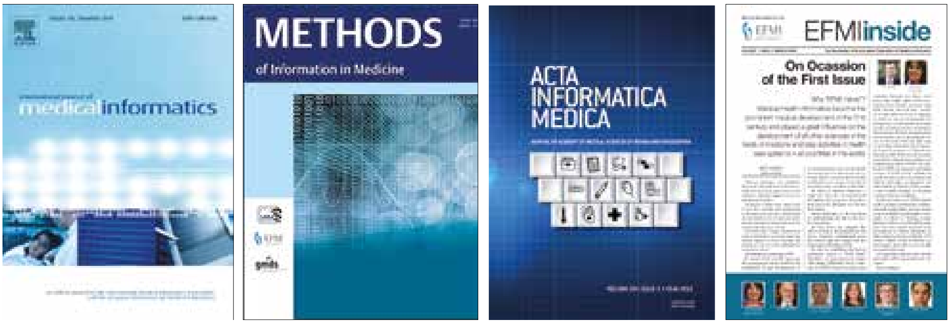


Figure 4. Official journals of the European Federation for Medical Informatics (EFMI)

EFMI PUBLICATIONS

The most important EFMI publication, indexed in Medline is Studies in Health Technology and Informatics, which publishes papers presented at MIE Conferences. EFMI also publishes several sub-specialty official journals covering the spectrum of medical informatics subdisciplines. Currently, EFMI has three officially endorsed general journals (Figure 4), Methods of Information in Medicine, International Journal of Medical Informatics and Acta Informatica Medica. Until the year 2020 official journal of EFMI was also International Journal of Biomedical Informatics (EJBI), but excluded this year. From the year 2020 EFMI started to pubish EFMI Inside magazine. Through its work, EFMI provides leadership and expertise to the multidisciplinary, health IT community and to policy makers, enables the transformation of healthcare in accord with the world-wide vision of improving the health of the world population (9-12). EFMI is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large.

EFMI HONORARY FELLOWS

During past period EFMI Council has been elected 31 Fellows as most influential Medical informatics experts for their contribution in development of this academic and scientific field (3).

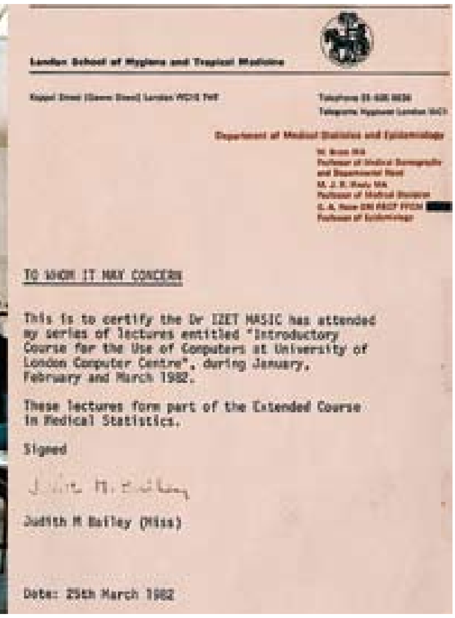
In alphabetical order EFMI Honorary Fellows are (Figure 5): Abbot “Bud” William (United Kingdom), Andersen Stig Kjaer (Denmark), Anderson John (United Kingdom), Barber Barry (United Kingdom), Baud Robert (Swetzerland), Blobel Bernd (Germany), Bryden John (Scotland, UK), Engelbrecht Rolf (Germany), Gell Günther (Austria), Gremy Francois (France), Hansen Rolf (Norway), Hasman Arie (The Netherlands), Hofdijk Jacob (The Netherlands), Jorgensen Mogens (Denmark), Mantas John (Greece),

Figure 5. Honorary Fellows of the European Federation for Medical Informatics (EFMI) - 1976-2021

Masic Izet (Bosnia and Herzegovina), McNair Peter (Denmark), Mihalas George (Romania), Moen Anne (Norway), Nordberg Ragnar (Sweden), O'Moore Rory (Ireland), Peterson Hans (Sweden), Reichert Assa (Israel), Reichertz Leo Peter (Federal Republic of Germany), Remond Antoine (France), Roger France Francis (Belgium), Rossing Niels (Denmark), Scherrer Jean-Raoul (Swetzerland), Wagner Gustav (Germany), Weber Albert (Swetzerland) and Zvárová Jana (Czech Republic) (3, 4).

EFMI AWARDS

In the year 2015, during MIE conference in Madrid, the EFMI Council approved the establishment of a Medical Informatics Award of Excellence named "Leo Peter Reichertz Young Scientist's Award" and "Rolf Hansen Memorial Award" to be given to an individual, whose personal commitment and dedication to medical informatics has made a lasting contribution to medicine and healthcare through her or his achievements in research, education, development or applications in the field of medical informatics. Also, during MIE conferences Mantas' Prize for Best Paper on Education in Biomedical



London School of Hygiene and Tropical Medicine

Department of Medical Statistics and Epidemiology

TO WHOM IT MAY CONCERN

This is to certify the Dr IZET MASIC has attended my series of lectures entitled "Introductory Course for the Use of Computers at University of London Computer Centre", during January, February and March 1982.

These lectures form part of the Extended Course in Medical Statistics.

Signed

Judith M Bailey (Miss)

Date: 25th March 1982

Figure 6. Participants of Medical informatics and Statistics course at London School of Hygiene and Tropical Medicine (LSHTM), London, 1981

and Health Informatics is giving to presenter for "Outstanding paper about Education in Biomedical and Health Informatics".

FORTY FIVE YEARS OF THE DEVELOPMENT OF MEDICAL INFORMATICS IN BOSNIA AND HERZEGOVINA (BIH)

From the 1974 automatic analysis of health data in health care institutions in Bosnia and Herzegovina was introduced gradually thanks to the engagement of Fuad Sacirbegovic director of Department for Statistics of the Federal Public Health Institute, Serstnev, whose heritage is on the same position. From 1977 Institute has published annual reviews and summary health statistics reports in BiH and utilization of health capacities under the title „Network, capacities and services of health institutions in BiH".

Initiation, development and implementation of some informatics activities, such as automatic manipulation of health data and intensive use of information technologies for the need of diagnostics, therapy and patient rehabilitation on the all levels of healthcare in BiH health system started to be solved systematically in the end of seventies and in beginning of eighties. Crucial decision at state level was in 1981, when BiH government brought decision to start with work on the project „Development of BiH Health Information System – HISBiH". Before the project, the study/analysis „Social-economical

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РСФСР

2-й МОСКОВСКИЙ ОРДЕНА ЛЕНИНА ГОСУДАРСТВЕННЫЙ
МЕДИЦИНСКИЙ ИНСТИТУТ имени Н. И. ПИРОГОВА

СПРАВКА

Figure 7. Izet Masic practicated at Univeristy of Moscow in 1989

Stellan Bengtsson
Avd för klin bakt
Akademiska sjukhuset
Box 552
S-751 22 UPPSALA

1991-01-16

Prof Izet Mašić
Acta Informatica Medica
Sarajevo, M. Pijade 6
Jugoslavien

Dear Prof Mašić,

I am sending you, as promised, a short introduction to the Action Program of the Swedish Medical Association: Computers in Health Services, which I hope will be suitable.

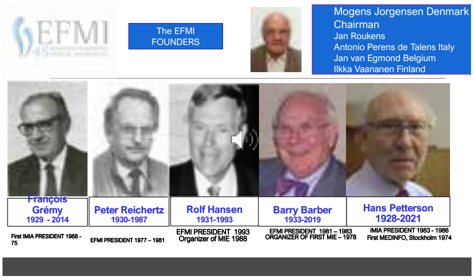
Your congress was really a great success and I was very happy to be able to take part in it.

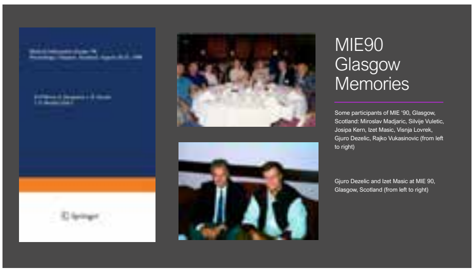
Best wishes for 1991.

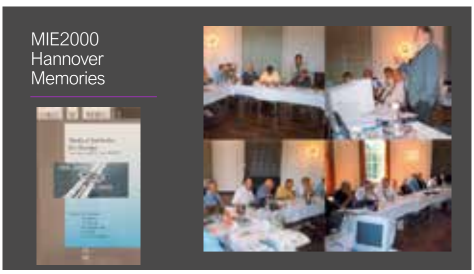
Yours

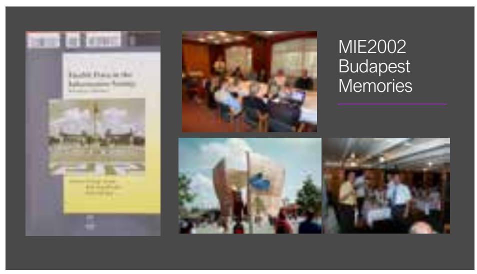
Stellan Bengtsson

Figure 8. Letter of Stellan Bengtsson, EFMI President, after participation at the First Congess of Medical Informatics of Yugoslavia, Belgrade, 1990.

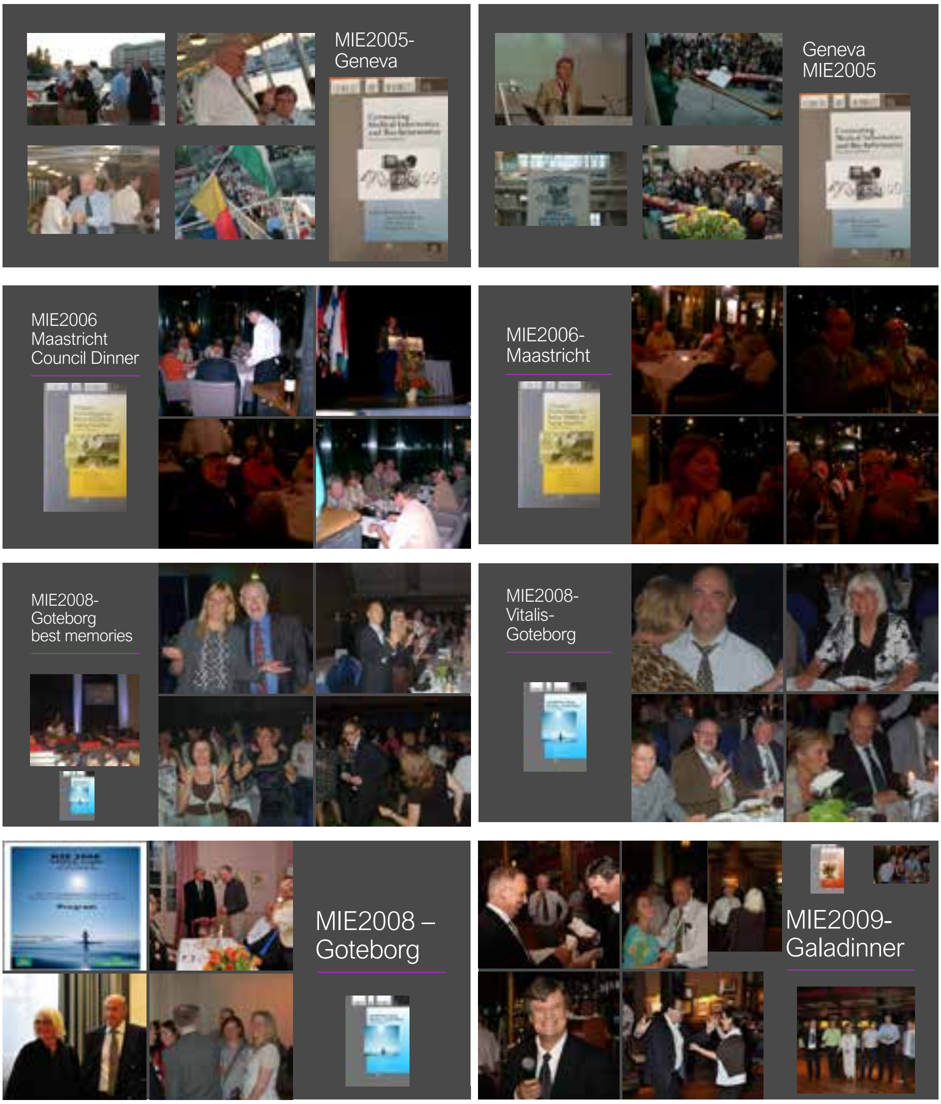




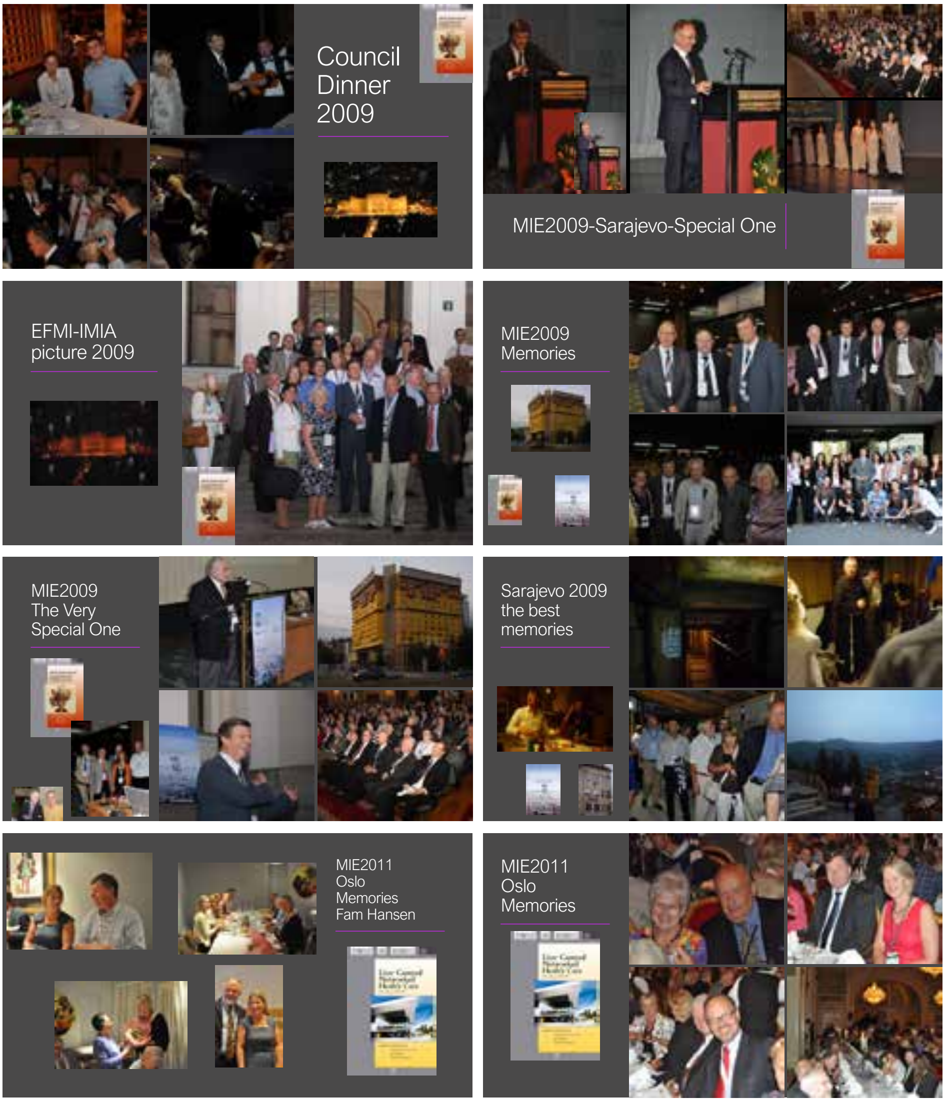




position of the health system in BiH“ was conducted. Based on that BiH Parliament approved preparation of appropriate project which should have made possible modernization of the information system of health care. Basically, this project should modernize and create automatic, well developed and functional health statistics system in Bosnia and Herzegovina which was part of also well organized (centralized) Yugoslavian health statistics system lead by the State Public Health Institute in Belgrade. Project „Development of information system of health care in BiH within circumstances of electronic data manipulation“ was approved by Executive Board of Association of healthcare communities BiH (National Committee with multidisciplinary members: MDs, statisticians,

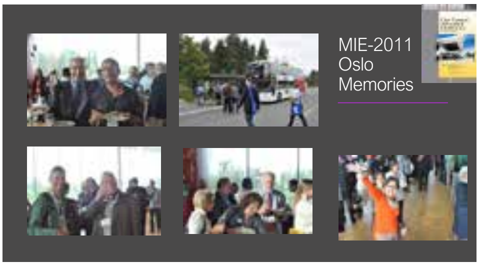


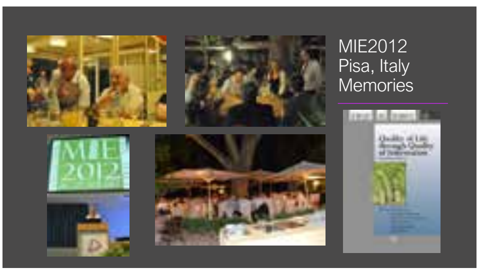
electro and mechanical engineers, economists and was chaired by myself). In 1985, after positive assessments, the revisions of the project were adopted and its implementation began after financial funds were ensured. Implementation started in 1986 and it was planned to be Concept of centralization of data manipulation in the architecture proposed in HIS BiH project (central host and analysis in Sarajevo, regional analysis in eight centers in BiH and local in 109 municipalities) but it has never been finalized and failed. The true is that some of designed activities were started on institutional level, but never reached finish as Clinical information system of the University Clinical Center in Sarajevo, which was one of the biggest projects in area of development and construction of

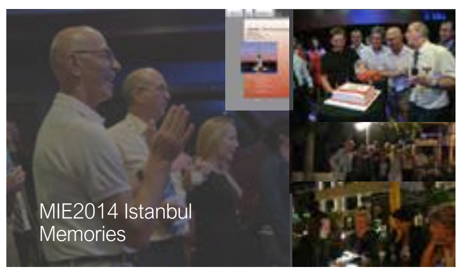


Health Information Systems. Unfortunately, during wartime 1992-1995 in BiH in regard to the procurement of hardware and production of software applications has never been completed and implemented in practice.

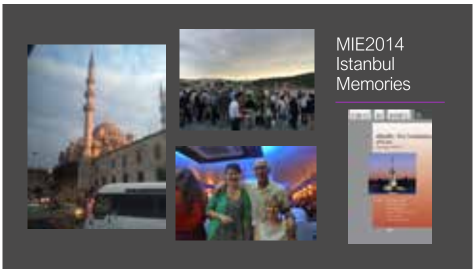
As young physician, who was graduated at Faculty of medicine at University of Sarajevo in the same year when EFMI was established (1976) I have been involved in project for revision of official system of medical documentation of current Health Statistical System in BiH, as a part of Federal Health Statistical System regulated on national level by Federal Government in Belgrade. The system was recognizable in Europe with its structure, content, organization and utility with very well designed „information flow“

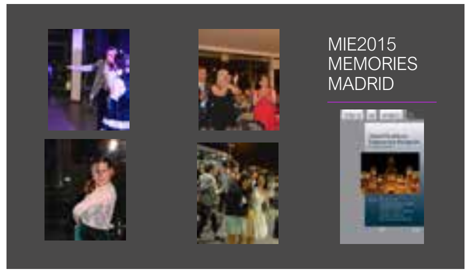


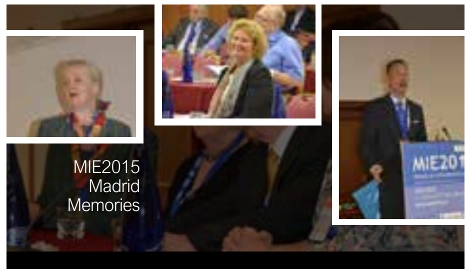




of medical data at every level of health care service (collecting, processing, evaluation, storage, using for decision making, etc.) in family practice, out-patients' clinics, general and special hospitals and university clinics. The time from primary collected data at every working place in health care system until final storage at in Department for statistics of WHO in Geneva was less than one year, it means it was very prompt and useful method and way for decision makers. But it was very huge and „paper based oriented“ and health professionals were very occupied with data collecting and processing. We need to mention that one of founders of WHO and the first President of General Assembly of WHO in 1948 was Academician Andrija Stampar from our country and







several directors of Department for Statistics and Informatics of WHO were professors from former Yugoslavia (most of them Pubic health experts).

My interest for this part of science started in 1979 when I, for the first time, visited Department for Community medicine at London School of Hygiene and Tropical Medicine (LSHTM) in London and recognized myself in that field of Family and Social medicine. During the 1981/1982, as part of my specialization, I spent at that school six months Extended Coureses of Medical Statistics and Computer Sciences. Before London, I also spent one month at University in Moscow at famous Visnjevski Institute for Research and received there my first experiences about computers use for health care protection

PROGRAMSKI ODBOR	
Predsednik:	*Deželić Gjuro* — Zagreb
Članovi:	*Adamič Štefan* — Ljubljana, *Donev Dončo* — Skoplje, *Krivokapić Slobodanka* — Titograd, *Lovrek Višnja* — Zagreb, *Mašić Izet* — Sarajevo, *Vukašinović Rajko* — Beograd.
ORGANIZACIONI ODBOR	
Predsednik:	***Vukašinović Rajko***, Beograd
Potpredsednici:	*Jelača Predrag*, Beograd *Popović Bosiljka*, Novi Sad
Generalni sekretar:	*Tasić Marija*, Novi Sad
Sekretari:	*Andrić Sonja*, Beograd *Čorluka Verica*, Beograd *Grujić Vera*, Novi Sad *Martinov-Cvejin Mirjana*, Novi Sad
Blagajnik:	*Turkulov Dragan*, Novi Sad
Članovi:	*Anđelski Hristo*, Beograd *Babić Momčilo*, Beograd *Barać Željko*, Beograd *Begoli Ilir*, Priština *Blagojević Miloš*, Beograd *Blat Jožef*, Kikinda *Dačić Milutin*, Beograd *Đukić Ljiljana*, Beograd *Grozdanov Jasmina*, Beograd *Jovanović Kostadinka*, Niš *Marinković Jelena*, Beograd *Mihaljev-Martinov Jelena*, Novi Sad *Mihajlović Jasmina*, Novi Sad *Mudrić Dragoljub*, Novi Sad *Naumović Predrag*, Beograd *Niketić Milovan*, Niš *Potić Zoran*, Novi Sad *Perišić Branko*, Novi Sad *Simić Snežana*, Beograd *Svoboda Zagorka*, Subotica *Vujić Miloš*, Novi Sad
REDAKCIONI ODBOR ZBORNIKA	
Urednici:	*Barać Željko* *Simić Snežana* *Jelača Predrag* *Mihaljev-Martinov Jelena* *Perišić Branko* *Dačić Milutin*

III

Figure 9. Cover page of "Proceedings of the First Congress of Medical Informatics of Yugoslavia", held in Belgrade on December 6th-8th 1990

and medical education (the first visit in 1975 and second visit in 1989), when I visited academicians Lisicyn and Gasparyan, recognizable persons in the health informatics and Cybernetics fields in Former Soviet Union. In that time University in Moscow produced „Vrach Kibernetics" (Doctor of Cybernetics), special medical occupation for health care informaticians. Education in Moscow and London defined my interest and occupation with Health informatics in Primary health Care and Family medicine and my Master and Doctoral thesis I earned in that field (Figures 6 and 8).

These are already mentioned facts which I published in interview with Professor Dezelic and explained important events regarding establishing and implementation of Health Informatics in Former Yugoslavia, but also in South-East Europe. I must describe some important points about development of Medical informatics and influence of our influential persons, not only from former Yugoslavia, because in the past very few experts in this field were mentioned as important persons who created strategy, tactic and operational activities in all kinds of Health and Medical informatics, not only in the Europe, even worldwide.

Figure 10. Rory O'Moore (EFMI Vice President), Izet Masic and John Bryant (EFMI President) (from the left to the right), EFMI Council at MIE '94, Lisbon, Portugal, 1994

Unfortunately, not so many of them became engaged in managing structure of EFMI and IMIA in the past (as presidents of IMIA or EFMI) besides very hard and effective influences od development of those associations. But, readers need to know that our students of Biomedical faculties have possibilities to learn the same subjects and contents of Heath informatics at Universities in former Yugoslavia as in US, UK, Germany, France, etc. because in that time we have had one of the best educational system in the world, also one of the best organized health care system in the world, which produced very qualitative products in all kind of industry, economy, education, etc. especially in Africa and Middle East, educated students from undeveloped countries, because president of former Yugoslavia, Tito chaired more than 100 countries („The Nonaligned Movement /The Block of Independent Countries"). Interesting fact is that in 1984, Energoinvest Company in Sarajevo produced computers (IRIS 16 and IRIS 32), led by Academician Bozo Matic and his team (he was Director of „Energoinvest" company, also, President of Academy of Sciences and Arts of BiH, and Rector of Sarajevo University) where his team of experts in 1977 worked on projects on biological robotics and produced „biological prosthesis", etc.

One of my projects was creating „Family Registration Card" as „Medical Record Linkage" in Primary healthcare system for collection and depositing „minimal data sets" on electronic cards, as optimum of data processing and storage medical data for quality assessment outcomes of MDs work in Primary Healthcare System protection („all data about one patient stored at one place" and the stored data must be kept by family practitioner). It was my project to establish the first Local Information System in BiH for Family medicine practice. Unfortunately, war in our country (1992-1995) stopped all those projects.

Figure 11. Attila Naszlady, EFMI President,during Opening ceremony of the First BHSMI Congress in Sarajevo in 1999 (left); EFMI Board members at Rector's office of Sarajevo University during the Second BHSMI Congress in 2004 (middle); SPC of MIE 2009 celebration of closing of MIE 2009 Conference in Sarajevo on September 2nd, 2009 (right)

For education of Medical informatics subject, academician professor Dezelic (1931-), as pioneer of Medical informatics in former South-East Europe, established almost all Cathedras at universities in former Yugoslavia, From such formulations it clearly follows that the terms „Medical informatics" and „Health informatics" were considered synonymous, but in the former Yugoslavia areas (with a socialist society organization, in which there was no private medical practice) the adjective „health" was preferred. With the appearance of the international associations, IMIA and EFMI, the name Medical Informatics finally prevailed in our country (recommendations by IMIA experts of WG for education).

Gjuro Dezelic and three other professors: Stefan Adamic in Slovenia, Rajko Vukasinovic in Serbia and Izet Masic in Bosnia and Herzegovina in the late '80s of the last century formed Yugoslav Association of Medical informatics (YAMI) in 1989 in Osijek (Croatia) by the Republic Societies for Medical Informatics in Bosnia and Herzegovina, Croatia and Slovenia, and the Section for Medical Informatics within the Serbian Medical Society (1, 5-8). It was decided that the headquarters of YAMI would be in Zagreb, and Professor Dezelic was elected as president. Association for Medical Informatics - YAMI. YAMI organized the First MI Congress in Belgrade in 1990 (Figures 7 and 9) with an impressive participation of over 500 participants. This scientific meeting of MI left positive effects on the later development of MI in Europe and the World (11).

At the time of the 1990 MIE Congress in Glasgow at a meeting of the EFMI Council and the IMIA Annual Assembly, YAMI was admitted to the membership of both international medical informatics organizations, but this did not last long. Already at that time, Yugoslavia entered a period of political unrest that led to its disintegration. It should be noted here that after the wars against Slovenia and Croatia in September 1991, both MI associations - Slovenian and Croatian - withdraw from YAMI, followed by the MI association of Bosnia and Herzegovina a few months later. After the Republic of Croatia and other republics of the former Socialist Federative Republic of Yugoslavia (SFRJ) were internationally recognized in January 1992 and became members of the UN in May of the same year, the conditions were met for medical informatics associations of the former three Yugoslav republics - Bosnia and Herzegovina, Croatia and Slovenia - to become members of IMIA and EFMI. This happened during the 1992 MEDINFO Congress in Geneva (7), but oficially accepted Izet Masic as national representative of Bosnia and Herzegovina at EFMI Council in Lisbon, Portugal, during MIE '94 Conference (Figure 10) .

The worst time was for the Medical Informatics Society of Bosnia and Herzegovina (BHSMI) was, because the armed conflict lasted between March 1992 and November 1995, with the siege of the capital Sarajevo. But even in such a terrible situation, BHSMI, which I led, had a fruitful activity, amazing in such circumstances, managing to organize professional gatherings, produce numerous publications and launch the journal „Acta Informatica Medica" (www.actainformmed.org) (Figure 4). Cooperation with EFMI Medical informatics helped me in organization of these events in Sarajevo: in 1999 the First Congress of Medical Informatics, opened by Attila Naszlady, EFMI President, who helped me during wartime in BiH that BSMI became official member of EFMI (Figure 11, left), in 2004 Rolf Engelbrect, EFMI President, gave us at University of Sarajevo the first tele-lecture from Munich via Skype, in 2005 full EFMI Board members (Reichert, Baud, Engelbrecht, Bryden, Hofdyjk, Weber, Rudel) visited Sarajevo and participated at the Second Congress of Medical Informatics (Figure 11, middle). Finally, Jacob Hofdijk, EFMI President opened MIE 2009 Conference in Sarajevo in 2009 (Figure 11, right) (1, 10-14).

In the post-war period, BHSMI organized national symposia and applied for the MIE Congress, which was held in 2009, and signed from a lot of participants of former MIE Conferences as „the best ever MIE". Much more about these facts described in this part of article could be read in my other articles and several books in the field of Medical Informatics (mentioned in the list of references at the end of the text). A few articles are published in two official EFMI journals: Acta Informatica Medica (indexed in PubMed) and EFMI Inside, both deposited on www.efmi.org) (7).

I will finish this small review about history of MI in BiH with words said by Gjuro Dezelic during opening of the MIE 2009 in Sarajevo in his keynote lecture: „We should consider the mandate to organize the MIE 2009 Congress in Sarajevo as the crown of all efforts of professor Masic efforts to get it for a long time… ". I added that the credit should be given to EFMI, which, by choosing Sarajevo, supported the construction of new medical, biomedical and health-information bridges between the western and eastern parts of the European world" and images which illustrates very important activities which helped to improve and use all achievements of Health/Medical/Biomedical informatics as scientific and academic disciplines and also in functioning of all segments of health protection at every level of healthcare systems.

CONCLUSION

Health (medical) informatics as separate scientific discipline began to be effective in academic institutions in the end of seventies by presentation of actual accomplishments in this area in under and postgraduate education at biomedical faculties. During past forty five years of existing EFMI, as leader in the field of Medical informatics in Europe and worldwide, have had great influence on the development of Biomedicine as a science and as a academic discipline, especially to improve quality of the healtcare protection of population on every level of health care systems and and in every country in the world.

REFERENCES

1. Masic I, Mihalas G. (Eds.) et al. Contributions to the History of Medical informatics. Avicena, Sarajevo, 2014:439 pp. ISBN: 978-9958-720-56-7.
2. Masic I. Biographical Lexicon of Medical Informatics. Avicena. Sarajevo, 2017: 546 pp. ISBN: 978-9958-720-62-8.
3. Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2019: 50: pp. ISBN: 978-9958-720-64-2.
4. Masic I. Honorary Fellows of the International Association of Medical Informatics. Avicena. Sarajevo, 2018: 49: pp. ISBN: 978-9958-720-70-3.
5. Masic I. Historical Backgrounf of EFMI in Development of Medical Informatics. EFMI Inside. 2020; 1(1): 3-9.
6. Masic I. The History of Medical Informatics Development - an Overview. Int J Bomed Healthc. 2020; 8(1): 37-52. doi: 10.5455/ijbh.2020.8.37-52.
7. Masic I. Interview with Gjuro Dezelic, Former President of Yugoslav Medical Informatics Association of Medical Informatics, Former President of Croatian Society of Medical Informatics, EFMI Council member 1990-1992. Int J Biomed Healtc. 2020; 8(1): 53-57. doi: 10.5455/ijbh.2020.8.53-57.
8. Dezelic G. After three decades of Medical Informatics Europe congresses. Stud Health Technol Inform. 2009; 150: 3-7.
9. Mihalas G, Zvarova J, Kulikowski C, Ball M. et al. History of Medical informatics in Europe–a short review by different approach. Acta Inform Med. 2014 Feb; 22(1): 6-10.
10. Zvarova J, Masic I. Medical informatics–an interdisciplinary approach. Med Arh. 1996; 50(3-4): 107-109.
11. Adlassnig KP, Blobel B, Mantas J, Masic I. (Eds). Medical Informatics in a United and Healthy Europe. Proceedings of MIE 2009. IOS Press. Amsterdam, 2009: pp. 1064.

12. Masic I. The History and New Trends of Medical Informatics. Donald School Journal of Ultrasound in Obstretics and Gynecology,2013;; 7(3): 313-322.

13. Masic I, Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-44.

14. Masic I. History of Medical Informatics in Bosnia and Herzegovina. Avicena. Sarajevo, 2007. 76 pages.

10

George I. Mihalas

EVOLUTION OF TRENDS IN EUROPEAN MEDICAL INFORMATICS

A comprehensive presentation of history of medical informatics requires a systematic and multiaxial approach, to provide not only a list of events, journals, organizations or people, but also to analyze the characteristics of each epoch, to reveal the trends and to recall both successes and failures. The evolution of ideas and trends in medical informatics had some specific features which deserve a special attention. By offering such a dynamic view, the "history" becomes a tool (1) for a realistic estimation of the impact of medical informatics on various domains - healthcare, computer science, industry and education. Such an approach was used in the Foreword to MEDINFO 86 of the Scientific Program Committee (2), analyzing the trends for a short period of time (3 years), within six major directions.

MATERIAL AND METHODS

One of the best ways to analyze the evolution of trends/ideas/concepts in any domain is to search the literature, starting with its early attempts to present the achievements in the specific field. This was also our approach, having an immense number of references: all congresses of medical informatics organized by EFMI (European Federation for Medical Informatics (3), or by IMIA (International Medical Informatics Association (4), as well as the contents of most representative journals (5-9) or book series dedicated to this field: Lecture Notes in Medical Informatics (10) for period 1978-1991, followed by Studies in Health Technology and Informatics (SHTI) (11). Nevertheless,

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

some important books (mainly referring the early stages) were also considered. Even the number of materials consulted was large; the references listed here were limited to most relevant ones.

Another important source of information came from the European Commission (12). Several volumes in series (11) refer to projects carried out within successive research frames financed by EC (13-16). As this article aims mainly to analyze the evolution of the trends in Medical Informatics in Europe and the author has been involved in the evaluation process or monitoring of several European projects since 2002, a balanced view was the target of the presentation, to match both the vision of EFMI (the author was EFMI's President 2006-2008, member of the Board 2001-2010, member of EFMI Council since 1994) and of EC. The topics of contents of conferences or congresses have been analyzed in several ways: counting the number of articles and pages for each topic/subject (most often a chapter was dedicated to a key-word from a list proposed by the Scientific Program Committee of the conference), tracing the presence of topics through the successive conferences, finding the growing or fading interest in various subjects. Links between various topics were also considered.

Another source about the evolution of trends in bio-medical/health informatics was to analyze the very content of the courses presented to the students, either medical students/computer science students or future Healthcare Informatics Professionals (HIPs); all teachers tried to be "up-to-date" to the most important topics of interest of the domain at the particular moment (17-21). We could find here, not only some clear milestones for defining the most representative stages of development of ideas in Medical Informatics, but also some views about potential future development of the domain. A comprehensive view from educational point of view is included in the article of Arie Hasman et al. published in Acta Informatica Medica journal (22).

The present paper intends to systematize the enormous amount of information analyzed. This attempt is not the first one and we can cite here several books and articles on "History of medical informatics" (23-26), seen from various perspectives: technological development, educational needs, research objectives, etc. Our attempt is to integrate all those views and extract from them the defining lines of trends, tracing the evolution of major topics and concepts of medical informatics within its complex environment, with moving targets, rapid technological advent and provocative societal challenges, by trying to identify the most common topics which raised the interest of the scientific community in (European) medical informatics over almost half a century.

The presentation was organized following the classical chronological way for a "historical" approach. From the point of view of evolution of trends, we can distinguish five major stages in the development of medical informatics, which will be presented here.

MAJOR STAGES OF MEDICAL INFORMATICS HISTORY

Early (pre-organizational/pioneering) stage: 1950 - 1975

It might be surprising, but a lot of ideas about future developments have their roots in this period. Visionary scientists have realized the enormous potential behind the "new emerging information technology". Important technological steps took place, with fast transition through first three computer generations; some authors do even split this phase into five distinctive periods (24). Most related work from this stage had a visible pioneering mark but becoming good introduction for the future work in the specific field, under the generic title "computer applications in …" (27). A major characteristics of this stage we can note the absence of coherent research plans, the work was performed mainly in isolated groups, not raising yet the interest of healthcare managers. Worth to mention that, the development of software in parallel with hardware drew the attention upon "information processing" as a key issue and IFIP (International Federation for Information Processing, established in 1960 (28) under the auspices of UNESCO), initiated technical committees for various domains, including medical domain (TC4 since 1974). Even it is difficult to distinguish important revolutionary achievements for the medical domain, this period was quite prolific in ideas, opening the doors for significant future work.

To summarize the major characteristics of this period:

- Pioneering work of scientists who envisioned various applications of IT in medicine and healthcare (M&HC);
- Analog computers still considered;
- Major work on: signal analysis, laboratory applications;
- First attempts on decision support (diagnosis);
- Databases, modeling and simulation of some biological processes.

Medical Informatics - "childhood/youth": 1975 - 1990

The work done in the preceding two decades traced the contour of the emerging domain, most often called "Medical informatics" or "Health informatics". It became clearer and clearer that several medical activities will use computer applications in the future; hence a certain preparation of present and future medical staff about computer use became obvious. Thus, the applications in major areas of medical informatics were systematized and first educational programs in medical informatics began (17), including advanced programs for healthcare information professionals. A detailed description about the evolution of medical informatics education is presented by Arie Hasman et al. (22).

This is also the period when first national and international professional organizations (associations, societies) were established and specialized conferences started to take place. The object of medical informatics is still mostly perceived as dealing with computer applications in various medical fields. They referred not only clinical applications but also healthcare management, which raised the interest at higher level of healthcare institutions and also the interest of industry - the roots of "e-health as a business". IT offices/compartments in health ministries or health insurance houses have been created in some countries, elaborating strategies for local, regional or even national healthcare information networks (29), but the progress in this line was still limited to a couple of successful networks by the end of this stage (30).

However, the awareness about the potential of these applications to address major challenges of healthcare, accumulated along this period, led to inclusion of ehealth/ medical informatics topics in the research programs of the European Commission at end of this period. Several projects were financed by the EC under the first research frames, led at the beginning by Niels Rossing; for our domain it was the AIM (Advanced Informatics in Medicine) Exploratory Plan (31). An important program of WHO, launched at the beginning of seventies, made also reference to the use of IT for reaching their goals (32).

Most important expectations were from the applications in healthcare system; besides the local health information systems to cover certain regions (counties) mentioned above, a visible interest was paid to the development of clinical/departmental and hospital information systems (33), dragging in also the issue of medical data protection, security and confidentiality (34). The term EHR (Electronic Health/Medical Record) has been introduced also in this period.

For research, the highest attraction was held by artificial intelligence methods (29, 35). The work on clinical decision support started to occupy an important place, including the development of medical expert systems, natural language processing, the work on medical terminology and ontologies, specialized high level software etc (36). Actually, research topics and developments showed a marked diversification: mathematical modeling and computer simulation of biological processes (37), advanced techniques for medical imaging (CT, MRI), biological signal processing and medical data analysis etc. Involvement of industry for the development of specialized equipment became evident, moving some of this work from medical informatics groups towards related fields of bioengineering. Actually, the parallel development of medical informatics and bioengineering is a good example of a successful cross-fertilization (38).

A point which has to be mentioned is that Europe was split by an "iron curtain" into West and East, with completely different views, mentalities, laws, etc by common heritage and goals (even not always recognized by the leaders). Communication between the two sides was difficult, facing obstacles which might seem today ridiculous! We should emphasize here that, despite all these obstacles, some people tried to maintain the feeble existing link. And, even this article aimed mainly to trace the trends and not the people, the names of Jana Zvarova and Jan H. van Bemmel should be mentioned for their efforts to offer the chance of two different worlds to meet (36, 39).

To summarize the major characteristics of this period:

- Founding most national and international organizations, conferences;
- Attempts to systematize major areas of medical informatics;
- First specialized schools and courses;
- Development of methodologies, EHR;
- Principles of Clinical and Hospital Information Systems;
- Security and medical data protection;
- Advanced decision support systems - expert systems.

Consolidation period: 1990 - 2000

The accumulation of knowledge and experience from the previous phase led to an important, maybe the most important conceptual step in the development of medical informatics: it became quite clear that "computer" as a key word in definition of medical informatics should be replaced by "medical information"; computers proved to be just convenient tools for information processing. Coiera made a nice comparison for this: "Medical informatics is about computers as much as cardiology is about stethoscopes" (40). This conceptual shift had a milestoning impact on defining future trends in medical informatics and this is why we proposed the term "consolidation stage" for this period. The new view was best perceived in medical informatics research and education, but it was less felt by the real/practical environment - the major beneficiary - the healthcare system itself. This difference of perception deserves a deeper insight; we will limit ourselves here to just notice it; some of its consequences will be included in the "Discussions" paragraph.

This stage was rich in outstanding achievements: new attractive infrastructure advance - accessibility of computers, extensive use of PC's, performant communications and start of internet applications, all together generating a new chapter - telemedicine (41), (the new term “telematics” was coined to reflect the strong synergy between telecommunication and informatics (42, 43).

Basic medical informatics courses have been generalized in most medical schools and several specialized medical/health informatics schools have been created, either at undergraduate or (most often) at master level (22). Doctoral level in medical informatics was also introduced in several European countries.

Technological development of IT&C (Information Technology and Communication), with its penetration into all domains, had an impact on its perception by politicians. Several countries extended the name of their ministries of communication with “information (technology)”. Potential medical applications in public health and in the “ever-lasting healthcare reform” (specific to most countries during last decades), determined the creation or development of IT/ITC compartments in health ministries, to elaborate or develop national/regional strategies for implementation of IT in healthcare/medical activities; quite often, health insurance houses were also dragged into this carousel. Even the results of national strategies for this specific stage were - sometimes - below expectations, the interest in the field of governmental institutions became an important fact to be considered for future developments.

Another fact to be considered, specific for Europe at the beginning of this decade, was the collapse of communist regime in East European countries. Almost all new governments tried to make ties with Western countries, developed various co-operation programs, exchanged specialists, launched projects, etc - it was an unprecedentedly concert of actions and voices. Some previous collaboration extended (44). National societies/associations of medical informatics have been established in most East European countries, becoming also members of EFMI. But, while political divide broke, economic divide still persisted. In order to facilitate the participation of East European scientists in European conferences, several ways to support them have been found: bursaries offered by National Library of Medicine for attending MEDINFO 92 in Geneva, a support action covered by EC for attending MIE 96 in Copenhagen (Peter McNair), bursaries from British Computer Society for attending Harrogate Conferences in 1996-1997 (Bernard Richards), fee waivers and bursaries for MIE 2000 in Hannover (Rolf Engelbrecht), etc. (45-48). This wave of sympathy brought an enthusiastic atmosphere and engagement in EFMI activities.

An important role was also played by the “e-health unit” of DG “Information Society” (they had various names) which became a major financing source for European research in medical informatics within frame programs 3 to 5. The calls for projects were carefully prepared, including endeavoring topics, including also fundamental research, often left aside due to the long duration of “return of investment”. The merit of

Jean-Claude Healy shall be underlined, who continued his mission even after moving to WHO (49). Several success stories from European projects have been reported (50).

The large palette of applications, with some visible achievements with high potential of extension had also a strong impact on industry; e-health market showed a marked increase.

To summarize the major characteristics of this period:

- Medical Informatics (MI) consolidates its position as independent (stand-alone) discipline, with own object and methods;
- Departments of MI/HI in health units (including ministries);
- Interest at high level, launching of national/regional strategies for implementation of IT in healthcare Hospital Information Systems (HIS) in several hospitals, still mainly for management;
- Start substantial funding for e-health research (e.g. The European Commission);
- More visible importance and complexity of EHR, including confidentiality, data protection, standards etc.;
- Development of MI education (mandatory discipline in most medical schools);
- Contour of new job: HIP - Health Information Professional;
- New chapters: internet applications, telemedicine, virtual reality etc.;
- Notable progress in classical topics - data bases and case mix, medical imaging, knowledge processing and ontologies etc.

Maturity of Medical Informatics: 2000 - 2010

The new millennium started in the enthusiastic atmosphere generated by several good achievements, handy technology, some well defined directions for medical informatics research and almost boundless trust in the potential of medical informatics/e-health to address major challenges of healthcare system. However, even a superficial survey over the work done last decades could show a discrepancy between expectations and reality. Reports showed that a high percentage of projects about implementation of information systems failed, others had deviations, either not reaching the parameters or having delays or exceeding the budget (51). Several studies tried to analyze this in detail, revealing potential factors which could contribute to these modest results (besides mismanagement or incompetence): low user acceptance, lack of interoperability, too rapid technological changes, low political support, lack of coordination between teams etc. The importance of quality assessment became evident; actually such studies have been performed even before, but their relevance has not been properly perceived until now (52).

Even successful projects had a lower impact than expected, being used after the end of the projects mainly by the participants in the consortia. Hence, the calls raised the requirements for well prepared exploitation and dissemination plans (15, 16). Moreover, the enlargement of European Union, with several new members, imposed actions to engage also the political factors. Thus, starting with 2002, EC organized annually the "E-Health High Level Conferences" (12), where delegations from ministries of health of member states were invited. These conferences usually adopted "Declarations", underlining the engagement of official institutions to support all actions directed to better dissemination and implementation of the results from European projects. Moreover, there were recommendations to attract universities or SMEs from the new member states in the research consortia.

Scientific community realized that the challenges for healthcare systems, including the type of problems around implementation of healthcare information systems, were not specific for Europe, but were general, like many other issues. That is why several actions to extend cooperation beyond Europe took place (53), with a couple of summits EC-USA by the end of the period. An important event of the period was the establishment in 2000 of ERA (European Research Area), which became a reference point for various research programs throughout Europe, including the well-known (first - 2004) "eHealth Action Plan" (54). Several actions have been done also within EFMI frame, leading to some successful common projects (55).

The increase of activities connected to e-health generated also an increase of scientific events (conferences, seminars, exhibitions) of medical informatics. EFMI, which used to organize their quasi-annual MIE conferences (Medical Informatics Europe - in each year when there were no MEDINFO's organized by IMIA), added another annual conference - Special Topic Conference, starting with the STC in 2001 in Bucharest (3).

Concerning the research topics, this stage maintained and developed all major topics from previous periods, emphasizing two aspects: interoperability and integration. Fundamental research was strongly stimulated in the 6^{th} and 7^{th} Frame Programs of EC. Virtual Physiological Human became an important platform (56), offering an excellent tool for vertical integration of biomedical information, for linking the molecular level (genomic data from bioinformatics, including development of nanotechnologies for data acquisition, like lab-on-chip), to cell and organ level (using modeling and simulation tools as well as visualization procedures), up to whole body, or even to public health (57). Most projects included also the horizontal integration - the availability of data from primary care to ambulatory specialized care or hospital.

Assessment of quality of information systems was also a topic of interest; as it is often associated with standards and certification procedures, such work took place within a couple of European projects, referring mainly to certification of EHR (58).

The high mobility of persons also required an improvement of health information exchange, yielding a new chapter - "travel medical informatics" (59, 60).

From a technological point of view one should mention the development of thematic networks (61), use of grid technology (62). It was also the period of general use of internet, and beginning of m-health (mobile phone use) (63) and p-health (use of personal portable devices for health data acquisition) (64).

To summarize the major characteristics of this period:

- Clearer understanding of e-health potential to address major challenges of present healthcare;
- Involvement of politicians, extension of regional/national projects;
- E-health as business, emergence of specialized industry (e.g. HIMSS);
- All big IT companies started to pay interest to M&HI applications;
- Patient-centered MI - development of EHR/EMR;
- New keywords: integration, interoperability, consumer informatics;
- More visible hidden gaps - difficulties in real implementation of Health Information Systems - several "failures" reported; analysis of "barriers", modest rate of user acceptance, quality assessment of HIS;
- Need of larger scale education & training programs (AMIA 10x10);
- Clear contour of sub disciplines: bioinformatics, neuroinformatics, VPH etc.

Full integration of Medical informatics in medicine and healthcare: 2010 - 2020

The last period in our staging is the present one, hence we will not insist in a detailed description and we will limit the presentation to emphasizing the new characteristic features.

Maybe the most relevant result of the fretful end of the previous decade was the ascertainment of the strong inter-relation between all factors related to health - life style, environment, culture, social and political factors etc and future e-health projects should integrate these features. This is visible in both "eHealth Governance Initiative (ehgi)" (65) "second eHealth Action Plan (eHAP)" (66). The directions to empowering the patient, well aging, personalized care, interoperability and integration are still in a developing trend.

At national level, most countries would need to rethink and revise their e-health strategies, according to the new trends and requirements, to adopt the developed standards and introduce certification procedures for use of all ITC applications in healthcare.

A new keyword is more and more used in all IT applications - 'big data', referring to the huge amount of data collected every day in healthcare (especially from genomic data, but not only from there), which need, of course, appropriate tools for handling and processing (W14). A suitable infrastructure was developed - cloud computing, which will have a strong impact on various ITC applications in healthcare, including the national healthcare plans and strategies (68).

The trend towards personalized healthcare will probably push forward fundamental research. Author's view is that any piece of biological/medical information has a "life" made of two parts: an "internal" life, expressed as molecular structure, transmitted as "cellular signaling", becoming biosignals detectable by laboratory or visualization procedures, thus starting its "external" life, when it is processed and interpreted by physicians; the pattern of all pieces of information represent the health state of an individual. For the present period we are still able to collect just fragments of information, which, most often can be integrated with sufficient accuracy for medical practice. We expect that theoretical development of models will be developed and complex simulations will be built, able to integrate all kind of individual data, from genomic and cellular to physiomic data at tissue and organ level, for building the "digital patient" (also called "e-patient" in (57). Such individual "virtual clones" will be the basic tools for the future of predictive and preventive medicine.

To summarize the major characteristics of this period:

- Big Data approach;
- Cloud computing;
- Social networks on health;
- Restructuring national e-health strategies:
  - Involvement of politicians, improvement of legislation;
  - Certification of EHR and ITC applications in healthcare;
  - Wide adoption of standards;
- Decreasing gaps, increase user acceptance;
- Certification of educational programs in medical informatics;
- Generalization of EHR/EMR, inclusion in Health Information Systems:
  - Integration of molecular & genetic data;

  - Full interoperability - communication, devices, semantic interoperability;
- Patient empowerment, involvement through PMR (Personal Medical Record);
- Visible steps towards "personalized medicine", with:
  - Increase patient safety, reduction of medical accidents and errors;
  - Increase preventive medicine, reduction of curative medicine;
  - Use of portable/wearable devices for monitoring, prediction & prevention;
  - Deployment of home monitoring systems and tele-assistance;
- Attention moves towards:
  - Deeper penetration of IT tools in medical research (modeling & simulation, digital patient etc);
  - Advanced decision support systems.

DISCUSSION

Writing about the history of a domain or idea is a complex work, requiring a sound documentation through an immense volume of literature and other documents and will always be biased by the personal perception, experience and background of the author. The history of medical informatics has already been approached in various angles, as mentioned above. The view here comes from author's background in biophysics and informatics, his experience as an expert of EC, as an EFMI Council member and as a professor to both students in medicine and in computer science, including an experience as a director of a governmental institution.

The intent in this paper was to reveal the topics which raised the highest interest along half a century and link these trends with the specific socio-political and technological context. There are several remarks which should be mentioned here, some of them were discussed during the panel in Prague, and others were added after reading so much literature.

a) The staging proposed by the author has no precise limits. The roots of most characteristic ideas can almost always be found in the preceding period; I have included them in the stage where they proved to arouse a large interest. There are visible developments of some trends even within a stage, making possible to split them into sub-periods.

b) There are some topics which have not been mentioned separately, like nursing informatics, compunetics, emergency e-health, e-prescription, etc, or just mentioned without any comment, like patient safety, ontologies, personal medical record, health-on-the-net, etc.

c) A better understanding of a certain event or feature is gained when one also mentions or describes the context in which it is presented. The inter-relations between context and events are strong and offer the best mean to foresee the future developments.

Finally, some comments about the references. The key words for articles and, especially the subject index in books are supposed to be not only helpful, but almost essential for such a historical undertaking. Unfortunately, even there are clear standards in this direction (Medical Subject Headings MeSH (69), they are not always observed, making "improvements": sometimes the granularity is either too low, but most often too high, making them useless. The common search engines make no distinction between normal text and key words. Moreover, most of the times, the classification is uniaxial. Or, in multidisciplinary domains, like medical informatics, one would prefer to classify an item (article, chapter, book etc) from various points of views: technological, methodology, domain of application, etc.

Concerning the references, for papers which are supposed to use a large number of references of various kinds, a classification seems welcome, hence we tried to use here separate lists for articles, books, journals and websites.

Another shortcoming is the limited life of some web addresses. It would be useful to have "archives" managed by the entities (institutions, societies, etc) which organized the events, where to store all the documents connected to them. An attempt to collect such documents is a part of the "IMIA History Project", led by Casimir Kulikowski, which has set up a web page (70) and organized an attractive Workshop at MEDINFO 2013 (71).

CONCLUSION

An analysis of the evolution of trends in medical informatics is useful not only to mark the major achievements of a specific period, but also to foresee the future developments and to help in designing the strategies. The involvement of high level institutions reflects the importance paid to the field of e-health, which is one of the most active domains, both scientific and industrial. The potential of the field to address the major challenges of healthcare systems gives medical informatics the role of an engine of future developments in healthcare. The expectations from medical informatics are very high. But, as underlined in this article, good results can only be obtained within a concerted action, to consider the real context, taking into account all stakeholders in the process.

At the end of the paper I will cite a phrase from the keynote speech of Jean-Claude Healy at MIE 2005 (72): “Medicine will change in the next twenty years more than it has changed in the last two hundred years!” and e-health will bring an important contribution to this change.

REFERENCES

Notes: book series “Studies in Healthcare Technology and Informatics” are refered as SHTI and all web sites or web pages are refered as on December 20th, 2013.

1. Pickstone JV. Ways of Knowing. A New History of Science, Technology and Medicine. Manchester Univ. Press, UK, 2000.
2. Van Bemmel JH, Shortliffe EH. Medical Informatics - From Art to Science. In [29], vii-xv.
3. www.efmi.org.
4. www.imia.org.
5. Journal of the American Medical Informatics Association, www.jamia.bmj.com.
6. Journal of Biomedical Informatics, http://www.journals.elsevier.com/journal-of-biomedical-informatics.
7. International Journal of Medical Informatics, http://www.ijmijournal.com/.
8. Methods of Information in Medicine, http://www.schattauer.de/en/magazine/subject-areas/journals-a-z/methods.html.
9. Artificial Intelligence in Medicine, http://www.journals.elsevier.com/artificial-intelligence-in-medicine/.
10. http://www.springer.com/series/684.
11. http://www.iospress.nl/bookserie/studies-in-health-technology-and-informatics/.
12. www.ec.europa.eu/information_society/newsroom.
13. Van Goor JN, Christensen JP (eds). Advances in Medical Informatics - Results of the AIM Exploratory Action. SHTI vol.2, IOS Press, Amsterdam, 1992.
14. Laires MF, Ladeira MJ, Christensen JP (eds). Health in the New Communication Age - Health Care Telematics for the 21st Century. SHTI vol24, IOS Press, Amsterdam, 1995.
15. http://www.ehealthnews.eu/research-and-development/fp6-projects.
16. http://www.ehealthnews.eu/research-and-development/fp7-projects.
17. Wingert F. Medical Informatics. Berlin Heidelberg: Springer Verlag, 1981.
18. Hasman A, Albert A, Wainwright P, Klar R, Sosa M (eds). Education and Training in Health Informatics in Europe. SHTI vol.25. IOS Press, Amsterdam, 1995.

19. Van Bemmel JH, Musen MA. (eds). Handbook of Medical Informatics. Springer Verlag, Heidelberg, 1997.

20. Mantas J (ed). Health and Medical Informatics Education in Europe. SHTI vol.57. IOS Press, Amsterdam, 2000.

21. Mihalas GI, Lungeanu D. Strategy for Medical Informatics Education at the University of Medicine and Pharmacy in Timisoara. Yearbook of Medical Informatics. Schattauer, Stuttgart, 1997.: 113-9.

22. Hasman A, Mantas J, Zarubina T. An Abridged History of Medical Informatics Education in Europe. Acta Inform Med. 2014 Feb; 22(1): 25-36. doi. 10.5455/aim.2014.22.25-36.

23. Van Bemmel JH. People and Ideas in Medical Informatics - A Half-Century Review. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2011: 175-82.

24. Masic I. A Review of Informatics and Medical Informatics History. Acta Informatica Medica, 2007, 15(3): 178-88.

25. Blum BI, Duncan KA. A History of Medical Informatics. ACM Press, USA, 1990.

26. Hayes G, Barnett D (eds). UK Health Computing. Recollections and Reflections. Swindon, UK: BCS, 2008.

27. Stacy RW, Waxman BD (eds). Computers in Biomedical Research, vol.1. Academic Press, New York, 1965.

28. http://www.ifip.org/images/stories/ifip/public/Archive/50thanni/Jubbook.pdf .

29. Salamon R, Blum B, Jorgensen M. (eds). MEDINFO 86. North Holland, Amsterdam, 1986.

30. Peterson HE, Lundin P. Documenting the Use of Computers in Swedish Health Care up to 1980. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2011: 169-74.

31. Van Goor JN, Christensen JP. (eds). Advances in Medical Informatics - Results of the AIM Exploratory Action. SHTI vol.2. IOS Press, Amsterdam, 1992.

32. Halfdan M. The meaning of Health For All by the year 2000. World Health Forum, 1981; 2: 1.

33. Boel A, Willems JL. Building Hospital Computer Network at the University of Leuven. In: Peterson H, Isaksson AI. (eds). Communication Networks in Health Care. North Holland, Amsterdam, 1982, 357-61.

34. CEC DG XIII/F AIM. Data Protection and Confidentiality in Health Informatics. SHTI vol.1. IOS Press, Amsterdam, 1991.

35. Fieschi M. The Development of AI in Medicine and the Research Environment of the SPHINX Project at the Start of the 1980s, IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2012: 153-60.

36. Van Bemmel JH, Gremy F, Zvarova J. (eds.). Diagnostic Strategies and Expert Systems. North Holland, Amsterdam, 1985.

37. Witten M. (ed). Mathematical Models in Medicine. Pergamon Press. New York, 1987.

38. Beneken JEW, Thevenin V. (eds). Advances in Bioengineering. SHTI vol.7. IOS Press, Amsterdam, 1993.

39. Zvárová J. Education in Methodology for Health Care - EuroMISE. Methods of Information in Medicine. 1994; 33: 315-7.

40. Coiera E. Guide to Medical Informatics, the Internet and Telemedicine. Chapman&Hall Medical, London, 1997.

41. Ferrer-Roca O, Sosa-Iudicissa M. (eds). Handbook of Telemedicine. SHTI vol.54. IOS Press, Amsterdam, 1998.

42. Barahona P, Christensen JP. (eds). Knowledge and Decisions in Health Informatics. SHTI vol.12. IOS Press, Amsterdam, 1994.

43. Sosa-Iudicissa M, Olivieri N, Gamboa CA, Roberts J. (eds). Internet, Telematics and Health. SHTI vol.36. IOS Press, Amsterdam, 1997.

44. Van Bemmel JH, Zvarova J. (eds.). Knowledge, Information and Medical Education. North Holland, Amsterdam, 1991.

45. Lun KC, Degoulet P, Piemme T, Rienhoff O. (eds). Medinfo 92. North Holland, Amsterdam, 1992.

46. Brender J, Christensen HI, McNair P. (eds). Medical Informatics Europe '96. SHTI vol.34, IOS Press, Amsterdam, 1996.

47. Richards B, De Glanville H. (eds). Current Perspectives in Health Computing. BJHC Ltd, Weybridge, 1996.

48. Hasman A, Prokosch HU, Dudeck J, Gell G, Engelbrecht R. (eds) Medical Infobahn for Europe. SHTI vol. 77. IOS Press, Amsterdam, 2000.

49. Iakovidis I. A Tribute to Jean-Claude Healy, a Free Thinker and Visionary Leader for Biomedical Informatics. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2008: 16.

50. Iakovidis I, Wilson P, Healy JC. (eds). E-Health. SHTI vol.100. IOS Press, Amsterdam, 2004.

51. Mihalas GI. Analysis of Barriers in Implementation of Health Information Systems. In Blobel B, Pharow P, Nerlich M. (eds). E-Health: Combining Health Telematics, Telemedicine, Biomedical Engineering and Bioinformatics to the Edge. STHI vol.134. IOS Press, Amsterdam, 2008: 21-6.

52. Brender J. Methodology for Assessment of Medical IT-Based Systems. SHTI vol.42,. IOS Press, Amsterdam, 1977.

53. Rogers R, Reardon J. Barriers to a Global Information Society for Health. Recommendations for International Action. SHTI vol.63. IOS Press, Amsterdam, 1999.

54. http://ec.europa.eu/information_society/doc/qualif/health/COM_2004_0356_F_EN_ACTE.pdf.

55. Mihalas GI, Detmer D, Li Yu-Chuan J, Haux R, Blobel B. EFMI Initiatives for Inter-Regional Cooperation - the TrEHRT Project. In: Blobel B, Engelbrecht R, Shifrin M. (eds). Large Scale Projects in e-Health. STHI vol.174. IOS Press, Amsterdam, 2012:3-7.

56. www.vph-noe.eu.

57. Reichert A, Mihalas G, Stoicu-Tivadar L, Schulz S, Engelbrecht R. (eds). Integrating Biomedical Information: From eCell to ePatient. IOS Press, Amsterdam, 2006.

58. www.eurorec.org/RD.

59. Li Yu-Chuan J, Detmer DE, Shabbir SA, Nbuyen PA, Jian WS, Mihalas GI, Shortliffe EH, Tang P, Haux R, Kimura M. A global travelers' electronic health record template standard for personal health records. JAMIA. 2011. doi:10.1136/amiajnl-2011-000323.

60. Mihalas GI, Saka O, Blobel B, Gulkesen K, Mazzoleni C, Pharow P. (eds). Travel Health Informatics and Telehealth. Ed. Victor Babes, Timisoara, 2009.

61. Paiva T, Penzel T. (eds). European Neurological Network. SHTI vol.78. IOS Press, Amsterdam, 2000.

62. Solomonides T, McClatchey R, Breton V, Legre Y, Norager S. (eds). From Grid to Healthgrid. SHTI vol.112. IOS Press, Amsterdam, 2005.

63. Istepanian R, Laxminarayan S, Pattichis CS. (eds). M-Health: Emerging Mobile Health Systems. Springer, New York, 2005.

64. Blobel B, Pharow P, Sousa F. (eds). pHealth 2012. SHTI vol. 177. IOS Press, Amsterdam, 2012.

65. www.ehgi.eu.

66. http://ec.europa.eu/digital-agenda/en/news/ehealth-action-plan-2012-2020-innovative-healthcare-21st-century.

67. www.mckinsey.com/insights/health_systems_and_services/the_big-data_revolution_in_us_health_care.

68. Shimrat O. Cloud Computing and Healthcare. San Diego Physician.org, April 2009: 26-9.

69. http://www.loc.gov/aba/.

70. http://infohistory.rutgers.edu/mediawiki/index.php/.

71. Lehmann CU, Ammenwerth E, Nohr C. (eds). MEDINFO 2013. SHTI vol. 192. IOS Press, Amsterdam, 2013.

72. Engelbrecht R, Geissbuhler A, Lovis C, Mihalas GI. (eds). Connecting Medical Informatics and Bioinformatics. SHTI vol.116. IOS Press, Amsterdam, 2008.

11

Izet Masic

HISTORICAL BACKGROUND OF EFMI IN DEVELOPMENT OF MEDICAL INFORMATICS

Historical facts in this article reflect on the development of the discipline of Medical/ Health informatics that is now part of all medical disciplines and part of the medical practice of all health professionals. Applications of computer and information technologies in all segments of society and knowledge of information technology is now part of general literacy (1).

The classical way to present a "history" is to list major events in chronological order, with more or less detailed comments about the persons, ideas or events. A distinction between periods brings a systematization flavor, easing the comments. The development of medical informatics began in the 1950's of 20th century, when the earliest reference to applications of electronic digital computers in medicine appeared.

During that period, new terms were born: medical computer science, computer medicine, medical electronic data processing, medical automatic data processing, medical information processing, medical information science, medical software engineering and medical computer technology. Most of these terms were interchangeable, such as medical computer science for medical information science, etc.

George Mihalas at Prague Conference about History of Medical Informatics (MI) in April 2013 proposed the following stages in the development of Medical Informatics (2):

*This text is republished with permission of the journal Acta Inform Med. 2021; 29(2): 141-147. doi: 10.5455/aim.2021.29.141-147.
Publisher: © Avicena, Sarajevo, Mis Irbina 11, 71000 Sarajevo, B&H. Some parts are corrected and edited by Editor of this book.

Figure 1. Panelists at MIE '79, Berlin, FR Germany, 1979: John Anderson, Francis Roger France, Klaus Peter Adlassnig, Jochen R. Moehr, Gjuro Dezelic (from left to right)

a) **Early-stage Medical Informatics (MI):** (up to ~1975): pioneering work of scientists, major work on signal analysis, laboratory applications, the first attempt on decision support, databases, modeling and simulation of biological processes, biostatistics;

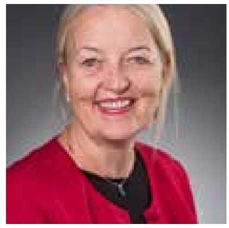
b) **Childhood / youth of MI (1975 -1990):** founding national and international organizations, conferences, attempts to systematize major areas of MI, first specialized schools, development of methodologies, patient records, health information systems (HIS), advanced decision support–expert systems;

c) **Consolidation of MI (1990-2000):** MI consolidates its position as an independent discipline. It becomes clear that the object of study is medical information (not computer applications); implementation of hospital information systems (HIS), and new chapters (imaging, telemedicine). Substantial funding for e-health research is allocated, the complexity of EHR becomes more visible, including confidentiality, data protection, standards etc.;

d) **Maturity of MI (2000-2010):** a clearer understanding of e-health potential to address major challenges of present healthcare, internet impact on medical applications; involvement of politicians, an extension of regional/national projects, e-health as a business, patient-centered MI, new keywords: integration, interoperability, consumer informatics; awareness on difficulties in the real implementation of HIS, "failures" reported; analysis of "barriers", quality assessment, the clear contour of sub-disciplines: bioinformatics, neuroinformatics, Virtual Physiological Human, etc.


Lacramioara_Stoicu-Tivadar (2019-2020), (Romania)


2017-2018: Christian Lovis (Switzerland)


2015-2016: Anne Moen (Norway)


2013 – 2014: Patrick Weber (Switzerland)

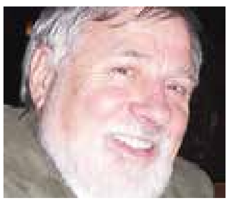

2011 – 2012: John Mantas (Greece)


2009 – 2010: Jacob Hofdijk (The Netherlands)


2006 – 2008: George Mihalas (Romania)


2004 – 2005: Robert Baud (Switzerland)


2002 – 2003: Assa Reichert (Israel)


2000 – 2002: Rolf Engelbrecht (Germany)


1998 – 1999: Attila Naszlady (Hungary)


1996 – 1997: Jean-Raoul Scherrer (Switzerland)


1994 – 1995: John Briant (United Kingdom)


1993: Rolf Hansen (Norway)


1991 – 1992: Stellan Bengtsson (Sweden)


1987 – 1990: Rory O'Moore (Ireland)


1984 – 1986: Francis Roger France (Belgium)


1981 – 1983: Barry Barber (United Kingdom)


1977 – 1981: Peter L. Reichertz (Germany)


1976 – 1977: Antoine Remond (France)

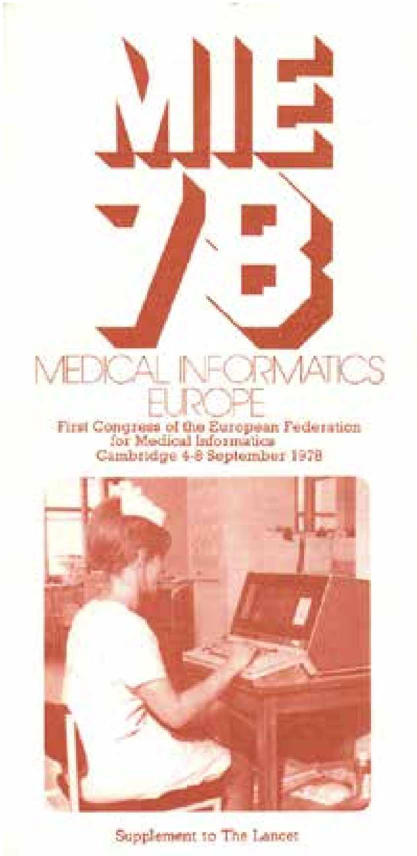


Figure 3. Poster of MIE ‘78, Cambridge, UK, 1978

e) **Full integration of MI in Medicine and Healthcare (2010-2020):** focus on user acceptance, a generalization of EHR/EMR, inclusion in HIS, vertical integration data (molecular/cellular/genetic up to organ/system and whole body, horizontal integration (primary care, specialized ambulatory, and hospital data), full interoperability, patient empowerment, visible steps towards “personalized medicine”, increase patient safety, preventive medicine, use of portable devices, home monitoring systems, Tele-assistance, intensive use of web facilities.

Until the creation of IFIP-TC4 (later IMIA) in 1967 and EFMI in 1976, theoretical and practical aspects of MI developed fast, presenting results in the beginning in scientific and professional journals of a predominantly interdisciplinary character, and later in dedicated MI journals (3-5).

In this period conferences with MI contents were organized mostly either under the umbrella of “parent” societies (e.g. general computer or specialized health documentation and statistics/epidemiology societies) or under organization of particular groups and associations of people engaged in MI, research and development of MI applications. In scientifically and technologically strong countries (e.g. in France, Germany, U.K., U.S.A.), but also in other countries, such conferences were organized predominantly as national events. International interaction at such events was rather sporadic.

First international acceptance came from the International Federation for Information Processing (IFIP), an organization formed under the patronage of UNESCO. In 1967 François Grémy (the first IMIA president) initiated the IFIP-TC4 on MI gathering medical informaticians, especially from Europe and triggered organization of national MI societies. IFIP-TC4 was perceived as a Federation of National Societies, thus reflecting the spirit of international cooperation among nations in education, science and culture. This federative thinking was transfered to EFMI.

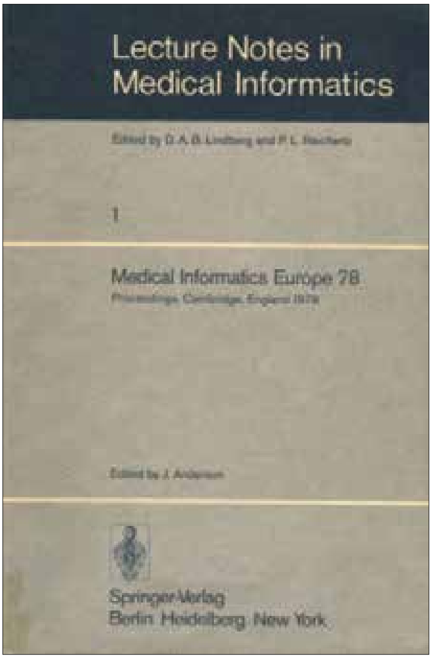


Figure 4. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

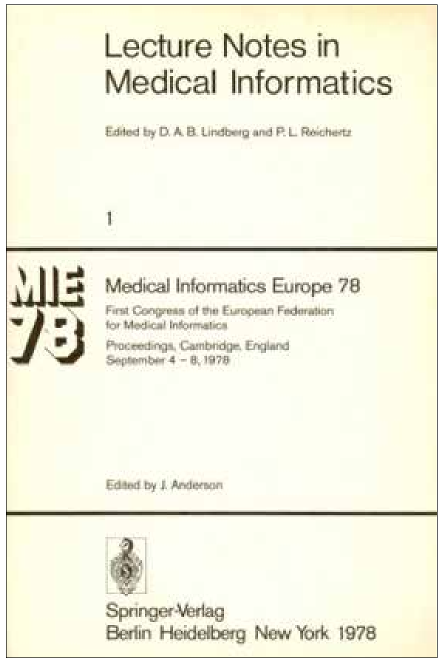


Figure 5. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

By establishing IFIP-TC4 on MI, Grémy was the first to add the adjective "medical" to the new term "informatics". Under his chairmanship several TC4 working groups were initiated, organizing meetings on information processing of medical records, education in MI, decision making and data protection. Earlier, in 1966, Grémy had initiated at the Faculté de Médicine of the Université de Paris, as professor of the Centre de calcul et de statistique, with a curriculum on information processing by computers.

Development of Medical informatics was also strongly pushed forward in Germany by Peter Leo Reichertz, who started in the beginning of the 1970's a series of MI conferences in Hannover. Reichertz founded the Department of Biometrics and Medical Informatics at the Medizinische Hochschule Hannover (MHH) and became first professor of Medical Informatics at MHH. Initially, Reichertz established the German Society for Medical Documentation and Statistics, now named "Deutsche Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie e.V. (GMDS)". Together with Grémy, Reichertz deserves credit for the spread of the term "Medical Informatics" all over the world.

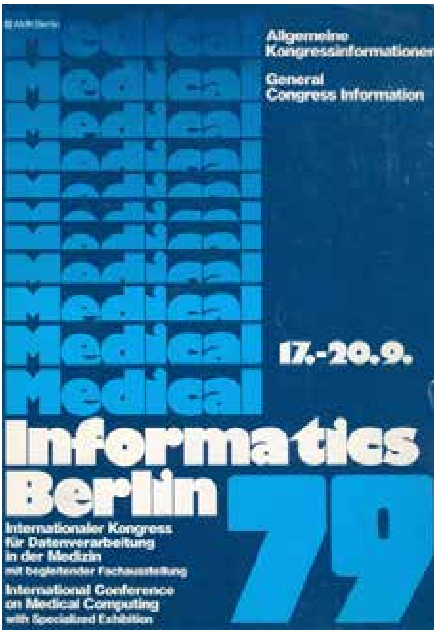


Figure 6. Cover page of Proceeding of MIE '79, Berlin, FR Germany 1979

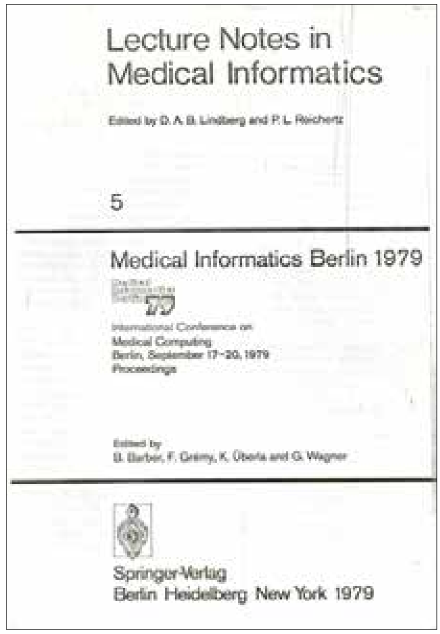


Figure 7. Cover page of Proceeding of MIE '79, Berlin, FR Germany, 1979

ESTABLISHMENT OF EFMI AND IMIA

The first World Congress of Medical Informatics/MEDINFO was organized by IF-IP-TC4 in Stockholm, 1974 (SPC Chair: John Anderson). The success of the congresss triggered the initiative of establishing an association of national MI societies in Europe. On September 10-11, 1976 in Copenhagen at the Office for Europe of the World Health Organization, hosted by M. Sedeuilh and Albert Weber, representatives of ten national MI societies (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Holland), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) adopted the statutes of new European Medical Informatics Assocation, - EFMI. Officers on the first EFMI Executive board were Antoine Remond (France), as a chairman, Barry Barber (UK), as secretary and Peter Leo Reichertz (FR Germany), as treasurer (1, 2). The History of EFMI has been described in my books published during the last 10 years, and in books and papers of other authors, some available in Researchgate and Academia.edu for those intersted in more details (4-6).

IFIP-TC4 followed this trend and evolved in 1979 from a IFIP Technical Commitee to the independent International Medical Informatics Association (IMIA).

Figure 8. Participants of MIE '88, Oslo, Norway: Jan van Bemmel, Bjarte G. Solheim, Jaap Noothoven van Goor, Gjuro Dezelic, Nada Dezelic, Barry Barber, Maureen Scholes, Angelo Serio, Francis Roger (from left to right)

Today EFMI is the leading nonprofit organization in biomedical and health informatics in Europe. EFMI comprises 28 national societies and includes an exceptional network of experts and stakeholders in health, care, IT and its societal dimensions; supported by 14 topic working groups ranging from human factors, to security and translational health informatics. EFMI has two governing bodies: EFMI Executive Board (President, Vice-President WGs, Vice-President IMIA, Secretary, Treasurer, Executive officer, Publication officer, Institutional members officer) and the EFMI Council. Council members represent national societies and WGs. **EFMI Publications**

Currently, EFMI has three officially endorsed general journals, Methods of Information in Medicine, International Journal of Medical Informatics and Acta Informatica Medica. The most important EFMI publication, indexed in Medline, is Studies in Health Technology and Informatics, which publishes papers presented at MIE Conferences. EFMI also publishes several sub-specialty official journals covering the spectrum of medical informatics subdisciplines.

Through its work, EFMI provides leadership and expertise to the multidisciplinary, health IT community and to policy makers, enables the transformation of healthcare in accord with the world-wide vision of improving the health of the world population. EFMI is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large.

Figure 9. Participants of MIE ‘90, Glasgow, Scotland: Miroslav Madjaric, Silvije Vuletic, Josipa Kern, Izet Masic, Visnja Lovrek, Gjuro Dezelic, Rajko Vukasinovic (from left to right)

MEDICAL INFORMATICS EUROPE

To advance its mission, EFMI started organizing the Medical Informatics Europe Congress (MIE) in 1978. So far 29 MIEs have been organized by EFMI: Cambridge (1978), Berlin (1979), Toulouse (1981), Dublin (1982), Brussels (1984), Helsinki (1985), Rome (1987), Oslo (1988), Glasgow (1990), Vienna (1991), Jerusalem (1993), Lisbon (1994), Copenhagen (1996), Thessaloniki (1997), Ljubljana (1999), Hanover (2000), Budapest (2002), Saint Malo (2003), Geneva (2005), Maastricht (2006), Gothenburg (2008), Sarajevo (2009), Oslo (2011), Pisa (2012), Istanbul (2014), Madrid (2015), Munich (2016), Manchester (2017), Gothenburg (2018) Geneva (2020) was cancelled due to the COVID-19 pandemic.

SPECIAL TOPIC CONFERENCES

EFMI Special Topic Conferences (STC) are typically 2-day events organized by member societies with 100+ participants in conjunction with their annual meeting, on a topic defined by the member society, and relevant EFMI Working groups are engaged for the content. EFMI Council and Board meetings are hosted by the STC. Past STC conferences took place in: Bucharest (2001), Nicosia (2002), Rome (2003), Munich (2004), Athens (2005), Timisoara (2006), Brijuni (2007), London (2008), Antalya (2009), Reykjavik (2010), Lasko (2011), Moscow (2012), Prague (2013), Budapest (2014), Paris (2016), Tel Aviv (2017), Zagreb (2018). STC2020 is planned to be organized by the Finnish society.

Figure 10. EFMI Council meeting during MIE '96, Copenhagen, Denmark

FIRST MEDICAL INFORMATICS EUROPE CONGRESS, CAMBRIDGE '78

In a rather short time after it was established, EFMI succeeded to launch its first big meeting - MIE '78 in Cambridge, organized by the Medical Specialist Group of the British Computer Society. In 1978, EFMI consisted of 12 constituent societies. John Anderson, an esteemed expert in medical data processing education, edited the Proceedings of MIE '78. The MIE '78 Proceedings contains 80 papers: a) Papers from 11 EFMI member countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, UK; b) Papers from 3 non-EFMI member European countries (4): Czechoslovakia (1), E. Germany (1), Poland (2); c) Papers from 3 non-European countries (6): Canada (1), Japan (1), USA (4); d) Paper with the address: WHO (1).

The MIE '78 conference program covered 19 topics: Medical records, Text processing, General practice, Image processing, Informatics technologies, Medical decision making, Training in Medical informatics, Implementation and user education, Modelling, Data bases, Clinical laboratories, Signal processing, Health care planning, Transferability, Treatment, Special interest papers, Evaluation, Nursing, Indexing and administrative systems.

John Anderson in his welcome noted: "*Medical informatics has established itself as an important area of medical activity and its growing application, as this conference illustrates, suggests a very rich potential for the future. Sociological changes have taken place to meet this challenge and developments in the issues of privacy and confidentiality are important, as also are user education, and the teaching of medical informatics to medical students and to doctors. Inevitably these changes illustrate that medical informatics has already had a significant impact on medical teaching and training as well as in the relationship of medicine to society.*" (3).

Figure 11. Participants of MIE '09 Conference in Sarajevo, Bosnia and Herzegovina: Michael Shifrin, John Mantas, Jana Zvarova, Assa Reichert, Jacob Hofdijk, Reinhold Haux (the first row, from left to right)

COPENHAGEN, MIE '96 - CELEBRATING 20 YEARS OF EFMI

The 13th MIE, in Copenhagen, on August 19-22, 1996 celebrated 20 years of EFMI and the 30th Anniversary of the Danish Society for Medical Informatics. MIE '96 was chaired by Prof Peter McNair and was main Medical informatics and Telematics event in 1996. Motto of MIE '96 Congress was *"Human facets in information technologies" with intention "that leading people in the field of Medical informatics will explore its role in the new Information Society and highlight user requirements and be presented with the capabilities".* Total amount of 224 papers were selected from 309 submissions, a clear sign of the popularity of MI research topics. The reviewing procedure by independent and impartial referees was extended by introducing 5 five selection criteria: (1) significance to medical informatics, healthcare and/or medicine, (2) quality of scientific and/or technical content, (3) originality and innovativeness, (4) references to related prior work, and (5) organization and clarity of presentation. The editors of MIE '96 Proceeding, Jytte Brender (Denmark, Chief Editor), Jean-Raoul Scherrer (Switzerland), Jens Pihlkjaer Christensen (Belgium) and Peter McNair (Denmark), pointed out: *"It was amazing that we could find little reuse of the topics from the previous MIE and MED-INFO Congresses, indicating that medical informatics is a discipline in a process of change."* (3).

Figure 12. Celebration of successful organized of the MIE ‘09 in Sarajevo.Hotel Holiday Inn, Sarajevo, September 2nd, 2009: Jacob Hofdijk (EFMI President), Petter Hurlen, Izet Masic (LOC Chair), Bernd Blobel, Marianna Diomidous, Klasus Peter Adlassnig (SPC Chair), Andrea Reppelsberger, John Mantas (from left to right)

Figure 13. EFMI Council dinner during MIE ‘14 Conference (at Bosporus, the Strait of Istanbul), Istanbul, Turkey, August 30th, 2014

MIE ‘09 SARAJEVO, B&H

In Sarajevo, on August 30 to September 2, 2009, MIE ‘09 celebrated twenty years of the Society for Medical Informatics of B&H, and was, chaired by Prof. Izet Masic. The proceedings of MIE ‘09, edited by Klaus Peter Adlassnig, Bernd Blobel, John Mantas and Izet Masic showed how much Medical Informatics progressed and changed since 1996. As Izet Masic, pointed during Opening speech *“In more than a decade we are witnesses of rapid changes in social development, in which information and communication technologies (ICT) play an important role. The modern society at the transition from the second into the third millennium, frequently labeled as “information society”, is asking for a* *new way of information thinking and working in all fields of human activity, and consequently in medicine and healthcare. Among new ICT, like mobile phones, fax, TV teletext, etc., the Internet plays the most important role. This ICT, using net resources all over the world, the World Wide Web (WWW or Web), expanded the transfer of information in all spheres of human activity, provoking a state described often as "Web-pandemic"* (1). This kind of change was already noted at previous MIE congresses. In the preface to the Proceedings of 17th MIE Congress, held in Budapest 2002, Rolf Engelbrecht, György Surján and Peter McNair noted that the impact of the Internet is comparable to Gutenberg´s invention of printing technology, accelerating by an order of magnitude the communication of information.We were eager to see at MIE '09 in Sarajevo how far we came after seven years. *"But technological changes was only a part of the progress and change. We should always have in mind that technology should be man´s servant and not a master"* said Masic. He explained the MIE '09 motto *"Medical Informatics in a United and Healthy Europe"*, Izet said: *"the motto: incorporates the role of MI as a scientific, technological, philosophical, and medical discipline, and raises the question as to whether and to what extend MI is contributing to a new scientific, cultural, social and political community in Europe."* Prof Izet Masic also called attention to *"the expansion of technological power raises the need for ethical responsibility and the preservation and promotion of human health"* (1).

Figure 14. Poster of 22nd MIE '09 Conference, Sarajevo, 2009

Along the same lines at Opening Ceremony, professor Gjuro Dezelic said "*the result of MIE '09 will be a contribution to the advance of human health in Europe streaming to unity*".

Reflecting on the development of MI in former Yugoslav countries and the South-European region, he said that the influence of MIE Congresses has been very strong (3). He recalled that the first opportunity to establish links with EFMI was the MIE '78 Congress in Cambridge. Dezelic was invited to attend the EFMI Council meetings as an unofficial observer from Yugoslavia. Then, he presented on his eight-year experience of teaching MI to medical students on an MIE '79 panel in Berlin, at a time when very few medical schools worldwide included MI in their curriculum. In 1987, Dezelic got the mandate to officially represent Yugoslavia to EFMI in the observer status. As a result, Gjuro Dezelic, Rajko Vukasinovic and Izet Masic represented the Yugoslav Association of Medical Informatics (YAMI) at MIE ‘90 in Glasgow, chaired by Prof. John Bryden. MIE Congresses had strong influence to the development of Medical informatics in former Yugoslavia and the establishment of the YAMI (1, 3, 6).

MIE ‘09 hosted also the BHSMI Special Track and EUROREC Conference 2009. Thr proceedings of MIE ‘09 (8) contains 213 contributions - 150 full papers, 21 student papers, 21 poster articles and 14 workshop descriptions. The Proceedings of MIE ‘09 included papers from 9 invited speakers: Gjuro Dezelic: “After Three Decades of Medical Informatics Europe Congresses”; Gerard Comyn: “EU eHealth Agenda Strengthening Research and Innovation”; William Edward Hammond: “Realizing the Potential of Healthcare Information Technology to Enhance Global Health”; Rolf Ewers: “Augmented Reality and Telenavigation in Cranio and Maxillophacial and Oral Surgery”; Mordechai Shani: “The Use of ICT in the Delivery of Healthcare Services to the Chronic Patient”; Reinhold Haux: “Health Enabling Technologies for Pervasive Health Care: a Pivotal Field for Future Medical Informatics Research and Education”; Andrew Ballas: “Interoperative Electronic Patient Records for Health Care Improvement”; Blackford Middleton: “Clinical Decision Support” and Sylwia Miksch: “Computer Based Medical Guidelines and Practice: Current Trends”.

The great variety of scientific topics and countries that were presented, made MIE ‘09 Conference in Sarajevo a huge success and a fruitful study of proceedings by those interested in MI.

In retrospect, the MIE congresses has always been a great motivation for medical informaticians, both scientists and health professionals. They are recognizing them as places most favorable for the presentation of own work, for exchange of ideas with colleagues and for learning what is new in Medical informatics in Europe and the world.

REFERENCES

1. Masic I, Mihalas G. (Eds.) et al.. Contributions to the History of Medical informatics. Avicena, Sarajevo, 2014: 439 pp. ISBN: 978-9958-720-56-7.
2. Masic I. Biographical Lexicon of Medical Informatics. Avicena. Sarajevo, 2017: 546 pp. ISBN: 978-9958-720-62-8.
3. Dezelic G. After three decades of Medical Informatics Europe congresses. Stud Health Technol Inform. 2009; 150: 3-7.
4. Mihalas G, Zvarova J, Kulikowski C, Ball M. et al. History of Medical informatics in Europe - a short review by different approach. Acta Inform Med. 2014 Feb; 22(1): 6-10.

5. Zvarova J, Masic I. Medical informatics - an interdisciplinary approach. Med Arh. 1996; 50(3-4): 107-109.

6. Masic I, Novo A. History of Medical informatics in Bosnia and Herzegovina. Acta Inform Med. 2007; 15(1): 49-61.

7. Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2017: 50: pp. ISBN: 978-9958-720-64-2.

8. Adlassnig KP, Blobel B, Mantas J, Masic I. (Eds). Medical Informatics in a United and Healthy Europe. Proceedings of MIE 2009. IOS Press. Amsterdam, 2009: pp. 1064.

12

Izet Masic

THIRTY YEARS ANNIVERSARY OF THE BIOMEDICAL INFORMATICS JOURNAL "ACTA INFORMATICA MEDICA" - 1993-2022

Acta Informatica Medica (www.actainformmed.org) is a peer-reviewed, open access journal which publish original articles, professional articles, reviews, viewpoints, and case studies, short communications and the Letters to editors (1-4). Acta covering issues in Biomedical and Medical/Health informatics, published by the Academy of Medical Sciences of Bosnia and Herzegovina (www.amn.ba) Journal is registered in National and University Library of Bosnia and Herzgovina in Sarajevo City with ISSN (Online): 1986-5988, and ISSN (Print): 0353-8109. An International Standard Serial Number (ISSN) is a unique code of 8 digits. It is used for the recognition of journals, newspapers, periodicals, and magazines in all kind of forms, be it print-media or electronic.

Issues are published quarterly: in March, June, September, and December. In case when Editorial Board received enough papers during one year, it is possible to print additional issue as special issue of supplement.

Specific scope of interests of the journal relates to System and System analysis, Medical documentation, Electronic health records, Clinical Decision Making, Artificial intelligence, Expert systems, Science editing, E-learning in medicine, On-line biomedical databases, Information and Communication technologies, Health information systems, Science editing and publishing. Evidence-based articles reflecting progress

*This text is republished with permission of the journal Acta Inform Med. 2022; 30(1): 4-10. doi: 10.5455/aim.2022.30.4-10. Publisher: © Avicena, Sarajevo, Mis Irbina 11, 71000 Sarajevo, B&H. Some parts are corrected and edited by Editor of this book.

Figure 1. Founder Editors of Acta Informatica Medica journal in 1993 - Izet Masic and Zoran Ridjanovic

Figure 2. Editorial team of Acta Informatica Medica in 1994 (Izet Masic, Amra Redzepovic, Ljubomir Kravec)

Figure 3. Editor-in-Chief Izet Masic promoted Acta Informatica Medica journal ("Ratna izdanja - War's editions" in 1994) at Book's Exibition in Sarajevo, 1994.

Figure 4. His Excelency, Ambasador of Austria, Franz Bogen, who supported us in 1994. Photo made at Office of prof. Masic, during wartime in Bosnia and Herzegovina (1992-1995)

of Medical informatics in Balkan and Mediterranean countries are prioritized (1, 2). Acta Informatica Medica journal has been founded in the year 1993 by Izet Masic and Zoran Ridjanovic, as official journal of Bosnian-Herzegovinan Society of Medical Informatics (BHSMI). The first Editorial Board perform: Irfan Zulic, Mustafa Kulenovic, Kenan Arnautovic, Besim Prnjavorac, Nedzad Mehic, Haris Pandza, Marijan Dover, Ljubomir Kravec, Amra Redzepovic, Mediha Zalihic) (Figures 1-4) (1).

In the year 2019 Acta Informatica Medica journal has been accepted as official journal of the European Federation for Medical Informatics (www.efmi.org), besides 3 other journals: International Journal of Medical Informatics, Methods of Information in Medicine and European Journal of Biomedical Informatics. Journal Acta Informatica Medica is abstracted and indexed in 30 on-line data bases, including Pubmed, Pubmed Central, Scopus, Embase, Hinari, etc. The website of the journal (www.actainformmed.org) is refreshed in 2018, revised by Editorial Board and new members were included (regularly updated). The authors of the published articles in 2021 issues are from 22 countries (Bosnia and Herzegovina, Croatia, Cyprus, Germany, Grece, Iraq, India, Indonesia, Italy, Jordan, Republic Kosovo, North Macedonia, Norway, Poland, Saudi Arabia, Serbia, Slovenia, Sweden, Ukraine, United Arab Emirates, USA, and Vietnam). Acceptance rate in 2021 was 42.3% (Table 1).

The journal in its function and everyday work is following the recommendations and guidelines of ICJME, COPE, EASE, WAME, etc. as well as the recommendations of “Sarajevo Declaration on Integrity and Visibility of Scholarly Journals”, accepted by 17 Editors of biomedical journals which are printed in the countries in South-Eastern Europe at “SWEP 2018” Conference held in Sarajevo (5-9).

The journal supports, and had its presentations at conferences held in Bosnia and Herzegovina. The abstract papers presented at “The Mediterranean Seminar on Science Writing, Editing and Publishing“ – “SWEP 2016”, “SWEP 2018”; “SWEP 2020” and “SWEP 2021”, also found its place in the journal, by which we met our goal of promoting science and scientific publication at the area of Bosnia and Herzegovina and other countries in the region, and in the Mediterranean countries (9).

Acta Informatica Medica is one of the six biomedical journals from Bosnia and Herzegovina deposited in databases Pubmed (in addition to the Bosnian Journal of Basic Medical Sciences, Medical Archives, Materia Socio-Medica, Medicinski Glasnik (Zenica), Acta Medica Academica), and Scopus (besides the Bosnian Journal of Basic Medical Sciences, Medical Archives, Acta Medica Academica, Medicinski Glasnik, Acta Medica Saliniana, Folia Medica and Journal of Health Studies) (3). The purpose of the journal is to continue the publishing of both–its online and print edition, four times a year. The journal in its function and everyday work is Importance of Acta Informatica Medica journal in spreading of Biomedical informatics knowledge and experiences in scientific and academic community. The journal began with the practice to publish the articles of PhD students free of charge, and in that manner opened to this population, and began with the practice of populating biomedical information technology, both in Bosnia and Herzegovina and in the region. The journal opened to PhD students, and they embrace it through the official letter to the Editor, presenting their goals and problems. The tendency for the future is to preserve the Open Access model, while enabling funding through the subscription and purchase of printed publications.

INFOMETRICS OF THE JOURNAL IN THE PAST

Acta Informatica Medica is a journal covering the technologies/fields/categories related to Medicine (miscellaneous) (Q3). It is published by Avicena Publishing in Sarajevo. SCImago Journal Rank is an indicator, which measures the scientific influence of journals (10-12). It considers the number of citations received by a journal and the importance of the journals from where these citations come.

Year	Rate (%)
2012	43.0
2013	47.0
2014	39.0
2015	37.0
2016	37.3
2017	28.7
2018	32.7
2019	37,8
2020	42,3

Table 1. Acceptance rate of Acta Informatica Medica in the period 2012-2020

SJR acts as an alternative to the Journal Impact Factor (or an average number of citations received in last 2 years). This journal has an h-index of 24. The best quartile for this journal is Q3. According infometric statistics for the last ten years - 2013-2022, we can stated great improvement: Scimagojr.com Index H (for 2017) for Acta Informatica Medica was 12, while scimagojr.com index (SJR) was 0.275 (2). On the aforementioned page, the total number of citations from the journal Acta Informatica Medica was 187 (it should be noted that the number is only from the journals that are covered by Scopus). Self-citation (the number of citations from a journal citing article to articles published by the same journal) was 7.

Publication Title	Author Listing
17th International Conference on Informatics, Management and Technology in Health Care, Athens, Greece, 5-7 July, 2019	Izet Masic
A Fuzzy Expert System to Predict the Risk of Postpartum Hemorrhage	Yussriya Hanaa Doomah · Song-Yuan Xu · Li-Xia Cao · Sheng-Lian Liang · Gloria Francisca Nuer-Allornuvor · Xiao-Yan Ying
A Review of Machine Learning Approaches in Assisted Reproductive Technologies	Behnaz Raef · Reza Ferdousi
Adoption of Hospital Information System Among Nurses: a Technology Acceptance Model Approach	Hosein Barzekar · Farzad Ebrahimzadeh · Jake Luo · Mahtab Karami · Zahra Robati · Parvin Goodarzi
An Assessment of Health Information Systems Through the Perspective of Computer Engineering Students and Medical Students	Esra Sevimli · Elif Naz Altingoz · Nur Oisman Kitapci · Okan Cem Kitapci · Leyla Koksal · Meral Yay · Pınar Kilic Aksu · Gonca Mumcu

Table 2. Highly Cited Articles in Acta Informatica Medica Journal during period from 1993 Until 2020 (Top Five - High Impact Research Articles)

Year	Impact Score (IS)
2021/2022	Coming Soon
2020	1.50
2019	0.72
2018	0.86
2017	0.70
2016	0.84
2015	0.59
2014	0.76

Table 3. Acta Informatica Medica Impact Score 2020

For the period 2013-2017, the Google Scholar h5 index was 17 and the h5 median was the 28. For the year 2020, the overall rank of Acta Informatica Medica is 15980. According to SCImago Journal Rank (SJR), this journal is ranked 0.267 (Figures 9 and 10). Journal Impact IF Ranking: In the Medicine (all) research field, the Quartile of Acta Informatica Medica is Q2. Acta Informatica Medica has been ranked: Highest Impact Factor for 2011–2022 was 1.496 and Lowest Impact Factor for 2011–2022 was 0.59 (11).

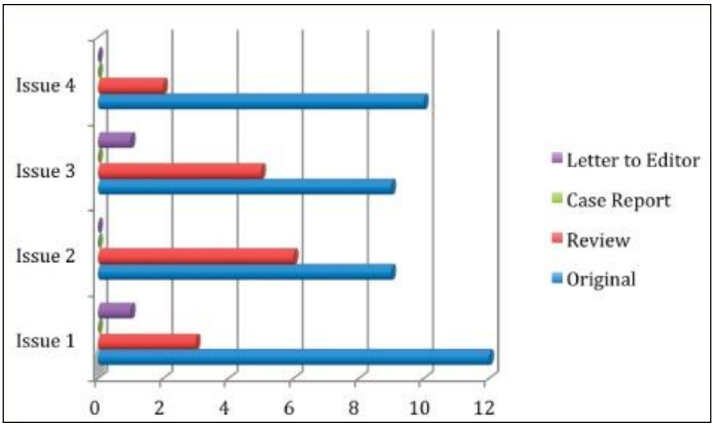


Figure 5. Distribution of articles according to type in the year 2020

During the year 2021 in Acta Informatica Medica journal was published 46 papers. From total amount published papers, 67,39% was original papers, where it was more published original papers in the journal than in the year 2020. In the year 2021 in Acta was published: 1 editorial, 31 original paper, 1 professional paper, 1 systematic review, 5 reviews, 2 case reoports, 1 dilemma, 1 the letter to editor, 2 obituaries, 1 newsletter. (Table 2 and Figure 5).

Acta Informatica Medica journal has next Important Metrics values for 2021 (last updated on November 16, 2021): Impact Score is 1.50, h-Index is 24, Rank is 15980, SJR is 0.267 (Figures 9-10). The impact score shown here is equivalent to the average number of times documents published in a journal/conference in the past two years have been cited in the current year (i.e., Cites / Doc. (2 years)). It is based on Scopus data and can be a little higher or different compared to the impact factor (IF) produced by Journal Citation Report of Thomson Reuters metrics.

The impact score (IS) 2020 of Acta Informatica Medica is 1.50, which is computed in 2021 as per its definition (Figures 9 and 10). Acta Informatica Medica IS is increased by a factor of 0.78 and approximate percentage change is 108.33% when

Figure 6. Cover page of the first issue of Acta Informatica Medica in 1993

compared to preceding year 2019, which shows a rising trend. The impact score (IS), also denoted as Journal impact score (JIS), of an academic journal is a measure of the yearly average number of citations to recent articles published in that journal. Acta Informatica Medica has an h-index of 24. It means 20 articles of this journal have more than 20 number of citations. The h-index is a way of measuring the productivity and citation impact of the publications. The h-index is defined as the maximum value of h such that the given journal/author has published h papers that have each been cited at least h number of times (10-12).

Presented facts above are based on Scopus data - Acta Informatica Medica journal coverage history is as following: 2012-2020. Also, on Figures 7 and 8 are shown Impressum of the journal with a few cover pages published in the past and one of ilustrative contents regarding EFMI 45th anniversary in 2021 (13-15).

ACTA INFORMATICA MEDICA JOURNAL STATISTICS

Journal statistics is calculated for the period of online presence on journal platform ejmanager and scopemed/bibliomed (5, 10-12). During the past Acta Informatica Medica journal was printed more tham 70 isues. Unitl Decembr 2021 via eJManager platform was 1,743 submitted articles. This number represents total of number of submitted articles. During the Acta’s online presence – currently six years–there have more than 1,700 submitted articles from authors all of around the world. Out of this number was 772 published articles. Acta Informatica Medica maintain usual peer-review process for selecting publishing articles. During online presence our meticulous selecting process leads to choosing more than 700 articles for publishing in last six years. Until now 389,923 total downloads. Total downloads includes statistics from our journal publishing platform ejmanager. It includes articles that are downloaded and read during the last six years of our online presence on current platform.

CONCLUSION

Acta Informatica Medica journal, as Biomedical Informatics journal, during past 30 years of existing played important role in distribution of knowledge and experiences within this scientific field, by publishing contributions of the biomedical experts from worlwide. This scientific journal, during the past 30 years of existing, played great role in spreading of Medical informatics knowledge and experience within scientific and academic community.

acta informatica medica

JOURNAL OF THE SOCIETY FOR MEDICAL INFORMATICS OF B&H

Background of DMIB&H and AIM

Web address: www.imasic.org/bh-

The Society of Medical Informatics of Bosnia and Herzegovina (DMI B&H) was founded 1988, as member of former Yugoslavian Association of Medical Informatics, founded also in 1988, and member of EFMI in 1990. The Society has now over 100 members. The Society become member of EFMI in 1994 (EFMI Council in Lisbon), and member of IMIA in 1994 (General Assembly in Dresden).

The Society carries out the following activities:

- Promotion and improvement of informatics within the health-care system, health insurance and bio-medical research,
- Engagement of experts in the field of medical informatics in B&H on development and establishment of health care information systems,
- Assistance in research, development and professional work in the field of medical informatics in B&H,
- Distribution and development of technical information in the field of medical informatics in B&H,
- Assistance in education of medical informatics experts,
- Exchange of professional experience on national and international level,
- Publishing activities in the field of medical informatics.

Acta Informatica Medica (AIM) is official journal of the Society for medical informatics of Bosnia and Herzegovina, founded in 1993. Journal discusses the basic methodology within field of medical informatics, like: fundamentals of processing data, information and data base knowledge, classification systems in medicine, health information systems, using of information technologies in health care systems, etc. It publishes original papers, professional papers, reviews, case reports, news, etc.

Prof Izet Masic, MD, PhD,
Editor-In-Chief

Figure 7. Impressum of Acta Informatica Medica journal a few years ago, with cover pages of different issues (3)

REFERENCES

1. Mašić I, Riđanović Z. Zašto časopis iz Medicinske informatike?/Why journal of Medical Informatics? Acta Inform Med, 1993; 1(1): 3-5.
2. Cerić O, Mašić I, Novo A. Metaanaliza časopisa Acta Informatica Medica/Meta-analysis of Acta Informatica Medica journal. Acta Inform Med. 2006; 14(3): 167-168.
3. Masic I. Fifteen years of Journal Acta Informatica Medica. Acta Inform Med. 2007; 15(2): 67-68.
4. Masic I. Twenty Years of Society of Medical Informatics of Bosnia and Herzegovina and the Journal Acta Informatica Medica. Acta Inform Med. 2021 Mar; 20(1): 5-14. doi: 10.5455/aim.2012.20.5-14.
5. Masic I. Acta Informatica Medica indexed in PubMed Central. Acta Inform Med. 2013 Mar; 21(1): 4-5. doi: 10.5455/aim.2013.21.4-6
6. Masic I, Begic E, Zunic L. Review of the Journal Acta Informatica Medica During Eight Year Period: 2008-2015. Acta Inform Med. 2016 Apr; 24(2): 84-89. doi: 10.5455/aim.2016.24.84-89.
7. Zunic L, Begic E, Masic I. Acta Informatica Medica as an Official EFMI Journal - One of the Leading Journals in the Field of Medical Informatics in Europe. Acta Inform Med. 2018 Jun; 26(2): 84–86. doi: 10.5455/aim.2018.26.84-86.
8. Zunic L, Masic I. Importance of Acta Informatica Medica Journal in Spreading of Biomedical Knowledge and Experiences in Scientific and Academic Community. Acta Inform Med. 2018; 26(4): 228-229. doi: 10.5455/aim.2018.26228-229.
9. Masic I, Begic E, Donev MD, Gajovic S, Gasparyan YA, Jakovljevic M, Milosevic BD, Sinanovic O, Sokolovic S, Uzunovic S, Zerem E. Sarajevo Declaration on Integrity and Visibility of Scholarly Journal. Croat Med J. 2016; 57: 527–529. doi: 10.3325/cmj.2016.57.527.529.
10. Available at: https://academic-accelerator.com/Impact-Factor-IF/Acta-Informatica-Medica. Accessed on: 25th January, 2022.
11. Available at: https://pdfs.semanticscholar.org/9616/b886a8fda85e8d49379528f2339b28aa1d12.pdf: Accessed on: 25th January, 2022.
12. Available at: https://www.scimagojr.com/journalsearch.php?q=21100203503&tip=sid&clean=0. Retrieved on: 10.02.2022: Accessed on: 25th January, 2022.
13. Masic I. European Federation for Medical Informatics - the Most Influential Promoter of Medical Informatics Development for Past 45 Years. Acta Inform Med. 2021 Jun; 29(2): 80-93. doi: 10.5455/aim.2021.29.80-93.
14. Masic I, Kern J, Zvarova J, De Lusignan S. Task Force of the EFMI Journals: Background, Rational and Purpose. Stud Health Technol Inform. 2009; 150: 946-950.
15. 15. Masic I, Chronaki C. EFMI Inside - the Official Newsletter of the European Federation for Medical Informatics.Acta Inform Med. 2021; 29(2): 139-170. doi: 10.5455/2021.29.139-170

13

Izet Masic

A SHORT HISTORY OF MEDICAL INFORMATICS IN BOSNIA AND HERZEGOVINA

In 2012, the health informatics profession in Bosnia and Herzegovina celebrated five jubilees (1-5):

a) Thirty five years on from the introduction of the first automatic manipulation of data. In Sarajevo 1977, under the supervision of Fuad Secerbegovic, MD, Chief of the Department for Health Statistics, Republic Institute for Public Health BiH in, the company–"Energoinvest" Ltd. carried out the first analysis of summary and periodic health data reports about the network, capacities and performance of the healthcare service in Bosnia and Herzegovina, this analysis was previously performed manually in the above Institute. In 1982, in the Regional health station "Visnjik", Sarajevo for the first time in the history of health within Bosnia and Herzegovina was tested Local Health Information System for approximatelly 2500 families, created by Izet Masic and Arif Agovic. Health data on services provided to 6000 users of healthcare who were treated by four teams of physicians was analysed in a software package Archive in an original Sinclair QL personal computer.

b) Twenty five years on from the establishment of the Society for Medical Informatics BiH. In October 1987, the above named Society was established by a group of enthusiasts and pioneers of health informatics in BiH (Izet Masic, Irfan Zulic, Arif Agovic, Marijan Dover, Mladen Novak, Zoran Kontic and others). On May 26th 1988, during

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Medical faculty (established)	Subject Medical Informatics	Curriculum	Cathedra website	Distance learning
Sarajevo (1946)	II and XI semester	30 + 45	Yes	Introduced in school year 2003
Tuzla (1976)	I, III, IV semester	60 + 90	n/a	n/a
Banja Luka (1986)	II semester	30 + 30	n/a	n/a
Foca (1994)	II semester	30 + 30	n/a	n/a
Mostar (1997)	II semester	30 + 30	n/a	n/a

Table 1. Curricula of Subject of Medical informatics at Medical faculties in Bosnia and Herzegovina

the 3rd STC Conference of Medical informatics in Zagreb, Croatia, presidents of the similar societies from Croatia (Gjuro Dezelic), Slovenia (Stefan Adamic) and from Serbia (Rajko Vukasinovic) at the meeting held in the School of Public Health "Andrija Stampar" in Zagreb, signed a common memorandum of understanding and established the Association of Societies for Medical Informatics of Yugoslavia, this Association was officially registered and started to work on February 16th 1989, and in 1990 (December 6-8th) organized the First Congress of Medical Informatics in Yugoslavia, which was held in Belgrade. After the dissolution of Yugoslavia, the Association of Societies ceased to exist and in 1992 a BiH Society was registered as the Society for Medical Informatics of Bosnia and Herzegovina.

c) Twenty years on from the establishment of the Scientific and Professional Journal of the Society for Medical Informatics of Bosnia and Herzegovina „Acta Informatica Medica". From the year 2008 articles published in Acta Infom Med are indexed in PubMed, PubMed Central, Ccopus and 20 other on-line databases.

d) Twenty years on from the establishment of the first Cathedra for Medical Informatics on Biomedical Faculties in Bosnia and Herzegovina. In October of the year 1992 the first Cathedra for Medical Informatics was established. Cathedra staff at the time comprised of the following: Asst. Professor Izet Masic, Chief of Cathedra and teaching assistants - Zoran Ridjanovic, MD and engineer Safet Jakupovic, and associates Amra Redzepovic and Ljubomir Kravec). Later cathedras for medical informatics at medical faculties in Tuzla, Banja Luka, Foca and Mostar were established. In past years the curriculum was modified and harmonized, but the basic one was the Program of Sarajevo cathedra for medical informatics. In this accademic year Medical informatics curricula consists of theoretical and practical part: 30 + 45 (Sarajevo); 60 + 90 (Tuzla); 30 + 30 (Banja Luka); 30 + 30 (Foca) and 30 + 30 (Mostar).

e) Ten years on from the introduction of the method of "Distance learning" in medical curriculum. In December 2002, at the Cathedra for Medical Informatics, Medical Faculty, University of Sarajevo a symposium was organised under the name "Tele-education in Biomedicine" organized to celebrate the ten-year anniversary of the establishment of the above cathedra; participants at the symposium were health informatics experts from both Bosnia and Herzegovina and Croatia. During the symposium, for the first time in the history of the University, an intra-university network was tested, this was prepared by the University Tele-information Centre - UTIC. The leader of this activity was electro-engineer Safet Jakupovic, UTIC manager. On this occasion the tele-lectoring had a duration of 90 minutes. It was the start of the project “Learning from distance in biomedicine”. Izet Masic was the leader of this project at the Medical faculty in Sarajevo, and the project was financed by funds of the cantonal Ministry of Science and Education and the Federal Ministry of Science and Education. Experiences from this project were presented at a number of world and European scientific events.

All five of the mentioned activities in the area of health informatics had special importance and gave appropriate contributions to the development of health informatics in Bosnia And Herzegovina (B&H).

The Society for Medical Informatics of Bosnia and Herzegovina gathered the most eminent experts, mostly medical doctors with various specialties (we belong among countries who are members of the European Federation of Medical Informatics - EFMI, which involve the largest number of health professionals). BiH Society became a member of EFMI during the war in 1994, and in the same year, a member of the International Medical Informatics Association - IMIA. In 2009 the Society for Medical Informatics of Bosnia and Herzegovina were given the opportunity to organize the 22nd European Congress of Medical Informatics in Sarajevo announced as “the best ever MIE”. At Sarajevo Conference participated more than 420 experts of Medical informatics from more of 40 countries from over all the word.

It should especially be pointed out that the professionals and experts of health informatics in Bosnia and Herzegovina have given important contributions to the promotion of this medical discipline through several studies and projects, from the building and realization of information systems at certain levels of healthcare to introducing modern education models in biomedicine using contemporary information technologies.

BEGINNINGS OF DEVELOPMENT OF HEALTH INFORMATICS IN B&H

Health (medical) informatics as a separate scientific discipline began to be effective in academic institutions at the end of the 70’s by the presentation of actual accomplishments in this area in under and postgraduate education at biomedical faculties. As a specialized discipline, health informatics has its rudiments in Bosnia and Herzegovina (B&H) in the beginning of the past century (20th), when experts, mostly graduates

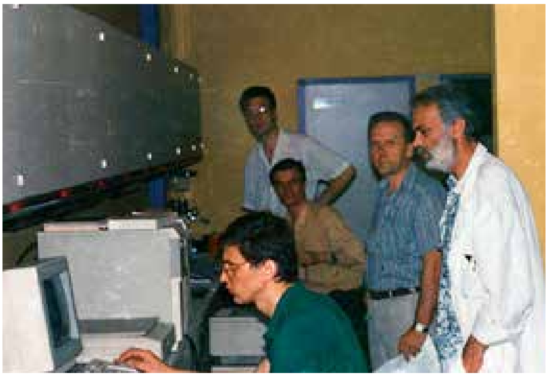


Figure 1. Founders of Society for Medical informatics of B&H in Sarajevo in 1992: Izet Masic, Zoran Ridjanovic, Aziz Hodzic, Zelimir Nastic and Ljubomir Kravec (Photo: Izet Masic)

from the Vienna Medical Faculty, began their professional careers in our country (6-9). Those who were more involved in the area of health statistics started to be intensely interested in the application of health technologies in health science.

Officially, health informatics has been used in B&H after the Second World War in Public health institutes on a regional level, special emphasis should go to the contribution of Fuad Secerbegovic, being manager of the Department for health statistics of Public health institute of Bosnia and Herzegovina from 1972 to 1995, after Evgenije Sestnev, the first chief of that Department (1946-1971). From 1977 the automatic analysis of health data in the above institutions was introduced gradually thanks to the engagement of Fuad Secerbegovic, who has published annual reviews and summary health statistics reports in B&H and utilization of health capacities under the title "Network, capacities and services of health institutions in B&H". The first health data was collected and processed by computers by the Company „Energovinvest" Ltd in Sarajevo in 1977 (1).

By the end of the 70's of the previous century, at the University of Sarajevo Health informatics under the subject Social medicine and organization of health care as well as on postgraduate studies of the same faculty was being taught (1, 2, 3). During 1992, the first year of the War, the Cathedra for Medical Informatics was established at the Medical Faculty, University of Sarajevo, and later on at other medical faculties in Bosnia and Herzegovina with a certain number of hours of theoretical and practical education. Currently, curricula are being adapted using the principles of Bologna process and declaration.

HEALTH INFORMATICS IN PRACTICE IN BOSNIA AND HERZEGOVINA

Initiation, development and implementation of some informatics activities, the automatic manipulation of health data and the intensive use of information technologies for the need of diagnostics, therapy and patient rehabilitation on all levels of care in BiH health system started to be solved systematically by the end of 70's and beginning of the 80's. A crucial decision with a state charter was made in 1981, when the B&H

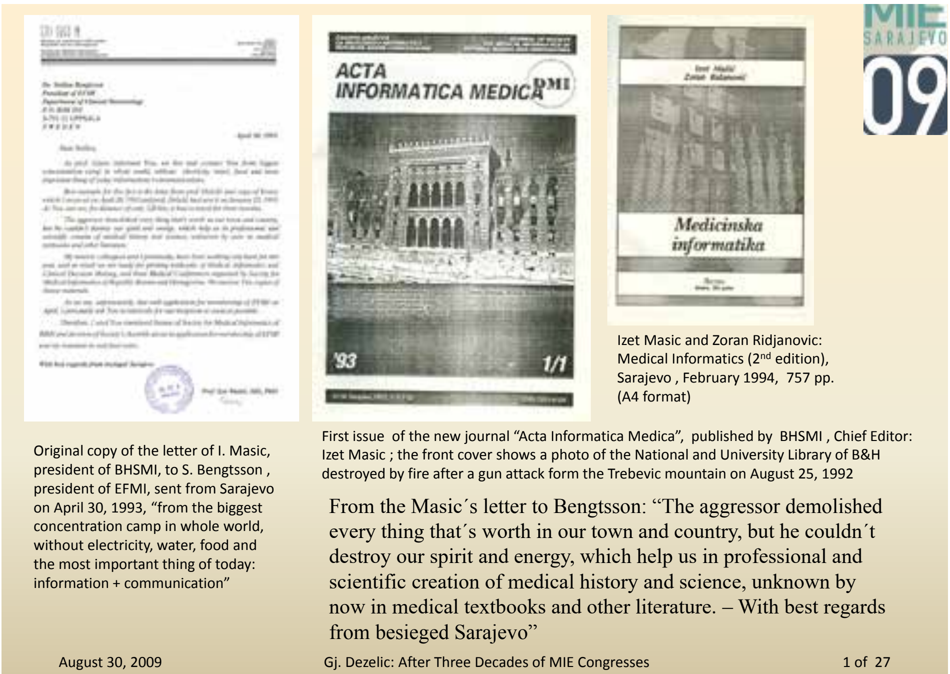


Figure 2. Slide presented by prof. Gjuro Dezelic, pioneer of Medical informatics in former Yugoslavia at MIE 2009 Conference in Sarajevo during Opening Ceremony

government made a decision to start with work on the project "Development of B&H health information system". Before the project, it was the completed study/analysis "Social-economical position of the health system in B&H"; based on that the B&H parliament approved the preparation of the appropriate project, this should have made modernization of the information system of health care. Basically, this project was to modernize and make automatic, the well developed and functional health statistics system in Bosnia and Herzegovina, which was part of an also well organized (centralized) Yugoslav health statistics system lead by the State Public Health Institute Belgrade. Project "Development of information system of health care B&H in circumstances of electronic data manipulation" was approved by the Executive Board of Association of healthcare communities B&H. On the 8th December 1983, eight companies applied for the tender, a contract was signed with the Intertrade Company from Ljubljana, Slovenia. In 1985 after positively assessed revisions the project was adopted and in the same year began its implementation after financial funds were assured (Table 1).

In 1985 the Electronic calculation centre of Health and retirement insurance fund in Sarajevo (ERC ZIPO) was established . The act itself, culminated in the establishment of a centre, was "Elaborate about social-economic finding of establishing working unit for manipulation of electronic data for health and retirement insurance fund". For a number of years the centre was lead by engineer Mirza Ceric. Unfortunately, this very well designed project, content of activities, as well as part of completed tasks in regard to the procurement of hardware and production of software applications, has never been completed and realized in practice. The concept of centralization of data manipulation in the architecture proposed in the ZIS B&H project (central host and analysis in Sarajevo, regional analysis in eight centres in B&H and local in 109 municipalities) has never been finalized and fell down. It was utopia which has no chance to be realized in practice. It is true that some of the designed activities were started at an institutional level, but never reached their end as Clinical information system of the University clinical centre in Sarajevo, which was one of the biggest projects in area of development and construction of medical information systems. From 23 companies bidding on the tender, IRIS (eminent Company for hardware and software and part of Energoinvest Company, fourth biggest company in former Yugoslavia) was chosen and has spent almost ten years working on the Study, Initiative design and Main project of Clinical information system of the University clinical centre in Sarajevo.

This project was also unfinished due to the War in B&H (1992-1995). Already procured hardware and designed software for some applications from the project (Medical subsystem, Diagnostics-polyclinic subsystem, Administrative-technical subsystem and Financial-economical subsystem) were destroyed or in the meantime lost their usefulness. The biggest progress was made in the development of information system for the pharmaceutical sector (only in Sarajevo the system connected 43 pharmacies in a centralized system of receipt collection and analysis). Besides the University clinical centre in Sarajevo, certain health institutions in Bosnia and Herzegovina started with the development of local and unique health information systems.

The first Local Health Information System was created and used in Sarajevo in the year 1982 when Izet Masic and Arif Agovic tested special designed Health data bases for the supervision of approximately 6.000 citizens - users of health care services at the Community health centre „Visnjik“ in Sarajevo. Health data was processed by a specially designed software package ARCHIVE on a Personal Sinclair QL computer, later redesigned in Clipper and DBASE III and FoxBASE. After 3 years of testing those data bases Izet Masic graduated first master thesis within Health informatics. During the war (1992-1995), and after the war, a lack of appropriate financial funds, and many other factors influenced the interruption of the planned activities, especially, having in mind how those activities were recommended in project plans regarding system development and perception.

The Ministry of Health and Social Welfare of Socialistic Republic B&H set up a Commission for a health information system. The Commission was put in charge to assess the above projects, concept, content of data necessary to collect, methods and methodology, information flow, functionality, rationality and efficiency. The Chair person for the Commission was Izet Masic and members were: Irfan Zulic, Zoran Ridjanovic,

Figure 3. Reception of EFMI Council members (meeting in Athens) at Embassy in Athens (March 2005) - Ragnar Nordberg (Sweden), Robert Baud (Switzerland), Bernd Blobel (Germany), John Bryden (UK); Saida Fisekovic, vice-ambasador (B&H), Izet Masic (B&H), Arie Hasman (The Netherlands) and John Mantas (Greece) (from left to right) (Photo: Izet Masic)

Gojko Babic, Nedzad Mehic, Stevica Krsmanovic, Mirza Ceric, Mustafa Hasovic and Naim Grebo. This Commission was very successful, but in the last ten structures of the Ministry of Health there is no such body.

HEALTH INFORMATICS IN MEDICAL EDUCATION

The need for additional education of health professionals was realised after the first application of electronic data manipulation. For physicians in primary health care and in clinics, in order to perform their duties in a high quality manner, must have been up to date with the latest accomplishments in medicine and health. Since the 60's the development of information technologies has had a quantitative and qualitative growth especially in diagnostics and therapy, and health workers had to follow that. Great role in this field had IMIA and EFMI. Working groups of IMIA and EFMI recommended and defined concepts and methodologies of education for medical informatics on three levels (3, 4, 5, 6).

First, informatics education which should provide general knowledge to users and data analysis on the place of their generation, and on all places of collecting data in health system (physicians of all specializations, nurses and paramedical staff).

Second level, informatics education of this level is in regard to medical staff which was directly involved in collection, manipulation, analysis and interpretation of health data. This kind of education was expanded with skills, knowledge and practical applications which are necessary for personnel on this level.

The Third level is basically a very wide and highly specialized education for experts in the health sector who would like to be professionally involved in this kind of work. In B&H there has never been an accepted proposal for introducing sub-specialization from medical informatics in spite of the fact that authors of this paper put a lot of effort and energy into making it official. It is a fact that at some universities in European countries there are separate faculties or universities for graduates with the title of engineers of health informatics.

There are five medical faculties in Bosnia and Herzegovina (Sarajevo, established in 1946; Tuzla, established in 1976; Banja Luka, established in 1986; Foca, established in 1994; and Mostar, established in 1997). At all the faculties, since 1992 and later, cathedras for medical informatics were established and/or introduced as independent subjects: medical informatics or health informatics, bioinformatics, etc. In principle, 60-70% of the curriculum are the same, or very similar; the only difference is that the chiefs of some cathedras are medical doctors and of others are professors, engineers, mathematicians or economists with the title of MSc or PhD in this area. Most of those cathedras have web sites where students can check the number of hours and content to be taught.

Openly speaking in undergraduate education until 1992 when medical informatics was introduced as an independent subject at the Medical Faculty, University of Sarajevo just some lectures were taught; those were methodological units in that time very important for health practice (medical documentary with two teaching hours and health information systems also two teaching hours) under the subject of Social medicine and organization of health care and Professor Izet Masic. from 1979 on Postgraduate education at the Medical Faculty, University of Sarajevo there were subject Health informatics led by the pioneer of health informatics in ex-Yugoslavia Prof Gjuro Dezelic, PhD using concept, content and methodology at the Medical Faculty, University of Zagreb. In the school year 1970-1971 at the Medical Faculty, University of Zagreb was introduced “Basic Informatics” (named Use of electronic computers in health care) as obligatory subject for 6th semester students with a duration of 15 school hours. A similar programme was at postgraduate studies at the same faculty under the subject “Introduction in scientific work”. In 1973 a separate cathedra for “Basics of Informatics” was established since it was obvious to make a distinction between those two areas. Both, under and postgraduate students had the chance to attend “Techniques of programming electronic computers” for a duration of 20 school hours. In

1973 the subject at postgraduate studies “Analysis of health data by methods of informatics and statistics” for a duration of 20 hours it was introduced.

Since 1985, Professor Izet Masic took over the leader position and with the help of Professor Gjuro Dezelic and Professor Arif Smajkic launched a separate course “Informatics and Economics in Health” for a total duration of 30 hours. Numbers of postgraduate students became MSc and PhD in this subject, and some of them became professors and assistants in B&H universities and abroad. Since 1992 at the Medical Faculty, University of Sarajevo there have been Cathedra for Medical Informatics. The content of education is 30 hours of theoretical and 45 hours of practical education for students of the Medical Faculty, 15+15 hours for students of Faculty of Dental medicine and 30+30 hours for students of College of Noursing. From 2002 the subject is split into two parts: Fundamentals of medical informatics with funding of 15+15 hours in the second semester of studies and Applicative medical informatics with funding of 15+45 hours in the eleventh semester. The final exam is due after the 11th semester. Curriculum, teaching materials, application for the exam, the exam itself and checking of results are possible at the web site (www.imasic.org). Also, since 2002 at Cathedra for Medical informatics the project “Distance learning in biomedicine” is in progress which allows students to use an electronic way of learning and to pass their exams in this subject. This method of education was in a pilot phase and waited for official approval from the appropriate institutions in charge for high education.

In total, education from Medical informatics gained 3000 students. At postgraduate students of The Medical Faculty, University of Sarajevo there are subject Medical Informatics with funding of 15+15 hours and this type of education enabled over 800 medical doctors all medical specializations. In progress is the adaptation of curriculum of neighbouring countries in Medical informatics and content of methodological units with the Bologna process.

BOSNIA AND HERZEGOVINA HEALTH INFORMATICS AT INTERNATIONAL LEVEL

All the above mentioned activities could not have been realized in practice without strategies and concepts developed by professionals and experts in the area of medical informatics. In the early 80’s, first in Sarajevo, then in other towns within Bosnia and Herzegovina, mostly engineers of electro-technique start to be intensely interested for some segments of health informatics; some of them managed certain projects, besides others they were involved in preparation of design of software applications for the mentioned project ZIS B&H. They have been followed by ambitious physicians who could see in the new information technologies a future and practical help in performing their everyday jobs. Pioneers in this area were: Izet Masic, Zoran Ridjanovic, Benjamin Djulbegovic, Sead Beganovic and others who attended professional meetings and workshops with appropriate topics from medical informatics. They were supported by Professor Abdulah Konjicija who in 1984 started to introduce mathematical models in diagnostics and therapy of certain diseases, and altered with mentioned experts algorithms for curing the phases of a disease.

Figure 4. Participants of First Congress of Medical Informatics of B&H, held in Sarajevo, on November 5th 1999 (professors: Attila Naszlady (EFMI President), Faris Gavrankapetanovic, Bozo Ljubic, Zehra Dizdarevic, Seid Hukovic, Nedzad Mulabegovic, Husein Kulenovic - sitting, from left to right (Photo: I. Masic)

Later, those experts began to work more closely on some parts of the medical informatics for which they had an affinity. Some of them have prepared papers and presentations for specially organized symposiums "B&H days of informatics" held annually on the mountain of Jahorina near Sarajevo from the year 1976. In October 1987 a group of experts within the field of Medical informatics decided at General Assembly to set up an independent Society for medical informatics of Bosnia and Herzegovina which was joined with similar independent societies from Croatia, Slovenia and Serbia (established at General assembly on February 16^{th} 1989 at Andrija Stampar School in Zagreb, Croatia) as the Association of societies for medical informatics of Yugoslavia.

The President of the Association board was Gjuro Dezelic, and members were Stefan Adamic, Rajko Vukasinovic and Izet Masic. In 1990 this association became a member of the European Federation for Medical Informatics and was officially accepted on the EFMI Council in Glasgow. The EFMI Council in Glasgow was attended by Gjuro Dezelic and Izet Masic who, in the same year, organized the First Congress of Medical Informatics in the Sava centre in Belgrade on December 6^{th}- 8^{th} which was opened by the EFMI president (at the time) Stellan Bengtsson. Over 500 delegates attended the First Congress of Medical Informatics.

In 1991 this association fell apart and each member established society at the level of new recognized states. The BiH society during the war year of 1992 became an independent professional organization and first of its kind in the independent state of Bosnia and Herzegovina. In the same year a group of society members (Izet Masic, Zoran Ridjanovic, Irfan Zulic, Aziz Hodzic, Zelimir Nastic, Ljubomir Kravec, Marijan Dover, etc.) kicked off the initiative for acceptance of the Society for Medical Informatics B&H in the European Federation for Medical Informatics. In 1994 the Society for Medical Informatics B&H became a member of the EFMI (EFMI Council decision in Lisbon) and IMIA (the Decision of the General Assembly in Dresden). It

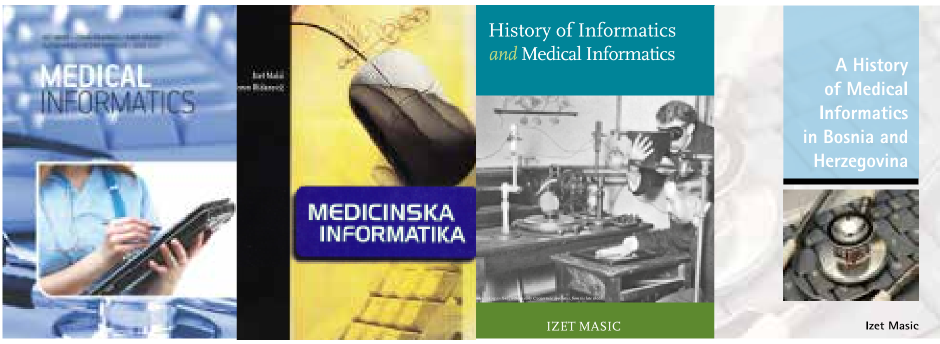


Figure 5. Cover pages of the books: Medical informatics (English version), Medicinska informatika (Bosnian version); History of Informatics and Medical informatics; History of Medical informatics in B&H

should be pointed out that much gratitude for those acceptances must go to President Stellan Bengtsson and Gjuro Dezelic, who, during unbelievable war conditions, carried out pre-activities over radio links with the establisher and first president of SMI B&H, Izet Masic. This was the only possible link from Sarajevo in that time. During incredible war conditions an official delegation (Izet Masic and Zoran Ridjanovic) attended the EFMI Council in Lisbon and were present at the official ceremony of this distinguished scientific association.

The War period (1992-1995) in Bosnia and Herzegovina Society for Medical Informatics was spent working very hard and in almost impossible conditions eight scientific and professional events were organized. At those events over 500 papers were presented which were published from the proceedings, which at that time was a real miracle and fantastic achievement having in mind that Sarajevo was under what was to be the longest siege any City has endured in history, added to this a severe lacking in electricity, water supply, gas and food. The siege of Sarajevo was to last for Approx: 1379 days without a break. Those materials found their way across Europe and they were recognized as a Sarajevo miracle at the time.

Serious activities of the Society follow on local and international level. The Society has organized a number of professional symposiums (eight in total so far) on the actual themes of:

- Classification systems in Health care system, December 1992;
- History of Health and Social culture in B&H, march 1993;
- Health information systems, December 1993;
- War medicine and medicine in a war, November 1993;
- War medicine and medicine in a war, November 1994;
- Medical documentation and evidence, November 1996;
- Tele-education in biomedicine, December 2002;
- eHealth and eEducation, December 2005.

The Society also organized the First congress of Medical Informatics of Bosnia and Herzegovina with international participation, held in Sarajevo in November 1999 and attended by 70 participants (from B&H, Croatia, Slovenia, Serbia and Montenegro, Macedonia, Norway, etc.) and officially opened by Professor Attila Naszlady (Figure 4).

The Second congress of Medical Informatics with international participation, organized in Sarajevo in May 2004 was officially opened by Professor Assa Reichert, president of the EFMI where 90 delegates from BiH, Croatia, Slovenia, Canada, Israel, Switzerland, Holland, United Kingdom, Germany, Norway, etc. attended. During the congress the EFMI held a meeting of the EFMI Board, which consisted of: Assa Reichert, president; Robert Boaud, vice president; Jacob Hofdijk, secretary; Rolf Engelbrecht, vice president IMIA; John Bryden, executive officer; Patrick Weber, treasurer. Members of the Board carried out an official visit to Bosnia and Herzegovina with regard to SMIBiH and the City of Sarajevo for the organization of MIE2009. At the next meeting of the EFMI Council held in Munich in June 2004, the Board made a positive decision on the application and

Figure 6. Participants of Second Congress of Medical informatics of B&H, held in Sarajevo, April 18th 2004 (Assa Reichert, Rolf Engelbrecht, Umid Salaka, John Bryden, Robert Baud, Patrick Weber, sitting, from left to right (Photo: I. Masic)

Figure 7. First electronic exam held on 20th June 2005, publicly, in the Physiology amphitheatre of the Medical faculty in Sarajevo (Photo: Izet Masic)

recommended to SMIBiH the preparation of the BID book for the following EFMI Council. Finally, on the EFMI Council meeting in Athens held on 18 March 2005, an official decision was made that Sarajevo will be the host of the MIE2009 to be held in Sarajevo (1, 2, 3).

The SMIBiH also organized a Special Topic Conference named "eHealth and eEducation" in the premises of the rector of Sarajevo University on 20th December 2005. During the conference Professor Rolf Engelbrecht, as key speaker, held a tele-conference from Munich, Germany on "Tele-medicine in Germany". It was the very first tele-lecture from biomedicine organized by our society. The event was organized with the support of ERICSSON and the International Society for tele-medicine and eHealth having in mind that the SMIBiH becomes an official member of the ISfTeH and Izet Masic a member of the ISfTeH Governing Council.

MEDICAL INFORMATICS IN BOSNIA AND HERZEGOVINA IN SCIENCE AND RESEARCH

SMIBiH after establishing in 1993 launched the professional and scientific journal Acta Informatica Medica (Acta Inform Med) and it has been published continuously for the past 20 years. At first journal was published twice a year, then three times a year, since 2005 quarterly and from this year bimonthly. The Journal has abstracted and indexed in more than 20 on-line databases (PubMed, PubMed Central, Scopus, Embase, EBSCO, etc. So far, it has published over 1.500 scientific papers, articles, editorials, case studies, and various actualities.

The first Editorial Board in 1993 were: Izet Masic (Editor-in-Chief), Zoran Ridjanovic (assistant of Editor-in-Chief), Amra Redzepovic (secretary), Ljubomir Kravec (technical editor), Georgina Janjic (lector), Tatjana Prastalo (English translation). Editorial board members were: Kenan Arnautovic, Meho Basic, Mahmut Djapo, Zoran Hadziahmetovic, Dragan Huml, Mehmed Kantardzic, Mustafa Kulenovic, Nedzad Mehic, Miroslav Polomik, Nikola Rukavina, Borisa Telebak, Irfan Zulic.

Teachers and associates involved in the education of students on post and undergraduate studies on biomedical faculties in Bosnia and Herzegovina during the past 20 years published a number of books, monographies, and other publications, some of which, have been translated into the English language (Figure 5). Also, BiH experts for medical informatics participate enthusiastically at European and world congresses of medical informatics with oral presentations or poster presentations. This is an opportunity to mention just some of the more important publications:

Medical informatics I, by Izet Masic, Zoran Ridjanovic, 1994;

Practicum for medical informatics by Izet Masic, Haris Pandza, 2000;

Health ethics and data protection by Izet Masic, Zoran Ridjanovic, 2001;

Medical informatics II by Izet Masic, Zoran Ridjanovic, 2001.

Medical Informatics - English version by Izet Masic, Zoran Ridjanovic, Haris Pandza, Zlatan Masic (2010),

History of Informatics and Medical Informatics by Izet Masic (2013).

Izet Masic and Ahmed Novo are also co-authors in a book **"Advances in International Tele-medicine and eHealth around the world"** edited by Wojciech Glinkowski (2006).

An important part of medical informatics in Bosnia and Hercegovina has to be underlined- this is the System of biomedical scientific and professional information (Library system in BiH-SBMNI), developed by the group of medical librarians and informatics professionals in BiH (Ana Gerc, coordinator, librarians: Amila Colakovic, Tanja Benic, Jelena Koprivica, Miljenko Krsmanovic etc..) during the period 1984-1990. That SBMNI was a part of the Yugoslavian system of biomedical information, established 1980 in Belgrade, known as Biomedicina Iugoslavica, in other words Index Medicus Iugoslavicus as a secondary periodical publication. This was like a continuing work of Index Medicus Iugoslavicus (1966-1983) published by the General hospital »Dr. J.

Kajfes», Zagreb and Biomedicina Slovenica published by the Institute for biomedical informatics Ljubljana since 1976. Scientific and professional articles published in indexed journals in former Yugoslavia were stored in computer host "System of biomedical, scientific and research information", called Index Medicus Iugoslavicus/Biomedicina Iugoslavica. It included professional papers, monographies, master and PhD thesis, scientific reports and other similar documents published in the country and aboard. Gathering and editing documents was performed using the well known rules in SBMNI, based on MEDLARS standards in English.

MIE 2009 Conference in Sarajevo (**August 30, 2009 - September 02, 2009**)

The MIE 2009 Conference was organized by the European Federation of Medical Informatics - EFMI and Society of Medical Informatics of Bosnia and Herzegovina - BHSMI in Sarajevo from August 30th to September 2nd of the year 2009. Venue place was hotel Holiday Inn in Sarajevo (Figure 8 and 8).

The Conference gathered participants all over the world, altogether 931 researchers have reported their results in MIE 2009 Proceedings. During the same Conference, joined conferences were organized: BHSMI Special Track and EUROREC Conference 2009. Proceeding of the MIE 2009 Conference (1064 pages) was printed by IOS Press, Amsterdam and contains 213 contributions to the MIE 2009 Conference - 150 full presentations, 21 student paper presentations, 21 presentations presented at MIE 2009 as poster presentations and 14 workshop descriptions. Also, in Proceedings were included papers from 9 invited speakers:

Gjuro Dezelic: After Three Decades of Medical Informatics Europe Congresses;

Gerard Comyn: EU eHealth Agenda Strengthening Research and Innovation;

Figure 6. Posters of Medical Informatics in Europe (MIE) 2009 Conference in Sarajevo, 2009 (left); Izet Masic, Klaus Peter Adlassnig and Jacob Hofdijk, chairs of MIE 2009 conference in Sarajevo (from left to right)

William Edward Hammond: Realizing the Potential of Healthcare Information Technology to Enhance Global Health;

Rolf Ewers: Augmented Reality and Telenavigation in Cranio and Maxillophacial and Oral Surgery;

Mordechai Shani: The Use of ICT in the Delivery of Healthcare Services to the Chronic Patient;

Reinhold Haux: Health Enabling Technologies for Pervasive Health Care: a Pivotal Field for Future Medical Informatics Research and Education;

Andrew Ballas: Interoperative Electronic Patient Records for Health Care Improvement;

Blackford Middleton: Clinical Decision Support and

Sylwia Miksch: Computer Based Medical Guidelines and Practice: Current Trends.

Figure 9. MIE Conference in Sarajevo: a) Opening ceremony; b) LOC staff; c) Participants of one of the main sessions (Sarajevo, 30.08.2009 - 02.09.2009).(Photo: Izet Masic)

The papers included were selected by an International Scientific Programme Committee (SPC) out of 324 submissions after careful review by three international reviewers for every single submission. The SPC chair and his two co-chairs (Klaus Peter Adlassnig, Bernd Blobel and John Mantas) did great job and all papers are indexed in PubMed/Medline databasis.

Most of the topics presented at MIE 2009 are interdisciplinary in nature and may be of interest to a variety of professionals: medical informatics, bioinformatics, health informatics scientists, medical computing and technology specialists, public health, health insurance and health institutional administrators, physicians, nurses, and other allied health personnel, and representatives of industry and consultancy in the various health fields. There are several trends and developments that can be recognized by carefully examining the single contributions to the various topics. First, interoperability and data exchange standards become most important. Systems must be interconnected to each other: locally, nationally, and transnationally. Second, ontologies ("those that is") are being developed in an increasing path. By doing so, medical vocabulary that is used in an application, as well as the semantics of applied items is defined. Third, Web apllications allow to share medical information and knowledge by many users - researchers, staff and patients. Fourth, clinical decision support systems provide huge impact on medical workflow and patient care to the benefit of patient, the caring physician, and the financing health care bodies (6-13).

The great variety of scientific topics and countries that were presented, made MIE 2009 Conference in Sarajevo a huge success and a fruitful study of proceedings by those interested in Medical Informatics.

FUTURE OF MEDICAL INFORMATICS IN B&H

Teaching staff performed a number of surveys analysing current levels among medical students and health professionals. Key activity of the B&H SMI will be to enhance efforts on reconstructing a high education system in the country in accordance with the Bologna process (14-26). There are two areas which the focus of activities needs to be directed: under and postgraduate education and continuous medical education (CME) for health workers, medical doctors as well as nurses.

REFERENCES

1. Masic I, Novo A. History of Medical Informatics in Bosnia and Herzegovina. Acta Inform Med. 2007; 15(1): 49-61.
2. Masic I. History of Medical Informatics in Bosnia and Herzegovina. Avicena, Sarajevo, 2007: 11-64.
3. Masic I. Education of medical informatics in Bosnia and Herzegovina. International Journal of Medical Informatics. Elsevier Science Ireland Ltd., 1998; (50),123: 95-101.
4. Hasman A, Mantas J, Zarubina T. An Abridged History of Medical Informatics Education in Europe. Acta Inform Med. 2014 Feb; 22(1): 25-36. doi: 10.5455/1im.2014.22.25-36.
5. Mihalas G. Evolution of Trends in European Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 37-43. doi: 10.5455/aim.2014.22.37-43.
6. Dezelic Gj. After Three Decades of Medical Informatics Europe Congresses. Stud Health Technol Inform. 2009; 150: 3-7
7. Masic I, Ridjanovic Z. Medical Informatics. Avicena, Sarajevo, 2010: 5-34.

8. Glinkowski W. et al. Advances in International Telemedicine and eHealth. Vol. 1 - Around the world. MedPage Ltd., Warsaw, 2006; 28-36.
9. Masic I, Ridjanovic Z. Medicinska informatika - jucer, danas, sutra. Acta Inform Med. 1993; 1(1): 13-9.
10. Masic I, Ridjanovic Z. Razvitak zdravstvene informatike u Bosni i Hercegovini. Acta Inform Med. 1993; 1(1): 21-2.
11. Masic I. Telematika u medicini - perspektive razvoja u BiH. Med Arh. 1995; 49(3-4): 69-70.
12. Masic I. A Short History of Medical Informatics in Bosnia and Herzegovina. Acta Inform Med. 2014 Feb; 22(1): 60-67. doi: 10.5455/aim.2014.22.60-7.
13. Masic I. Prvi kongres medicinske informatike BiH - Novi izazovi. Med Arh. 1999; 53(4, supl.3): 3-4.
14. Masic I. Quality Assessment of Medical Education at Faculty of Medicine of Sarajevo University - Comparison of Assessment between Students in Bologna Process and Old System of Studying. Acta Inform Med. 2013; 21(2): 76-82. doi:10.5455/aim.2013.21.76-82.
15. Masic I. Quality assessment of Medical Education at Faculty of Medicine of Sarajevo University. Med Arh. 2012 Jun; 66(3, Suppl. 1): 5-10. doi: 10.5455/medarh.2012.66.s5-s10.
16. Masic I, Ciric D, Pulja A, Kulasin I, Pandza H. Quality assessment of medical education and use of information technologies. Stud Health Technol Inform. 2009; 150: 898-902.
17. Masic I, Novo A, Deljkovic S, Omerhodzic I, Piralic A. How to asses and Improve Quality of Medical Education: Lessons Learned from Faculty of Medicine in Sarajevo. Bosnian Journal of Basic Medical Sciences. 2007; 7(1): 74-8.
18. Masic I, Dedovic-Halilbegovic G, Novo A, Izetbegovic S. Ocjena kvaliteta edukacije na Medicinskom fakultetu Univerziteta u Sarajevu. Med Arh. 2006; 60(6): 395-400.
19. Masic I. et al. Quality assessment of medical education- why Bologna? Mater Sociomed. 2007; 19(2): 122-4.
20. Masic I, Novo A. Medical informatics education in Bosnia and Herzegovina. Acta Inform Med. 2005; 13(4): 184-8.
21. Masic I, Sivic S. Social networks in medical education in Bosnia and Herzegovina. Mater Sociomed. 2012; 24(3): 162-4.
22. Masic I, Novo A, Kudumovic M, Masic Z. E-learning at Medical faculty of Sarajevo University. Acta Inform Med. 2005; 13(3): 132-5.
23. Masic I, Pandza H, Kulasin I, Masic Z, Valjevac S. Tele-education as a method of medical education. Med Arh. 2009; 63(6): 350-3.
24. Masic I. E-learning as a Method of Medical Education. Acta Inform Med. 2008; 16(2): 102-17. doi: 10.5455/aim.2008.16.102-117.
25. Masic Z, Novo A, Masic I, Kudumovic M, Toromanovic S, Rama A, Dzananovic A, Bander I, Basic M, Guso E, Balta E. Distance Laerning at Biomedical Faculties in Bosnia and Herzegovina. Stud Health Technol Inform. 2005; 116: 267-72.
26. Mašić I, Kudumović M, Pašić E. Deset godina edukacije iz Medicinske informatike na Medicinskom fakultetu u Sarajevu. Med Arh. 2002; 56(4): 233-9.

14

Gjuro Dezelic, Josipa Kern, Mladen Petrovecki, Vesna Ilakovac, Mira Hercigonja-Szekeres

MEDICAL INFORMATICS IN CROATIA - A HISTORICAL SURVEY

As in many European countries, medical informatics (MI) began to develop in Croatia in the sixties of the 20th century when medicine was widely recognized as a field in which the use of computers is important and widespread, and will be necessary in the future. This was not much later of the period, when the roots of this discipline were planted all over the world by various working groups and associations engaged in research and development of computer applications in medicine and health care (1).

Let us remember that in the fifties of the last century, i.e. after the 2nd World War, USA was a leading country in the field of computer science, introducing the first uses of computers in medicine (2). But soon, when Europe recovered from the war disasters, the use of computers in medicine and health care began to advance rapidly, especially in the technologically advanced European countries - France, Germany, Sweden and United Kingdom. This was a result of the entrance of the biggest American computer companies, as for example IBM, Univac, Burroughs, Control Data and Honeywell, into European markets with their computer systems, and the beginning of their investments into European computer industry, in which among the known European computer manufacturers were English ICL, French Bull (bought by the American General Electric in 1964 and sold to Honeywell in 1970) and German Siemens. As most of the US companies were already involved in the realization of medical computing projects, this had, of course, its reflection on MI development in Europe, especially in the field of medical and health information systems. The names of some of the first European hospital information systems from the sixties-in Sweden the Danderyd

*This text is republished from the book “Contributions to the History of Medical Informatics” (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Hospital and Karolinska Hospital Systems in Stockholm, in Great Britain the Kings Hospital System in London, in Germany the Medizinische System Hannover, are still in our memories.

Figure 1. Panelists on MI Education at the EFMI MI Berlin 1979 Congress

This development resulted in the formation of a new scientific discipline named in 1967 by François Grémy "Medical informatics" (2, 3). The new name began to spread all over world, especially after the foundation of the European Federation for Medical Informatics (EFMI, 1977) and the International Medical Informatics Association (IMIA, 1979).

In the time of the development of first medical computing projects in the USA and European West, i.e. in the fifties of the 20th century, in Croatia the quantity of data and information in the Croatian healthcare system reached such a high level, that introduction of sophisticated information and communication technologies (ICT) was widely demanded. As elsewhere, most benefits were expected by the use of computers because of their efficiency in information processing. Croatia, in these days a federal republic in the former Yugoslav Federation, had a rather developed healthcare system as a result of the tradition in the public health philosophy and ideas of Andrija Stampar (4). As the healthcare system in a substantial part deals with collecting, storing and processing of data, by several independent studies performed in those days it has been shown that the costs in the information sector amount to at least one-third of total costs in the healthcare system (5). So e.g. Morris F. Collen reported that 25-40% of hospital costs are connected with data handling (6), but in other sources it is estimated that the costs might be even higher. So it became apparent that the Croatian healthcare system should be based on the use of modern ICT, especially by the use of computers.

But in that period it was not easy to introduce computers into Croatian healthcare practice. The installation of computers in the whole country was slow, first computers were installed in state statistical institutions, some of the banks and leading research institutes, as well as in newly established computing centres, serving various users (in whole Yugoslavia in 1962 there were installed 30 computers, and to the end of 1968 the number increased three times, cf. ref. 7). It became clear that new technologies and scientific fields can be implemented in healthcare only by corresponding education of professionals engaged in this field. In such circumstances the Andrija Stampar School of Public Health (bearing the name of its founder since 1959 and being a part of the School of Medicine in Zagreb), already engaged in organizing postgraduate courses for health professionals working in public health (physicians, health economists, etc.) introduced MI fundamentals into their curricula. This was done by the initiative of the director of the School Prof. Branko Kesic, Stampar's successor, a visionary realizing early the importance of computers for medicine and health care, noting the appearance of the growing crisis in processing healthcare data and expecting that these tools could help in this situation.

First lectures on MI were given in the academic year 1966/67 as a part of the subject "Introduction to Scientific Work", held in part by Branko Kesic and by Gjuro Dezelic, who was the first of the teaching staff of the School of Medicine in Zagreb having opportunity to work with a large-scale computer, learning programming in order to perform calculations for his scientific research during the postdoctoral training in the USA. But from the very beginning the aim of this initial education of health professionals in MI (still under the name "medical computing", as Grémy proposed the name for this medical discipline just in the same time in 1967) was to extend it as soon as possible to medical students, in order to prepare them for their future professional work characterized by the use of rapidly developing ICT. It is important to mention that at that time this approach in medical education was extraordinary rare. For example, first report on teaching computers to medical students came from USA in 1965 (8), and further reports of similar attempts were published only a few years later. In addition, these first curricula were concerned only with the narrow area of computer programming, and not with other aspects of MI, so important for future health professionals.

All that was still before the Todd Commission Report on medical education in Great Britain (9) stressed the urgent necessity for medical students to be trained in MI, stating that "computers, with all their implications in terms of equipment, procedures and ways of thinking, will play too large a part in the work of all doctors in the future to be left entirely to the expert (*in computing - author's comment*); every doctor should at least learn to understand their basic principles and potentialities."

Soon after these first publications on MI education, and experiencing positive acceptance in teaching MI to postgraduate students, the Andrija Stampar School of Public Health, as a part of the School of Medicine in Zagreb and supported by the Association of Healthcare Institutions of Croatia, proposed to the end of 1969 introduction of special compulsory appreciation courses in MI at the undergraduate and postgraduate levels for all medical students. The School of Medicine in Zagreb accepted it and teaching for undergraduates and

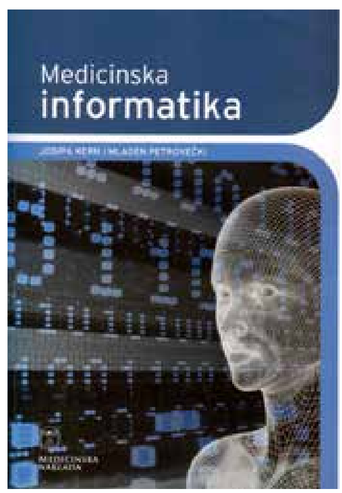


Figure 2. New textbook/manual „Medical Informatics" (in Croatian), Medicinska naklada, Zagreb, 2009

Figure 3. Participants of the Alpe-Adria conference in Zagreb (1989); from left: M. Madjaric, Gj. Dezelic, V. Lovrek, (all from Croatia), R. Greiller (Germany), G. Gell (Austria)

clinical postgraduates started in the summer semester of the academic year 1970/71 (10). When in 1972 the University Computing Centre (SRCE) was opened in Zagreb, operating a modern time-sharing UNIVAC 1110 system, a Terminal station, equipped with conversation terminals, was opened at the Andrija Stampar School of Public Health. This Terminal station, apart from its importance for medical research, served as the first MI Laboratory for practical work with computers in the MI education of medical students and healthcare personnel in Croatia. As the terminal network of SRCE spread to other Croatian universities (in Osijek, Rijeka and Split, being in the same time major health centres in Croatia), this gave a strong impetus to the development of MI teaching, as well as to the scientific and professional development of MI in Croatia.

In late sixties of the past century first MI projects in Croatia's healthcare are noted, mainly concerned with problems in public health. The gathered experience was reported at the First Symposium on Applying Computers in Healthcare (Zagreb, April 21-23, 1971) and later published in the symposium proceedings as reports on (1) the use of automatic data processing in the healthcare of the City of Zagreb (processing of data from people not being health insured); (2) the processing of health-statistical data in the field of outpatient healthcare and occupational health in the Medical Center Varazdin; and (3) the computerization of the Croatian Cancer Registry (initiated 1967 in the Croatian National Institute of Public Health in collaboration with international institutions, and continued at home in 1969) (1).

In a recent panel discussion on the history of MI in Europe (at the Special Topics Conference of the European Federation for MI, Prague, 2013) there have been two presentations finding it appropriate to divide the whole MI history into five periods (stages). Talking about the evolution of concepts in MI George Mihalas denoted the period until the middle of seventies of the past century as the "Early Stage" in MI concepts evolution (11), and in their presentation of the history of MI education Arie Hasman and John Mantas named it the „initiation stage“ (12). These two terms, similar in their meaning, denote well the first period of the development of MI as a new field in biomedical sciences.

Further development of MI in Croatia, its appearance on the international scene and the establishment of the CSMI

Development of MI projects

Further development of MI in Croatia, still in its early stage, was mainly related to the administrative and financial applications in healthcare institutions (especially in larger hospitals, such as the University Hospitals in Zagreb) and Croatian health insurance funds. Among the important projects which are introduced in the field of medical documentation it is worth to mention the beginning of computer data processing in the Health Center Remetinec (Novi Zagreb) in 1970, in collaboration with the Computing Centre of the City of Zagreb and continued as a routine after 1973. Following the previously mentioned first successfully computerized health registry - the Croatian Cancer Registry, the Croatian National Institute of Public Health started with computer processing of data in its second registry - the Croatian Psychoses Registry (founded in 1961). Two other computerized health registries followed: the Croatian Registry of Cured Alcoholics (1974) at the University Hospital "Sisters of Mercy" in Zagreb, and the Registry of Diabetes (now National Diabetes Registry CroDiab) at the University Clinic for Diabetes, endocrinology and Metabolic Diseases "Vuk Vrhovac" in Zagreb.

Remembering the introduction and development of these early MI projects it is worth to note the support that came from the Croatian state health authorities, realizing that application of modern ICT in health care is one of the important components in its modernization and future development. This was an important impetus for future development of MI in Croatia.

The development of health information systems in several countries in the mid-sixties of past century induced also such projects in Croatia at the beginning of seventies. The "Integrated Health Information System" project for the whole healthcare system of the City of Zagreb, was conceived still in 1974 as a comprehensive application of ICT in that field. Its conceptual design started several years later (in the beginning of eighties) (13), but could not be implemented as planned because of the financial problems during the eighties and the later decay of the ex-Yugoslavia at the beginning of nineties. In the late eighties as similar approach was adopted in the Istria County for the needs of primary healthcare (PHC) (14), with the extension to apply the rapidly spreading microcomputer hardware affordable for PHC teams working in territorially distributed offices and to satisfy their information needs by the use of Lawrence Weed´s POMR (Problem Oriented Medical Record) approach (15, 16).

Among the first hospital information systems in Croatia one can note the beginning of the implementation of such system at the Clinical Hospital Centre in Zagreb in the eighties (17), oriented under conditions of limited hardware resources to develop a basic data set at the level of an integrated hospital information system covering several hospitals (18).

MI applications in clinical medicine

As in many clinical disciplines in Croatia in those years significant efforts were made to follow the development of medical science in the world, so the application of diagnostic and therapeutic methods based on electronic computers started early. Besides the methods for the calculation of radiation doses in radiotherapy applied in several Croatian hospitals, applications in nuclear medicine and electroencephalography have been developed, and the computed tomography has been applied in Zagreb very early (1975). A Centre for Tissue Typisation, supporting kidney transplantation, was established 1973 at the University Hospital Centre in Zagreb, and started with computer applications from its very beginnings. The use of medical records designed for computer processing started in psychiatry, diabetology, otolaryngology, maxillofacial surgery, gynaecology and other clinical disciplines. ICT based diagnostic and therapeutic instrumentation (e.g. in the clinical laboratory, intensive care, electrocardiography, etc.) was introduced in daily medical work also in the seventies of the last century.

Start and development of MI research

First published results on MI research in Croatia originate from the Andrija Stampar School of Public Health. After the opening of the Terminal station at the School many biomedical researchers in Croatia wanted to perform their statistical data analysis, so necessary in their work, using the big mainframe in SRCE. At that time such analysis was performed by using computer programs in batch processing mode, with software packages specifically intended for biomedical research (e. g. MEDCOMP from the University of Cincinnati [1963], BMD - from UCLA [1971] and SPSS from Stanford University [1973]). As these packages at that time did not allow the user to work online and to create their own strategies of data analysis during this work, a special conversational statistical data analysis language as well as a special interactive statistical package for biomedical research, CSTAT, were developed (19, 20). This was welcomed by the users, because it allowed a narrower contact with their own data and creation of new strategies for their statistical analysis, an approach possible today when using personal computers.

In the beginning of eighties the Croatian funds for scientific work started financing first two MI projects. Let us mention their titles: “Production and flow of information in the health care system” (1981-1985) and “Creating algorithms and models of information flow on the operational level in the healthcare system” (1981-1983). These projects resulted in a number of papers: two on the health information systems, four on databases and one on the role of microcomputer technology in health applications (the IBM PC Model 5150 was released in 1981!) (the citations of these papers can be found in ref. 21). Another project was started in the field of modelling and computer simulation of infectious diseases in the population, with the development of software for continuous simulation with graphics modules, partly in collaboration with the Institute of Medical Cybernetics, University of Vienna. The method of continuous simulation was also applied to other health problems, especially to investigate the dynamics and control of non-communicable diseases in the population, and to study the creation and monitoring genetic diseases. The results of these computer simulation studies were published in nine papers (21).

Figure 4. YAMI s delegation at EFMI MIE 1990 Congress in Glasgow (dinner after becoming member of EFMI and IMIA); from left: M. Madjaric, S. Vuletic, J. Kern (all from Croatia), I. Masic (Bosnia and Herzegovina), V. Lovrek, Gj Dezelic (both from Croatia), R. Vukasinovic (Serbia)

The project of continuing education in PHC (1985-1988) in collaboration with the Japan International Cooperation Agency (JICA) has gathered researchers from Croatia and Japan in the development of new methods for computer assisted instruction (CAI) in medicine, and this joint work resulted in four papers (21).

Two last projects in the eighties were "Information aspects and ICT basis of health assessment" (1986-1990), and the interdisciplinary project "Connecting the space and health data to assess the health status of the population" (1986-1990). In the framework of these projects four papers have been published on information systems, three on databases in PHC, two on linkage of space, households and inhabitants, and one on genealogies handling by computers (21).

To the end of the eighties, inspired by the rapid development of the medical decision-making software and computer-based expert systems, first ideas appeared to start with research in this field. At that time in the Andrija Stampar School of Public Health several research projects disposed with computerized databases, so it appeared suitable to exploit these data for such purposes. It was favourable that during the eighties at the University of Ljubljana a suitable software system was developed (named ASSISTANT) allowing automatic learning of rules by which physicians make their decisions. In collaboration with the Slovenian colleagues it was possible to acquire the software, so the first pilot study could be carried out on data in the field of perinatology and rheumatology (22), as an introduction for future medical decision-making research in the next decade.

All projects described in this subchapter were led by professors at the Andrija Stampar School of Public Health, which is a part of the School of Medicine in Zagreb. The first two MI projects described in this subchapter were led by Gjuro Dezelic, professor of MI, and Silvije Vuletic, professor of medical statistics. The project on computer simulation was led by Gj. Dezelic in close cooperation with Prof. Branko Cvjetanovic, a leading Croatian epidemiologist, professor at the School and WHO expert. The project on continuing education in PHC was led jointly by Gj. Dezelic and Takao Akatsuka, professor of information engineering at Yamagata University, Yonezawa, Japan. The project on health assessment was led by Gj. Dezelic, and the interdisciplinary project on connecting space and health data was led by Nada Dezelic, professor of health ecology. Most of the papers cited in this subchapter were published in the proceedings of international conferences (in total 12 papers, 6 of them at EFMI MIE congresses and 3 at IMIA MEDINFO congresses), in the proceedings of domestic conferences there were 9 papers, and the rest was published in journals.

Development in MI education

After the introduction of first MI compulsory courses at the School of Medicine in Zagreb in the academic year 1970/71, other medical schools in Croatia followed this trend. The School of Medicine of the University of Rijeka introduced such education in 1977. As the medical schools in Osijek and Split were in the beginning linked to the School of Medicine in Zagreb, so the first MI education in Split (the medical study was opened in 1974) started in 1976, and in Osijek (the medical study was opened in 1979) in 1981. In the second part of eighties personal computers were gradually introduced into MI laboratories, allowing students to broaden their practical work. In Croatian nursing schools MI education was also introduced in early eighties of the past century. The Zagreb University School of Dental Medicine introduced MI in its postgraduate education in the middle of eighties. As noted earlier, all medical postgraduate studies had MI courses in their curricula. Consequently, medical and health professionals in Croatia obtained MI education in the form of appreciation courses for almost three decades and were well prepared for the future challenges of the Croatian computerized healthcare. The early beginning of MI education at Croatian medical schools aroused attention elsewhere, including its spreading to other parts of ex-Yugoslavia and discussions on its first experiences, problems and prospects at international conferences (10, 23).

After more than one decade of MI education at the appreciation level, and with several successful research and development projects, trained MI specialists were needed. Following these demands, the School of Medicine, together with the Faculty of Electrical Engineering and Computing and the Faculty of Science, all of the University of Zagreb, started a program of postgraduate education in MI in 1984. The program was called “Health Information Systems” and lasted about two decades. More than

120 students enrolled and about 30% finished the program by a M.S. thesis. Most of the students were physicians, but there were also pharmacists, mathematicians, economists, librarians and engineers working in healthcare (1).

At the beginning the teaching materials for MI were in the form of handouts with lectures and tests in written form. The first Croatian textbook, intended for MI teaching and accepted by the Zagreb University Publishing board as an official text, was published in 1976 and entitled "Fundamentals of Informatics" (24). The next three enlarged and revised editions under the changed title "Health Informatics" were published in 1986, 1987 and 1989. To the end of the eighties, the teaching materials needed for practical work in MI education were also prepared in the form of handouts, until the first MI laboratory manual was published as a book in 1990 (25).

It is worth mentioning that during the eighties an intensive cooperation in MI teaching has been established by the Andrija Stampar School of Public Health with the Medical School in Sarajevo, in the neighbouring Bosnia and Herzegovina, where Gjuro Dezelic taught MI to their postgraduate students from 1984 to 1990, until Izet Masic, after gaining his PhD, succeeded him in teaching and expanded the MI education in his country to the undergraduate level.

Beginnings of international cooperation and establishment of CSMI

First international contacts of Croatian MI professionals happened already at the first of the EFMI congresses - Medical Informatics Europe MIE 1978 in Cambridge. At this venue Gjuro Dezelic had a chance to contact with leading persons of EFMI, and they invited him to participate at the EFMI Council meetings as an informal observer representing Yugoslavia, in which Croatia was one of the six federal republics. As EFMI then consisted of 11 member countries, the Council was interested to get new members and national representatives. In September 1979, at the Congress MIE Berlin, IMIA held its General Conference, so Dezelic could also participate as an observer. As EFMI and IMIA accepted as regular members only MI societies of individual countries, being members of the World Health Organization, in Ex-Yugoslavia it was necessary to found such societies in particular republics, and then to establish their federal association eligible for membership. As the number of MI professionals in particular parts of Yugoslavia was uneven, and most of them were in Croatia, it took a rather long time until the full membership in EFMI and IMIA could be achieved.

In the meantime, after the successful panel of the Croatian Medical Association entitled "Health Information Systems and Health Informatics Activity in the Development of Modern Medicine and Healthcare" in April 1983 in Zagreb (attended by more than hundred participants), the first association of Croatian MI professionals has been established - the Medical Informatics Section of the Croatian Medical Association, with Marija Strnad elected as chair. The members of the Section were physicians and other professionals interested in MI. Already at this panel it was concluded that, when circumstances permit, to establish in Croatia an autonomous MI society, similarly as in other countries, as an incentive to join EFMI and IMIA.

As MI became a topic of increased interest in the medical community in Croatia, the Croatian Association of Healthcare Institutions, an organizer of traditional international exhibitions "Medicine and Technology" held each May in Zagreb, initiated in 1986 the first of "Meetings of Informatics in Healthcare" (MIH) as a successful accompanying event. At the 2nd MIH in May 1987 the Association founded its Committee for Health Informatics, with Gj. Dezelic serving as chairman. The Committee was specially engaged to organize MI conferences with participants from other parts of Ex-Yugoslavia and abroad (especially MI experts from the so-called "Alpe-Adria Region" [A-A Region], consisting of geographically relevant parts in Austria, Germany, Italy and Ex-Yugoslavia). At this MIH the Committee was entrusted with the mandate of representing Yugoslav MI professionals in EFMI and IMIA, until an association at the federal level was formed. In the same time Gjuro Dezelic, as the chairman of the Committee, became the status of the official observer from Yugoslavia in EFMI and IMIA.

At the 3rd MIH in May 1988 it was agreed that in particular Yugoslav republics, able to gather enough members, autonomous MI societies should be formed. As a result of this agreement the Croatian Society for Medical Informatics (CSMI) was established on February 16, 1989, succeeding the previously mentioned Committee for Health Informatics. Also to the end of 1988 MI societies were established both in Bosnia and Herzegovina (BiH) and Slovenia, and Serbia formed the MI section of the Serbian Medical Association. In that way the prerequisites to establish the Yugoslav Association for Medical Informatics (YAMI) were fulfilled.

Simultaneously in August 1988, at the EFMI Congress MIE 88 in Oslo, several participants from A-A Region agreed to meet yearly by turns in Graz, Trieste and Zagreb. According to that in May 1989, at the occasion of the 4th MIH in Zagreb, the first "Alpe-Adria Round Table Discussion" was organized, and the topics were "Presentation of MI activities in the A-A Region" and "Possibilities of the MI collaboration in the A-A Region" (the organizers on behalf of their countries were Günther Gell [Graz, Styria, Austria], Silvio Sponza [Trieste, Friuli-Venezia Giulia, Italy] and Gjuro Dezelic (Zagreb, Croatia, Yugoslavia]; from other parts of the A-A Region main representatives at the meeting were Reinald Greiller [Munich, Bavaria, Germany] and Stefan Adamic [Ljubljana, Slovenia, Yugoslavia]). A month later, in June 1989, the representatives of MI societies of BiH, Croatia and Slovenia, as well as of the MI section of Serbia, gathered in Osijek (Croatia) to attend the founding assembly of YAMI. At this assembly it was decided to locate YAMI´s seat in Zagreb, with Gjuro Dezelic elected as president of YAMI, and Izet Masic (BiH), Rajko Vukasinovic (Serbia) and Stefan Adamic (Slovenia) as YAMI´s Board members. Additional Board members were YAMI´s secretary Visnja Lovrek and treasurer Josipa Kern, both members of CSMI. The road to join EFMI and IMIA was open.

MEDICAL INFORMATICS IN CROATIA IN THE LAST DECADE OF THE 20TH CENTURY

CSMI becomes member of EFMI and IMIA

The prospects for further successful advancement of MI in Croatia were good. Research was advancing well by pursuing many of the problems of the time and orienting itself to contemporary themes. The development of information systems in healthcare began, and MI education produced a new generation of people interested to work in MI. As an indicator of this it can be noted that CSMI had more than hundred members soon after its foundation in 1989. The regulation of its official links with EFMI and IMIA through YAMI was awaited, but the procedure was long. Although YAMI was founded in the middle of 1989, its registration by the federal authorities of Ex-Yugoslavia was fulfilled at the end of that year, so the official application for admission to EFMI and IMIA could be submitted only at the beginning of 1990. Although the boards of both international organizations quickly accepted YAMI´s application, one had to wait until August to formalize its membership at MIE 1990 in Glasgow.

Soon after founding, YAMI organized its first MI congress in December 1990 in Belgrade. At YAMI´s first general assembly held at this occasion, it was decided to submit to IMIA the candidacy of CSMI for the MEDINFO congress in 1995 in Zagreb. So the plans for future activities both of CSMI and YAMI were ambitious.

At the same time the Commission of the European Communities (the forerunner of the European Commission), in the endeavour to support common understanding and cooperation in research and basic technological developments in Europe, at the end of 1989 "undertook a number of programmes with the aim of advancing informatics and telecommunications in important application fields. One of these programmes is concerned with medicine and health care. It is called AIM, Advanced Informatics in Medicine." The AIM action supported in the beginning 42 projects, and a special EFMI´s working group was mandated to submit project proposals of its members (26). As CSMI members participated for years at MIE congresses, this was a good possibility for them to participate also in European projects, either by proposing own projects, or to collaborate in AIM meetings. Everything seemed favourable for Croatian MI researchers, especially for the younger generation trained in MI, expecting to increase their international presence in Europe. But future events disturbed these prospects.

Yugoslavia has entered a period of political turmoil, which led to its dissolution. A little more than two years after the founding of CSMI, in mid-1991 began the aggressive war against Croatia (the main aggression ceased at the beginning of January 1992, but the war ended in August 1995). It caused many victims and great destruction, and many members of CSMI were engaged in defending the country and fighting for its freedom and independence. This of course influenced the work and development of CSMI. But difficulties occurred also in international cooperation. As examples let us mention two cases: (1) Due to the war threats, members of CSMI could not travel to Graz to attend the second meeting "AA 91–Alpe Adria–Informatica Medica" in early October 1991, but could be represented by their fellow Miroslav Madjaric (working at that time with Professor Gell); at this meeting participants from four countries– Günther Gell from Graz, Attila Naszlady from Budapest, Mateja Kozuh-Novak from Ljubljana and Miroslav Madjaric from Zagreb - issued a Resolution to the responsible governments "to stop fighting in Croatia and to induce a peaceful solution on the basis of democracy, freedom and respect for human rights"; and (2) Gjuro Dezelic could not travel to deliver his invited lecture at the "Conference on Training Strategies for Health Information Systems" organized by the Council of Europe and EFMI in Strasbourg, which was scheduled for October 31st, 1991 at 10:40 hours; this happened because at the beginning of that month the Commission of the European Communities, after the start of the war in Ex-Yugoslavia, decided to forbid all invitations of participants from that country to European conferences, as well as to cancel those in progress; at this conference Dezelic had to participate also as a member of the Programme Committee.

The war against Croatia, which followed after a short 10-days war against Slovenia at the end of June, led to the dissolution YAMI. In September 1991 the Slovenian and Croatian MI societies withdrew from YAMI, and the MI Society of BiH followed a few months later. After January 15th, 1992, when the Republic of Croatia was diplomatically recognized by the European Community member countries and most other Western countries, CSMI already on January 20th submitted its application for membership to EFMI and IMIA. Both organisations accepted CSMI´s application at their first formal meetings, and at the MEDINFO 1992 in Geneva CSMI became member of IMIA (on September 5th) and EFMI (on September 6th).

The candidacy of CSMI for the MEDINFO 1995 Congress in Zagreb, announced in 1990, was from the very beginning fully supported by the Croatian ministers of health and science as well as by the lord-mayor of Zagreb, but due to the post-war economic problems in the country CSMI could not continue any more to apply for the organization of this big world MI gathering in Croatia.


Figure 5. Opening of the Brijuni EFMI STC 2007; left: J. Kern, president of CSMI and member of EFMI Council addresses the participants; right: J. Kern (Croatia), G. Mihalas (Romania) and J. S. Bryden (United Kingdom)

Advancement of MI research in Croatia, beginning of CSMI biennial symposia and start of the CSMI Bulletin

After Croatia gained international recognition and became a member of the United Nations in May 1992, the opportunities for MI research began to normalize. CSMI could finally revive initial plans, stipulated at its founding, to organize national MI symposia. It was decided to organize them biennially, and the first was scheduled for October 21-22, 1993 in Zagreb. Since then, CSMI MI symposia are organized each two years until today. From the very beginning the proceedings to all symposia (published under the title "Medical Informatics") were prepared in advance and available to participants, and this habit important for the success of these scientific gatherings is kept until the present time. The main editors of the symposia proceedings, being a good indicator of MI topics investigated by Croatian MI professionals in this period, were from the beginning Josipa Kern and Mira Hercigonja-Szekeres, with several other CSMI members joining occasionally as co-editors.

The number of submissions at symposia in the nineties of the 20th century was about thirty, mostly in the form of full papers (in average 27), and a significant number of authors wrote their texts in English. The 3rd Symposium in 1997 in Split introduced as a novelty a video conference between Split and Zagreb, provided in cooperation with CARNet – the Croatian Academic and Research Network. The success with video-conferencing has enabled to organize the 4th Symposium in 1999 entirely as a video conference between the four major medical centres in Croatia: Zagreb–Osijek–Rijeka–Split. The submissions covered various MI topics: (1) information systems (IS) in hospitals, (2) IS in primary healthcare and public health, (3) software and databases, (4) data security and classification, (5) standardization in MI, (6) signal and image processing, (7) telemedicine, (8) medical decision support systems, (9) modelling and simulation, (10) education in MI (there was a total of 107 full papers [32 in English, other in Croatian] in the 4 volumes of proceedings from 1993 to 1999; the numbers in particular topics were as follows: [1] 22, [2] 24, [3] 9, [4] 5, [5] 5, [6] 14, [7] 6, [8] 8, [9] 4 and [10] 9 papers), showing a rather broad range of subjects, some of them quite contemporary, which were investigated by Croatian MI professionals in these days. As the 1st symposium in 1993 was held shortly after the end of war, an extraordinary topic was introduced - MI in emergency conditions. Here an interesting work was presented by Neven Henigsberg and co-authors describing an information system connecting 32 healthcare institutions, based on digital data exchange by using packet-radios (the then available wireless technology), able to communicate large quantity of data collected during disasters (in the pertinent case in besieged areas) and stored in databases, when existing communication infrastructure is disabled.

In parallel to the introduction of MI symposia in 1992 CSMI started to publish its periodical named "Bilten HDMI" (CSMI Bulletin, ISSN 1330-0253). The first editor-in-chief was Josipa Kern, followed in 1996 by Silvije Vuletic, who edited it until 2004. In the same period a change occurred also in the person of the CSMI representative in the EFMI Council and IMIA General Assembly. The CSMI president Gjuro Dezelic, who had the observer status of his country in these bodies since 1978, and continued to serve as the official representative since 1990, after joining the Croatian diplomacy could not fulfil this duty any more asked for a successor, so the CSMI vice-president Josipa Kern overtook the duties of the CSMI representative to EFMI and IMIA in 1994. After the beginning of work in the field of medical decision-making and expert systems at the end of the eighties of the 20th century, despite unfavourable post-war economic conditions in the country, two new research projects were started: (1) "Heuristic decision support systems in healthcare" (led from 1991 to the end of 1992 by Gjuro Dezelic, and from 1993 to 1994 by Josipa Kern), and (2) "Information technologies and decision-making in healthcare" (led from 1996 to 1999 by Josipa Kern). The results were published in more than twenty papers, including a PhD thesis and several Master's theses. The methods applied were: inductive learning, neural networks, pattern recognition and text analysis (21).

Development of MI projects

In the nineties of past century new projects in the field of health information systems appeared, based on new ICT technologies - local computer networks, personal computers and Internet. Several applications were developed, serving needs of special health facilities, like general practitioners offices (Zadar, 1995) and institutions for the prevention and rehabilitation of diseases (Polyclinic for Prevention of Cardiovascular Diseases and Rehabilitation in Zagreb). In the field of image and signal processing, as well as computer assisted modelling, several research groups developed applications in orthopaedics, electroencephalography, dental medicine and other fields. First projects in telemedicine were introduced, starting with telepathology, alergology and teleradiology. They were reviewed (27) and followed in late nineties by a telemedicine project in isolated areas, with a number of Adriatic Sea islands chosen as test sites for first trials (beginning in 1998) (28).

Several new registries were established in the Croatian Institute of Public Health: Registry of health professionals (in 1991), Registry of persons treated for psychoactive drugs (in 1983) with regular annual reports on the epidemiology of addiction (started in 1999), Registry of persons with HIV/AIDS (established in 1985).

Further development of MI education

In the beginning of nineties, the MI laboratory at the School of Public Health has been equipped with a number of personal computers networked to a workstation of the Croatian Academic and Research Network (CARNet), the first Internet Service Provider (ISP) in Croatia (established in 1992). Except that medical students were now able to extensively use common software for text processing, spreadsheets, databases and statistical computing, they were also able to start using Internet and communicate via e-mail. This enabled them to become familiar with examples of the computer applications in doctor´s offices, information on drugs, computer-assisted instruction etc. They could start searching Medline databases and read electronic magazines. The postgraduate students were able to start studying special topics, like simulation modelling, methods of inductive learning, decision making by data mining and by free text analysis. In the year 1999, in collaboration with CARNet, the MI university teachers at all four Croatian medical schools - in Osijek (Vesna Ilakovac), Rijeka (Mladen Petrovecki), Split (Marijan Erceg) and Zagreb (Josipa Kern, Jadranka Bozikov) - organized a teleconference on telemedicine for students of medical schools, a project which provoked much interest among Croatian medical students.

In 1997 a fully revised edition of Dezelic´s MI textbook appeared under the title "Medical Informatics", published by CSMI, and a new chapter on medical decision-making was added (written by J. Kern) as a result of the increased interest for this special MI field among students (29). In this textbook MI is clearly defined as an interdisciplinary "scientific discipline that deals with the theory and practice of information processes, i.e. with data processing in the broadest sense", as well as it "deals with the procedures for handling of medical data, information and knowledge needed to solve medical problems and for decision-making in healthcare".

DEVELOPMENT IN THE 21ST CENTURY

Development of MI projects—Current status of computerization of the Croatian healthcare system

Figure 6. Participants at the Brijuni STC 2007

Since the beginning of the 21st century the Ministry of Health is committed to developing a national health information system in Croatia. The key drivers behind this decision were previous experience with computerized applications and health information systems development, coupled with a growing understanding of the importance of health information for making appropriate decisions in health care. Health information is used to treat individual patients or population groups, to plan health care and estimate health problems requiring intervention, as well as to ensure better use of resources.

In 2001 a group of experts, consisting of health professionals, MI professionals, and jurists was established to start a new project - an integrated national health information system (INHIS). The requirements for this system were that it should be centralized and cover primary health care (PHC, the 'gate keeper' in the Croatian healthcare system), as well as hospitals (the main generator of expenses in health care). The need for centralization derives from the fact that Croatia has a rather small population (< 5 million people), and the Croatian Public Health Institute and the Croatian Health Insurance Institute both require reports on health and health service status as well as surveillance of costs. Security and standardization were *sine qua non* requirements for the integrated health information system (30).

The first phase of the pilot project was based in general practitioner's (GP) offices which agreed to participate, and several hospitals (clinical and general hospitals). After the successful evaluation of the pilot results the hospital part of the project was halted, but the primary healthcare component continued to develop (31, 32). The PHC project was designed at two levels: central (kernel of the system) and local (individual GP offices). The kernel was run by one vendor, and the local applications were given to several vendors. At the same time a process for certifying local applications was established. The outcome of this process was that several vendors were certified to develop and install their applications in GP offices. All the GP offices holding contracts with the Croatian Health Insurance Institute were obliged to install one of the certified software systems by the end of 2008. By the end of 2007 about 50% had started the real work by using these applications. The most recent information (end of 2012) indicates that the implementation of these systems was successful. An evaluation procedure ("are the health professionals satisfied with") was completed (33). Recently, development of an integral evaluation instrument for the PHC information system has been under way (34).

Croatia is mindful of the importance of a regulatory framework for the computerization of its healthcare system and several relevant laws have been passed, one of which is the Personal Data Protection Law (35). In addition, an Agency for Personal Data Protection has been established to ensure compliance with this law. Other important legislation covers issues such as the relationship between electronic and paper documents, digital signatures, and standardization.

The ethical aspect of personal data protection is covered by the Code of Ethics for Health Information Professionals, passed by IMIA (36) and translated by CSMI (37). Although the hospital part of the INHIS project was halted, hospital directorates have continued to develop and implement particular ICT applications in their hospitals (38, 39, 40, 41).

In the Croatian Institute of Public Health a new registry was established. It is the Registry of persons with disabilities, established in 2002.

Wanting to direct the process of computerization in Croatia, the Croatian Academy of Medical Sciences (CAMS) established the Committee for e-Health (previously: the Committee on Telemedicine), with a mission to engage all stakeholders in the implementation/improvement of the INHIS in Croatia. The members of the Committee for e-Health are members of CAMS and CSMI. It issued the Declaration on e-Health, organized a debate among the members of both organizations, and finally published it at the CAMS's website (42). The settings of this Declaration entered into the "National Health Care Strategy" issued by the Croatian Ministry of Health. Also, it became a basis for development of the strategic document on e-Health in Croatia.

In the period 2007-2010 the project ACTION Grid (International Cooperative Action on Grid Computing and Biomedical Informatics between the European Union, Latin America, the Western Balkan and North Africa) (43) was established as the initiatives to create a common health information infrastructure in Europe, and extending it to other regions. The Facultad de Informatica, Universidad Politecnica de Madrid (Spain) was the coordinator of the project (Victor Maojo). The University of Zagreb, School of Medicine was a partner institution with Josipa Kern as the project leader from the Croatian side. The aim was to enhance cooperation between research centres, universities, hospitals, small and medium-sized enterprises, public entities and others, and expand the impact of European achievements in grid and biomedical informatics to researchers, educators, and health practitioners world-wide (44, 45, 46, 47, 48).

Current development in MI education

The e-Croatia Education Program started in the early years of the 21st century with the introduction of information science into the national curriculum at all levels - from elementary schools through to universities. The development of an appropriate ICT infrastructure was the first step. This involved building of computer classrooms and creating broadband access to the Internet via ADSL from 600 libraries, 700 primary schools, all secondary schools and higher education institutions (49).

Figure 7. Proceedings of Brijuni EFMI STC 2007

IMIA recommends that all health professionals should be acquainted with ICT and be able to use technology responsibly in their daily work. All health professionals should be educated in MI, as well as nursing informatics should be a part of the medical/nursing curriculum. Recently there are four medical schools at Croatian universities, and several nursing schools at baccalaureate level. All the university MI education programs are similar, using the same MI textbooks. However, the position in the medical/nursing curriculum is not the same.

Having several computer laboratories at the School of Medicine in Zagreb, students and teachers began to introduce e-learning into several subjects (pathology, brain research, physiology, etc.). However, MI and medical statistics are the subjects which make the greatest use of ICT, not just as an educational tool, but also as a way of solving information problems in medicine and healthcare. Recently, all courses at the School of Medicine in Zagreb have developed e-lectures, put their teaching material to local Intranet, and realized communication with students by using their internal system maintained by the School´s Office for e-learning, and supervised by using the authentication and authorization infrastructure (AAI) of research and high education system implemented in the Republic of Croatia (50).

In 2009 a new comprehensive MI textbook was published, again under the title "Medical Informatics". This was a big innovation in Croatian MI publishing, as it serves both for educational and scientific/professional purposes. It is a work of 42 Croatian authors - university teachers (8 professors, 1 lecturer and 6 assistants from all four Croatian medical schools, 2 professors from other university institutions), scientists and professionals from health institutions and firms engaged in MI projects (51). It is officially recognized as a university textbook in all medical schools in Croatia, but has also characteristics of a MI manual, suitable for other medical practitioners and health professionals interested in MI. Recently, this textbook serves also as a basis for the elective course “Biomedical Informatics” at the Faculty of Electrical Engineering and Computing, University of Zagreb.

The current MI professors at Croatian medical schools and applied health studies are Josipa Kern and Jadranka Bozikov (University of Zagreb), Mladen Petrovecki, Lidija Bilic-Zulle and Gordana Brumini (University of Rijeka), Vesna Ilakovac (University of Osijek), Zoran Djogas (University of Split) and Mira Hercigonja Szekeres (Applied Health Studies Zagreb).

Graduate study curricula for medical and nursing students in Croatia

As an example of MI teaching at Croatian universities, the MI curricula at the School of Medicine in Zagreb will be described.

The MI curriculum for medical students begins with basic ICT skills as an elective course at the beginning of the study. MI for students of the fifth year includes topics relevant to acquaint the students with the concept and tasks of medical informatics as an interdisciplinary profession that deals with the theory and practice of information processes in medicine, health care and research.

The nursing informatics curriculum starts in the second year of the graduate study in nursing (52). The course begins with basic ICT skills and continues with the concepts and tasks of nursing informatics and its role in the nursing process, health care and research.

Both curricula are delivered through lectures, seminars and practical work in computer labs.

Postgraduate study curriculum

At present the specialized postgraduate MI program at the School of Medicine in Zagreb is suspended. However, there are several MI courses in other postgraduate and doctoral programs. These include: Methods in MI, Knowledge discovery in medical domains, Statistical analysis of free text, Health information system management, Simulation modelling, Public health information systems, Bio-signal processing, and Medical image processing.

A new initiative in postgraduate education is the project at the University of Zagreb named “Curriculum Development for Interdisciplinary Postgraduate Specialist Study in Medical Informatics (MEDINFO)”. It started in August 2013 as a 18 months joint project of the Faculty of Organization and Informatics in Varazdin (project leader vice-dean Diana Simic) and the Andrija Stampar School of Public Health, School of Medicine in Zagreb (director Jadranka Bozikov). This project is included into the Croatian

Qualifications Framework of the Multi-annual Operational Program “Human Resource Development” as a grant within the External Actions of the European Union, and is performed in collaboration with CSMI, the Croatian Chamber of Economy and the Ericsson Nicola Tesla Company in Zagreb during 18 months.

ACTIVITIES OF CSMI

The first president of CSMI Gjuro Dezelic was on duty to the year 2004. The next presidents were: Josipa Kern (2004-2008, the vice-president until 2004), Mladen Petrovecki (2008-2009) and Vesna Ilakovac (2009 until today). In year 2004 the past president Gjuro Dezelic was elected honorary president of CSMI. The CSMI representatives to EFMI and IMIA were: Gjuro Dezelic (until 1994), Josipa Kern (1994-2010) and Mira Hercigonja-Szekeres (2010 until today).

Figure 8. CSMI Publications: Bulletin of CSMI (left), MI Textbook (right)

Two IMIA documents were translated to Croatian by CSMI and are available at the CSMI Website (53): (1) IMIA Code of Ethics for Health Information Professionals, and (2) IMIA Recommendations on Education in Biomedical and Health Informatics. A document relating to the protection of health information produced by the CSMI Working Group for Data Protection is also available at this website.

In light of the difficulties encountered when building networks and by the lack of interoperability between different systems, the need for standards in MI was recognized as a major challenge. Consequently, at its 4th Symposium in 1999 CSMI initiated the establishment of a local Technical Committee for Medical Informatics (TC 215) at the Croatian Institute for Standards (54, 55). The Committee was established in 2000 with Josipa Kern as its first president. The HL7 Croatia International Affiliate, initiated and established by CSMI and the Croatian Medical and Biological Engineering Society (CROMBES), is the second Croatian organization responsible also for standards in health and medical informatics. This affiliate was established in September 2002. The first president of HL7 Croatia was Gjuro Dezelic (2002-2008), followed by Stanko Tonkovic (2008-2011), and now by Miroslav Koncar (2011 until today) (56). At the HL7 Croatia Assembly, held on September 22, 2011 Gjuro Dezelic was elected honorary president of HL7 Croatia.

To maintain progress in developing health information systems in Croatia and to inform the rest of Europe about it, CSMI and EFMI organized an international meeting

(EFMI Special Topic Conference) titled “Medical Informatics in Enlarged Europe” in 2007 in Croatia on the Brijuni Islands (John Bryden, president of the Scientific Committee). Four EFMI working groups were represented (Primary Care Informatics, Electronic Health Record, Security, Safety and Ethics, and Nursing Informatics) and organized sessions with participation of local, regional and European speakers (57). The keynote lectures were devoted to globalization, progress and challenges of MI (Francis Roger France) and to trends in bio-medical research in Europe (Octavian Purcarea, George Mihalas). The Croatian invited speaker was Diana Simic, as the representative of the e-Croatia Agency. In its cooperation with associations having similar goals and activities, CSMI closely started collaboration with the Slovenian Medical Informatics Association (SIMIA) and HL7 Croatia in organizing ISHEP workshops and conferences (58) (in 2010, 2011 and 2013).

Figure 9. Proceedings of one of CSMI Symposia: Brijuni Symposium 2007

In the promotion of use of high quality electronic health record (EHR) systems in Europe the project “Thematic network on quality and certification of EHR systems” (EHR-QTN) started in 2009, with EuroRec Institute as the coordinator of a permanent network of National ProRec centres in Europe. This project was initiated by the EuroRec Institute (Jos Devlies). CSMI was one of partners in the project, with Vesna Ilakovac as the Croatian representative in it. As the result of these activities the Croatian ProRec Center was formed in November 2013 during the ISHEP conference in Dubrovnik.

REFERENCES

1. Dezelic Gj, Kern J. History of Medical Informatics in Croatia. Acta Inform Med. 2009; 17: 233-8.
2. Dezelic Gj. A Short Review of Medical Informatics History. Acta Inform Med. 2007; 15: 43-8.
3. Dezelic Gj. After Three Decades of Medical Informatics Europe Congresses. Stud Health Technol Inform. 2009; 150: 3-7.
4. Masic I. Contribution of Andrija Stampar to the Development of Public Health. Mater Sociomed. 2008; 20: 178-85.
5. Dezelic Gj. The Development of Medical Data Bases and Organization Problems of Health Information Systems (in Croatian). In: Proceedings 22th JUREMA Conference “Medicine and Technology”. Zagreb: JUREMA; 1977; T1-5.

6. Collen MF. Implementing Hospital Computer Systems - General Requirements. In: Collen MF, Ed. Hospital Computer Systems. New York-London-Sydney-Toronto: J. Wiley and Sons; 1974: 3.

7. Dezelic G, Kern J, Petrovecki M, Ilakovac V, Hercigonja-Szekeres M. Medical Informatics in Croatia - a Historical Survey. Acta Inform Med. 2014 Feb; 22(1): 49-59. doi: 10.5455/aim.2014.22.48-59.

8. Long JM, Beckman ChB, Wilson RV. Experience Teaching Computer Programming to Medical Students. J Med Educ. 1965; 40: 675.

9. Report of the Royal Commission on Medical Education (Chairman Lord Todd). London: Her Majesty´s Stationery Office; 1968: 29.

10. Dezelic Gj. Educational Problems in Teaching Health Informatics to Medical Students; International Conference on Medical Computing, Medical Informatics Berlin, 1979. Lecture Notes in Medical Informatics 5. Berlin-Heidelberg-New York: Springer-Verlag, 1979: 73-79.

11. Mihalas G. Evolution of Concepts in Medical Informatics. Panel „History of Medical Informatics in Europe", EFMI STC 2013 "Data and Knowledge for Medical Decision Support", Prague, Czech Republic, 2013; Available at: http://stc2013.org/joint-activities/panels–2nd part.

12. Hasman A, Mantas J. Abridged History of Medical Informatics Education in Europe. In the Panel quoted in loc. cit. 11.

13. Dezelic Gj, Golec B, Manhalter T, Milonja Z, Strnad M. Health Information System of the City of Zagreb as a Prerequisite for Systematic Follow-up of the Healthcare System Functioning and Development (in Croatian). Materia Socio-medica Iugoslavica. 1982; 5: 617-25.

14. Dezelic Gj, Kern J, Vuletic S, Ivankovic D. Development of Health Information Systems for Health Centers Delivering Primary Care in Distributed Environment. Proceedings of the 7th International Congress MIE 87. Rome 1987; Vol. I, pp. 203-8.

15. Weed LL. Medical Records that Guide and Teach. NEJM. 1968; 278: 593-600.

16. Kopjar B, Kern J, Juresa V, Ivankovic D, Vuletic S, Dezelic Gj. A Microcomputer Based Comprehensive Problem-oriented Medical Record System for PHC. In: Proceedings of the 8th International Congress MIE 88. Oslo, 1988: 207-11.

17. Lovrek V, Madjaric M. Hospital Information System Development under Conditions of Limited Hardware Resources. In: Proceedings of the 5th International Congress MIE 84. Brussels, 1984: 51-5.

18. Lovrek V, Madjaric M, Dezelic Gj. Basic Data Set and Local Classifications. In: Proceedings of the 6th International Congress MIE 85. Helsinki, 1985: 225-9.

19. Jarnjak S, Kern J, Dezelic Gj. Conversational Statistical Program (CSTAT). In: Proceedings of the 9th International Symposium on Information Processing, INFORMATICA 74. Bled 1974: 1-8.

20. Dezelic Gj, Kern J, Mesaric V, Vuletic S, Zagar M. An Interactive Statistical Package for Biomedical Research. In: Proceedings of the 12th International Symposium on Information Processing, INFORMATICA 77 Bled, 1977: 1-8.

21. Dezelic Gj, Kern J, Bozikov J. Medical Informatics - Contribution of the Andrija Stampar School of Public Health to Croatian Medicine and Health Care for the Transition to the 21th Century (in Croatian). Lijec Vjesn. 2002; 124 (Suppl. 2): 21-7.

22. Kern J, Dezelic Gj, Tezak-Bencic M, Dürrigl Th. Medical Decision-making by Using a Program for Inductive Learning (in Croatian). In: Proceedings 1st Yugoslav Congress for Medical Informatics. Belgrade, 1990: 221-8.

23. Dezelic Gj. Medical Informatics Teaching at Medical Schools: Problems and Prospects. In: Adlassnig K-P, Dorda W, Grabner G (Eds.) - Medizinische Informatik. Wien-München: R. Oldenbourg Verlag 1981: 82-89.

24. Dezelic Gj. Fundamentals of Informatics (in Croatian, 1st Ed.). Zagreb: University of Zagreb, School of medicine 1976; 78 pp. Dezelic Gj. Health Informatics (in Croatian, 4th Ed.). Zagreb: University of Zagreb, School of Medicine; 1989, 122 pp.

25. Kern J, Bozikov J. Health Informatics Laboratory Manual (in Croatian: Praktikum iz zdravstvene informatike). Zagreb: Medicinski fakultet Sveucilista u Zagrebu; 1990: 73 pp.

26. Van Goor JN. Standards in Health Care Informatics, a European Aim. In: Data Handling in Science and Technology, Vol. 6, Proceedings of the Scientific Computing and Automation (Europe) Conference. Amsterdam: Elsevier; 1990: 365-370.

27. Kovacic L, Loncaric S, Paladino J, Kern J. Croatian Telemedicine. Stud Health Technol Inform. 2000; 77: 1146-50.

28. Margan A, Rustemovic N, Loncaric S. Virtual Polyclinic - a Consultant Health Service for Rural Areas and for Islands (in Croatian). Acta Med Croatica. 2005; 59: 169-78.

29. Dezelic Gj. (with collaboration of J. Kern). Medical Informatics (in Croatian). Zagreb: Croatian Society for Medical Informatics. 1997; 164 pp.

30. Koncar M. Implementing the HL7v3 Standard in Croation Primary Healthcare Domain. Stud Health Technol Inform. 2004; 105: 325-36.

31. Koncar M, Gvozdanovic D. Primary Healthcare Information System - the Cornerstone for the Next Generation Healthcare Sector in Republic of Croatia. Int J Med Inform. 2006; 75: 306-14.

32. Gvozdanovic D, Koncar M, Kojundzic V, Jezidzic H. National Healthcare Information System in Croatian Primary Care: the Fundation for Improvement of Quality and Efficiency in Patient Care. Inform Prim Care. 2007; 15: 181-5.

33. Andrijasevic L, Angebrandt P, Kern J. Users' Satisfaction with the Primary Health Care Information system. Croat Med J. 2012; 53: 60-5.

34. Kralj D. Dissertation. University of Zagreb (under way).

35. Law on the Protection of Personal Data (in Croatian). Narodne novine. 2003; 103.

36. IMIA Code of Ethics for Health Information Professionals. Available at: http://www.imia.org/ethics.lasso.

37. Croatian Society for Medical Informatics. Available at: http://www.hdmi.hr.

38. Majdancic Z, Jukic V, Bojic M. Introducing Computer Units into the Reception Office as Part of the Vrapce Psychiatric Hospital Information System (in Croatian). Acta Med Croatica. 2005; 59: 179-84.

39. Plasaj T. Development of the Information System at the Sisters of Mercy Clinical Hospital (in Croatian). Acta Med Croatica. 2005; 59: 213-8.

40. Pale I. Hospital Information System - Project of Implementation of the SAP Information system at Holy Spirit General Hospital (in Croatian). Acta Med Croatica. 2005; 59: 225-32.

41. Petrovecki M, Raunic D, Cej D, Vukovic D. Implementation of Integrated Hospital Information System in the Existing Hospital Organization - Experience at Dubrava Clinical Hospital in Zagreb (in Croatian). Acta Med Croatica. 2005; 59: 219-24.

42. Declaration on E-Health. Available at: http://www.amzh.hr/news%20and%20events.html.

43. ACTION-Grid. Available at: http://www.action-grid.eu/index.php?url=home.

44. Kern J, Fister K, Petrovecki M, Polasek O, Stevanovic R, Vuletic S, Maojo V, Martin-Sanchez F, Potamias G, Gonzalez Bernaldo de Quiros F, Gonzalez D, Legre Y, Moustakis V. Action-grid: International Networking in Grid Computing and Biomedical Informatics. Acta Inform Med. 2008; 16(3): 156-8.

45. Maojo V, Fritts M, Martin-Sanchez F, De la Iglesia D, Cachau RE, Garcia-Remesal M, Crespo J, Mitchell JA, Anguita A, Baker N, Barreiro JM, Benitez SE, De la Calle G, Facelli JC, Ghazal P, Geissbuhler A, Gonzalez-Nilo F, Graf N, Grangeat P, Hermosilla I, Hussein R, Kern J, Koch S, Legre Y, Lopez-Alonso V, Lopez-Campos G, Milanesi L, Moustakis V, Munteanu C, Otero P, Pazos A, Perez-Rey D, Potamias G, Sanz F, Kulikowski C. Nanoinformatics: Developing New Computing Applications for Nanomedicine. Comput Sci Eng. 2012; 94(6): 521-39.

46. De la Iglesia D, Maojo V, Chiesa S, Martin-Sanchez F, Kern J, Potamias G, Crespo J, Garcia-Remesal M, Keuchkerian S, Kulikowski C, Mitchell JA. International Efforts in Nanoinformatics Research Applied to Nanomedicine. Methods Inf Med. 2011; 50(1): 84-95. doi: 10.3414/ME10-02-0012.

47. De La Iglesia D, Chiesa S, Kern J, Maojo V, Martin-Sanchez F, Potamias G, Moustakis V, Mitchell JA. Nanoinformatics: New Challenges for Biomedical Informatics at the Nano Level. Stud Health Technol Inform. 2009; 150: 987-91.

48. Chiesa S, De La Iglesia D, Crespo J, Martin-Sanchez F, Kern J, Potamias G, Maojo V. European Efforts in Nanoinformatics Research Applied to Nanomedicine. Stud Health Technol Inform. 2009; 150: 757-61.

49. Kern J. Health and Medical Informatics in Croatia. Health Info Libr J. 2008; 25: 302-8.

50. EduHr. Available at: http://www.srce.unizg.hr/homepage/products-services/middleware/aaieduhr/.

51. Kern J, Petrovecki M, Eds. Medical Informatics (in Croatian). Zagreb: Medicinska naklada, 2009; 390 pp.

52. Kern J, Bozikov J, Fister K, Cisic-Svetic R, Gacina S. Nursing Informatics at the University Graduate Nursing Study (in Croatian). In: Proceedings of the CSMI symposium Medicinska informatika 2013. Dubrovnik, HDMI 2013; 13-16.

53. Croatian Society for Medical Informatics. Available at: http://www.hdmi.hr.

54. Kern J, Strnad M, Dezelic Gj. Role of Standardization in Healthcare System Computerization (in Croatian). Acta Med Croatica. 2005; 59: 201-7.

55. Kern J. Standardization in health and medical informatics. In: Lazakidou AA, Ed. Informatics in Healthcare and Biomedicine. Hershey: Idea Group Reference; 2006.

56. HL7 Hrvatska. Available at: http://www.hl7.hr.

57. Bryden J, de Lusignan S, Blobel B, Petrovecki M, Eds. Proceedings of the EFMI Special Topic Conference 2007, Brijuni (Croatia), 1 May-30 June 2007.

58. ISHEP is the acronym for “InterOperability and Standards in Healthcare–European Perspective”. Available at: http://www.ishep.org.

15

Jana Zvarova

MEDICAL DECISION SUPPORT AND MEDICAL INFORMATICS EDUCATION

The International Federation for Information Processing (IFIP) is a non-governmental, non-profit umbrella organization for national societies working in the field of information processing. It was established in 1960 as a result of the first World Computer Congress held in Paris in 1959. IFIP has developed its activities through so-called technical committees (TC). The IFIP-TC4 was founded by Frangois Gremy, from France, in 1967. The first interactions of Czechoslovakia with the field of medical informatics started at this time. In the late sixties, the Medical Cybernetics Unit was established at the Institute of Hematology and Blood Transfusion in Prague. One of the three groups of the Medical Cybernetics Unit was focused on research on computer-supported medical decision making, pattern recognition, and health services evaluation. This group organized the first conference Decision processes in clinical medicine in Prague in 1972. This group's research progress was to the great merit of Albert Perez, member of IFIP, who was a leader of the Czech school of information theory. Albert Perez endorsed two of his Ph.D. students to be representatives to the IFIP-TC4 on medical informatics topics. The International Medical Informatics Association (IMIA) grew out of the former TC 4 of the IFIP in 1979. Francois Gremy and Peter Reichertz from Germany deserve credit for the spread of the term medical informatics all over the world.

In Czechoslovakia, the research work of the Medical Cybernetics Unit was stopped as a result of an administrative decision in 1977. The need to pursue the research work and discuss remaining problems lead the researchers of the former Medical

*This text is republished with permission of Publisher: Schattauer GmbH, Publishers for Medicine and Natural Sciences Hoelderlinstrasse 3 / 70174 Stuttgart. Some parts are corrected and edited by editors of this book.

Cybernetics Unit to create the Medical Informatics Section in the Czechoslovak Society of Biomedical Engineering in 1979.

THE BIRTH OF MEDICAL INFORMATICS (1970 - 1989)

In the early 1970s, new developments brought first prototypes of decision support systems in medicine and health care to Czechoslovakia. In 1980s, new information and knowledge in the field of medical informatics was acquired by Czechoslovakian researchers mainly through MEDINFO and MIE conferences and through some national conferences with international participation described further in more detail.

The 1981 National Conference with International Participation on Medical Informatics

The national conference Medical Informatics was organized by the Medical Informatics section of the Czechoslovak Society of Biomedical Engineering on 26-28 August, 1981, in Prague. The conference gathered more than 100 Czech and Slovak participants. There were three invited lectures given by Peter Adlassnig from Austria, Paul Chastang from France, and by the IMIA President Jan Roukens from the Netherlands.

IFIP-IMIA international Working Conference on Computer-Aided Medical Decision Making

During the MEDINFO 1983 Congress in Amsterdam, Jana Zvarova discussed with Jan van Bemmel the intention of the Czechoslovak Society of Biomedical Engineering to organize an IMIA working conference in Prague. Jan van Bemmel strongly supported this idea and promised to chair the Program committee. The first IMIA conference held in a socialist country was organized in Prague, Czechoslovakia from September 30th to October 4th 1985. Figure 1 shows Jan van Bemmel, chair of the Scientific Program Committee (SPC), Jana Zvarova, chair of the Local Organizing Committee (LOC), and Shigekoto Kaihara (then IMIA president) from Japan. The proceedings made of selected full papers, titled Diagnostic Strategies and Expert Systems, were published by Elsevier, North Holland (1). Among 79 published papers in the proceedings, 30 papers were from Czechoslovakian authors.

The 1988 National Conference Computers with International Participation on Medical Education

The conference was organized by Charles University in Prague on their premises in August 29-31, 1988. The languages used at the conference were Czech, Slovak, English, and Russian. The papers of the conference focused on using computers in teaching biophysics, physiology, and clinical disciplines, on medical informatics education, and on the use of expert systems. The international speakers were F. Gremy (France), S.A. Simbircev (Union of Soviet Socialist Republics), H. Weihrauchand and J. Michel (German Democratic Republic), R. Engelbrecht (Federal Republic of Germany), J. Doroczewski (Polish People Republic), and G. Mihalas (Romanian Socialist Republic).

THE CHILDHOOD OF MEDICAL INFORMATICS (1990 - 1999)

The Velvet Revolution in Czechoslovakia, initiated by a students' strike on November 17th, 1989, opened the door for cooperation in science and education with a number of western countries. In 1990s, medical informatics topics were further developed in education and decision support tasks at the national level and through international co-operations.

IMIA Working Conference in Prague 1990

The second IMIA conference held in Prague, 3-7. September 1990, focused on medical informatics and medical education (Figure 2). It brought together participants from 18 countries from all over the world and the proceedings, titled Knowledge, Information and Medical Education, were published by Elsevier in 1991. The proceedings contained over 60 contributions describing the influence of computers on medical education (in the curriculum and at the postgraduate level) and the education in medical informatics in general (2).

Education in the Methodology Field of Healthcare

Due to political changes in the last decade of the twentieth century, Central and Eastern European countries were able to receive support through selected programs of the European Union. The first European project focused on medical informatics education, titled Education in the Methodology Field of Healthcare - EuroMISE (European education in Medical Informatics, Statistics and Epidemiology) was operational from 1993 to 1995. The key issues of this educational programme were to promote multidisciplinary approaches and to focus on healthcare issues that received insuffi-

Figure 1. Shigekoto Kaihara with chairs of the LOC and SPC at the IMIA conference in Prague, 1985.

cient attention in traditional training (3, 4). The project developed educational programs and designed courses in a broad European co-operation focusing on teaching teachers and health professionals from Central and Eastern European countries. EuroMISE courses given in English consisted of 200 hours of teaching, and more specifically, 160 hours of direct teaching (lectures and practices) and 40 hours devoted to the preparation of the lectures presented by students at EuroMISE workshops and conferences. Moreover, students were given three months to prepare a final thesis on a subject taught during EuroMISE courses.

Czech participants had a sound experience during visits at universities participating in the project. Visits were organized by cooperating EU teachers. In the field of medical informatics, several visits were organized by J. H. van Bemmel and A. Hasman (The Netherlands), R. Engelbrecht, and R. Haux (Germany), and B. Richards (United Kingdom). Participants of EuroMISE courses were able to discover new methods of teaching medical informatics, especially in cooperation with universities, e.g. medical informatics courses developed by the University of Heidelberg (R. Haux) and Heilbronn (H. Dickhaus). The last conference organized in frame of the EuroMISE project was the conference Information, Health and Education, held in Prague, October 20-23, 1995. Among delegates of the conference, there were more than 70 participants from the Czech Republic and other Central and Eastern European countries, who successfully completed the EuroMISE courses. These participants received a Certificate during the Ceremonial session in the Aula Magna of Charles University in Prague.

Figure 2. Participants of the IMIA Working Conference in Prague, 1990.

Managing Uncertainty in Medicine

The second European project entitled Managing Uncertainty in Medicine with the acronym MUM, was operating from 1994 to 1996. The goal was to contribute to the emerging unification theory of managing uncertainty, when both probabilities and logical approaches were applied, and incorporate these methods into diagnostic knowledge-based systems and smart systems for data analysis. Another important part was to gain practical experience in the field of medical data analysis and knowledge processing by introducing software tools in selected medical health care facilities and by developing decision support systems to be used in various health care facilities in order to offer better treatment to patients, especially in situations where clinical experience may be lacking.

European Center for Medical Informatics, Statistics and Epidemiology (EuroMISE Center)

Both EuroMISE and MUM projects contributed to the founding of the joint programme of the Charles University in Prague and the Academy of Sciences of the Czech Republic named the European Center for Medical Informatics, Statistics and Epidemiology (EuroMISE Center) on 12th April 1994. At the occasion of the EuroMISE Center founding, a one-week conference Medical Informatics Education and Research was held in Harrachov in the Czech Republic. The EuroMISE Center started its joint activities among the Faculty of Mathematics and Physics of Charles University, the First Faculty of Medicine of Charles University, and members of the Institute of Computer Science of the Academy of Sciences of the Czech Republic. In the following years, the activities of the EuroMISE Center were significantly supported by several European grants and during the years 2000-2004 by the national program of research centers of the Czech Republic of the Ministry of Education, Youth and Sports. This support allowed the extension of the multidisciplinary cooperation of the EuroMISE Center to three more institutions, namely the University of Economic in Prague, the University General Hospital in Prague, and the Municipal Hospital in Caslav. An intensive collaboration between the Faculty of Science and the Second Faculty of Medicine of the Charles University was formalized.

Information Technology for Education and Training

The main goal of the 4th framework program of European countries titled IT EDUCTRA (Information Technology EDUcation and TRAining) operating from 1996 to 1998 was to contribute to the information distribution from of information technology in education and training in medicine. Twenty universities and research workplaces and companies took part in the project, among them the EuroMISE Center. One aim was to develop teaching materials in different European languages (including the Czech language) from research results reached in Spain, Germany, Italy, Denmark, Great Britain or other countries. High priority was given to topics such as electronic communication, patient electronic records, safety and security of data, computer-assisted diagnosis, and management of health care quality. Based on the analysis of educational needs in medicine, ten topics were selected for health care education, each of them covering many incremental subjects and disseminated on a CD (5).

EuroMISE Courses from 1996 to 1999

The financial support given for the EuroMISE project stopped December 31st 1995. Nevertheless, courses were conducted in Prague until the year 1999 due to the personal support of many teachers from organizations participating in the EuroMISE project and the personal involvement of other medical informatics colleagues, like Jean Raoul Scherrer from Switzerland and Ioana Moisil from Romania. Between 1996 and 1999, the number of countries and teachers increased and the EuroMISE Center welcomed in Prague students not only coming from Central and Eastern European countries but also from Belgium, Ireland, Turkey, and the United Kingdom. Therefore, through EuroMISE courses, about 150 participants graduated in total. In 1999, a small conference was held at the occasion of the 5th anniversary of the EuroMISE Center. European cooperation stimulated the development of courses and teaching materials in Czech language for a broad dissemination in graduate, postgraduate, and life-long education in the Czech Republic.

Integration and Communication for the Continuity of Cardiac Care

The Integration and Communication for the Continuity of Cardiac Care (I4C) European project was further developed in Czech and Slovak languages as a TripleC Project. It was undertaken between 1998 and 2000 in three hospitals of Eastern Europe (in Prague, Caslav, and Bratislava). The goals of the TripleC Project were to test and further develop methods proposed in the I4C Project to design the ORCA (Open Record for Care) Electronic Health Record (EHR) applied to cardiology (6, 7). This project led to the creation of the first structured EHR in both Czech and Slovak languages and evidenced the importance of structuring the information to allow systems interoperability in health care.

The knowledge acquired from the TripleC Project was further advanced in the national research centers project EuroMISE-Cardio (2000-2004), where multidisciplinary research in the field of EHR and decision support systems was conducted with a focus on cardiology and dentistry. The priority was to propose and develop appropriate tools for structured data entry, representation, and processing in order to minimize the effort of users (physicians, nurses) and maximize the clinical relevance of collected data. The suggested Czech solution was implemented in a pilot application named MUDR (MUltimedia Distributed electronic health Record) (8, 9). Two cardiology outpatient clinics were involved in gathering patients' data and validating research prototypes. The Minimum Data Model of a Cardiology Patient was proposed and research in formalizing clinical guidelines in cardiology was initiated. A voice-recognition component of an EHR used in dental medicine, titled DentCross, was developed and semantic interoperability in cardiology was studied. The synergy of both voice recognition and the graphical representation of data made activities in the dental practice easier, quicker, and more comfortable (10, 11). Since 2004, a dental EHR with the interactive voice-recognition DentCross component has been in use in dental care at the University Hospital in Prague-Motol.

Medical Guideline Technology

The MGT (Medical Guideline Technology) European project was conducted during the years 1998 to 2000. The project focused on the development of computerized tools providing patient-specific practice guidelines (combining general guidelines for specific medical circumstances and specific conditions with a valid price model). Three main applications were created in the same medical domain of hypertension and cardiology by countries that differed in their health care systems, available resources, and organizational structures.

THE ADOLESCENCE OF MEDICAL INFORMATICS (2000 -2013)

Central and Eastern European (CEE) countries made many efforts to be included in the main research and development activities conducted in Europe in the field of medical informatics. CEE countries, including EU CEE countries operate in different environments in terms of economic transformation and status, as well as health care systems. The development of electronic healthcare in the Czech republic was significantly accelerated by education and a broadened research and development in co-operation with all EU countries in the field of medical informatics.

Ph.D. Studies in Biomedical Informatics at Charles University in Prague

The agreement of cooperation of the Charles University in Prague and the Academy of Sciences of the Czech Republic on the doctoral degree study programs in biomedicine was signed on April 23rd, 1997. There are now 20 boards of scientific disciplines in postgraduate doctoral studies in biomedicine at Charles University in Prague. As a result of the initiative of the First Faculty of Medicine, in cooperation with the EuroMISE Center, the scientific board of Biomedical Informatics was established in 2001 (12). Courses were given in Czech and English languages. Doctoral degree study programs are provided either as fulltime programs or in a combined form. The full-time program lasts four years and the combined form can last a maximum of nine years. The requirements for the successful completion of the education program leading to the Ph.D. degree are to pass the National doctoral examination in a chosen field and to defend a thesis, compiled on the basis of personal papers published in peer-reviewed journals.

IMIA Recommendations on Education in Health and Medical Informatics updated in a second version published in Methods of Information in Medicine (13) have been a valuable material for medical informatics education at the Ph.D. level. Students of the Board of Biomedical Informatics are also active in workshops of their specific research field, which are held at the First Faculty of Medicine of Charles University in Prague.

In 2011 and 2012, discussions during workshops were enriched by the questions and comments of the foreign chairs of the workshops B. Blobel (2011) and A. Hasman (2012). In biomedical informatics courses designed for doctoral degree studies, we regularly use interactive electronic books, video films, and audio presentations of lectures. Based on the knowledge gathered from the European projects, the EuroMISE Centre has started to develop two editions titled Biomedical Informatics and Biomedical Statistics published in Czech language. Five volumes have been published to date in the Biomedical Informatics edition and three volumes in the Biomedical Statis-

Figure 3. Workshop of Ph.D students at the 1st Faculty of Medicine of Charles University in Prague, 2011.

tics edition. Both editions have been published by the Carolinum Printing House of Charles University in Prague. Since 1998, the ExaMe system is being developed to evaluate students on a targeted knowledge (14). The system is based on generalized multiple-choice questions. There is no prior restriction on the number of offered answers, but at least one answer is correct and at least one is wrong. The new research how to evaluate students' knowledge using the

ExaME system can be found in the paper by Martinkova.et al. (15) and in the book by Dostalova et al. (16).

International Joint Meeting EuroMISE 2004

Between 12 and 16 April 2004 more than 200 experts from 30 countries gathered in Prague, Czech Republic, to participate to the International Joint Meeting EuroMISE 2004, which consisted of the IMIA working conference Statistical Methodology in Bioinformatics and Clinical Trials and three parallel symposia. The first symposium, organized in cooperation with EFMI focused on Electronic Health Record, Healthcare Registers and Telemedicine, the second symposium centered on Computerized Guidelines and Protocols and the third symposium, held at the 10th anniversary of the EuroMISE Centre, focused on Biomedical Informatics and Biomedical Statistics Education. Moreover, one workshop focused on RTD potential of Central and Eastern Europe for building Information Society in Healthcare and another workshop was

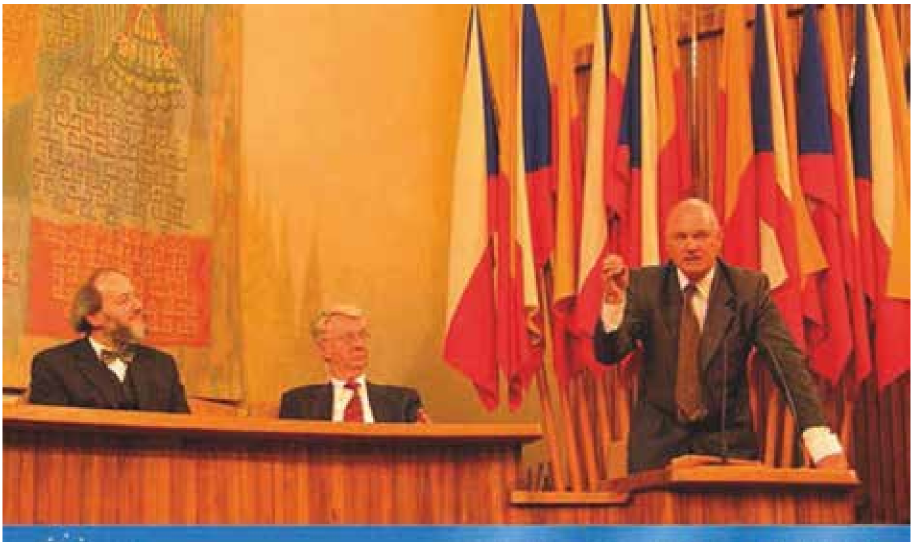


Figure 4. J. C. Healy from the European Commission intruduces eHeatlh concept

on HL7 Standards. Detailed information about EuroMISE 2004 conferences, satellite symposia, and workshops were published in special issues of the International Journal of Medical Informatics (17, 18), and Methods of Information in Medicine (19, 20). Keynote speeches were given in the Aula Magna of the Charles University in Prague with great impact on the audience (Figure 4).

Information Technology for the Development of Continuous Shared Health Care

The Information Society program of the Academy of Sciences of the Czech Republic was operating from 2004 to 2008. It's theme was the development of methods and tools for providing shared health care continuity in the information society. Research focused on the remote access to information either as data or knowledge from medical records using HL7 standards. It was validated in co-operation with the Municipal Hospital in Caslav.

Center of Biomedical Informatics

The Center for Biomedical Informatics was operated during the period from 1st March 2006 -to 31st December 2011 with the support of the Czech Research Centers program of the Ministry of Education, Youth and Sports of the Czech Republic as the joint work environment for five organizations. This project had the following main goals a) development of a protocol using an optimal set of genes for the diagnosis and prognosis of cardiovascular diseases, b) design of decision support systems for the diagnosis and personalization of health care in cardiology, c) design of deci-

Figure 6. Participants of the workshop Standards and Electronic Healthcare in 2011.

sion support systems for the diagnosis, therapy, and prognosis in dentistry and d) enhancement of quality in postgraduate Ph.D. education and training in the field of biomedical informatics. The research was successfully completed and results were made accessible as papers published in peer-reviewed journals, presentations made during prestigious international conferences, as prototypes of software systems, or as proven technologies, patents, utility patterns, and other outputs. Based on the results of the EuroMISE Center and of the Center of Biomedical Informatics, the platform for multidisciplinary research and higher education was created (21).

MEDICAL INFORMATICS IS GETTING MATURE

The importance of information in medicine continues to rise. Medical research and practice benefit from fast development of information and communication technologies. Challenges that medicine is now facing will not be met without access to even more expansive and higher-quality data. Medical applications based on information technology are sure to have a very strong potential to maintain or lower medical costs, improve quality, and support new medical agenda. Many eHealth applications support the processes of health care. It is expected that an increasing development of eHealth applications will influence also medical informatics education and training. Education is the core of the research and development. It is true for all business branches and the same holds for the health care industry. Since the year 2000, the Czech Society of Biomedical Engineering and Medical Informatics (often in co-operation with the EuroMISE Center) organized at least one workshop per year in the House of Physicians dedicated to a selected medical informatics topic. The workshop in 2001 titled International Standard HL7–a Pathway to Better Healthcare chaired by W. Ed Hammond from the Duke University in Durham, USA, introduced the HL7 organization and its activities. This workshop initiated the foundation of the HL7 group of the Czech Republic (22). The workshops in the House of Physicians introduced different topics to a broad audience of Czech physicians, engineers, and other healthcare workers and served also the dissemination of medical informatics knowledge to Ph.D. students. Figure 5 shows the participants of the workshop on Standards and Electronic Healthcare supported by GS1[1] Czech Republic and held in the House of Physicians in October 2011.

Medical informatics education has been incorporated to faculty curricula at several universities in the Czech Republic, e.g. Charles University in Prague, Czech Technical University in Prague, Masaryk University in Brno, and Technical University in Brno. The project MEFANET (MEdical Faculties NETwork) has been operating since 2007 and focuses on the progress in education of medical and health care disciplines using modern information and communication technologies. MEFANET aims at developing and strengthening the cooperation between Czech and Slovak medical faculties. More details about medical informatics education at medical faculties can be found in the web page of MEFANET (23) and in (24, 25, 26).

CONCLUSION

Since the foundation of IFIP-TC4 in 1967, the medical informatics field has grown significantly. There are now many journals and books devoted to the field. Of note is the survey initiated by Izet Masic regarding the journals issued in European countries that are members of EFMI (27). The European Journal for Biomedical Informatics that considers European's needs to share electronic information in the multilingual and multicultural European area is published in the Czech Republic (28). Further of note is the symposium on Biomedical Informatics: Confluence of Multiple Disciplines organized in Heidelberg June 11th 2011 at the occasion of the 50th anniversary of Methods of Information in Medicine (29).

However, there is still a lot of work ahead of us. First, we have to be clear on how we define the term informatics. Do we understand informatics as a computer science or do we consider it as a discipline focused on the information analyzed by different in-

1 GS1 is an international not-for-profit association with member organizations in over 100 countries. GS1 is dedicated to the design and implementation of global standards and solutions to improve the efficiency and visibility of supply and demand chains globally and across sectors. The GS1 system of standards is the most widely used supply chain standards system in the world.

formation sciences (30-35). Second, medical informatics started with a focus on medicine. Nowadays, medical informatics is growing and medical informatics research and education address both biomedicine and healthcare. The medical informatics field has grown to a broad field including biomedical and healthcare informatics. Healthcare informatics is focusing mainly on electronic healthcare development in different countries. Therefore it is focused on the eHealth concept (36) with healthcare applications to be judged not only from electronic but also from the economic and environmental points of view (37). The environmental view is considered at large, including culture, legislation, language, geographic position, healthcare, and social systems.

More than 40 years after the first national conference on medical decision support in Prague in 1972, we evaluated the development of the medical informatics field at the EFMI special topic conference Data and Knowledge for Medical Decision Support held in Prague, in April 2013 (38). Many research results from the medical informatics field are deployed in healthcare practice and support the forthcoming electronic healthcare.

REFERENCES

1. van Bemmel JH, Gremy F, Zvarova J, editors. Diagnostic Strategies and Expert Systems. Amsterdam: North Holland; 1985.
2. van Bemmel JH, Zvarova J, editors. Knowledge, Information and Medical Education. Amsterdam: North Holland; 1991.
3. Zvarova J. Education in Methodology for Health Care – EuroMISE. Methods InfMed 1994; 33: 315-317.
4. Zvarova J, Engelbrecht R, van Bemmel JH. Education and training in medical informatics, statistics and epidemiology in EuroMISE. Int J Med Inform. 1997; 45: 3-8.
5. IT EDUCTRA CD. Commission of the European Communities; 1998.
6. van Ginneken AM, Stam H, van Mulligen EM, de Wilde M, van Mastrigt R, van Bemmel JH. ORCA: the versatile CPR. Methods Inf Med. 1999; 38: 332-338.
7. van Bemmel JH, van Ginneken MA, Stam H, van Mulligen E. Integration and communication for the continuity of cardiac care. J Electrocardiol. 1998; 31: 61-68.
8. Spidlen J, Hanzlicek P, Riha A, Zvarova J. Flexible Information Storage in MUDR EHR. Int J Med Inform. 2006; 75: 201-208.
9. Hanzlicek P, Spidlen J, Heroutova H, Nagy M. User Interface of MUDR Electronic Health Record. Int J Med Inform. 2005; 74: 221-227.

10. Zvarova J, Dostalova T, Hanzlicek P, Teuberova Z. Nagy M, Pies M, et al. Electronic health record for forensic dentistry. Methods Inf Med. 2008; 47: 8-13.

11. Hippmann R, Dostalova T, Zvarova J, Nagy M, Seydlova M, Hanzlicek P, et al. Voice-supported Electronic Health Record for Temporomandibular Joint Disorders Methods Inf Med. 2010; 49(2): 168-172.

12. Zvarova J, Svacina S. New Czech Postgraduate Doctoral Program in Biomedical Informatics In: Surjan G, Engelbrecht R, McNair P, editors. Health Data in the Information Society, Proceedings of MIE2002. Amsterdam: IOS Press; 2002: 766-769.

13. Mantas J, Ammenwerth E, Demiris G, Hasman A, Haux R, Hersh W, et al. Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics, First Revision. Methods Inf Med. 2010; 49(2): 105-120.

14. Zvarova J, Zvara K. Evaluation of knowledge using ExaMe program on the internet. In: Iakovidis I, Maglaveras N, Trakatellis A, editors. User acceptance of health telematics applications. Amsterdam: IOS Press; 2000: 145-151.

15. Martinkova P, Zvara Jr. K, Zvarova J, Zvara K. The New Features of the Exame Evaluation System and Reliability of Its Fixed Tests. Methods Inf Med. 2006; 45: 310-315.

16. Dostalova T, Seydlova M. et al. Dentistry and Oral Diseases. Prague: Grada; 2010.

17. Zvarova J, Blobel B. Electronic Health Record Healthcare Registers and Telemedicine. Int J Med Inform. 2006; 3(75):183-252.

18. Zvarova J, Paralic J. International Joint Meeting EuroMISE 2004 Satellite Workshop on "RTD Potential in Central and Eastern Europe for Building Information Society in Healthcare". Int J Med Inform. 2006; 4(75): 255-342.

19. Zvarova J, Kulikowski C, Mansmann U. Statistical Methodology in Bioinformatics and Clinical Trials. Methods Inf Med. 2006; 45: 137-233.

20. Zvarova J, van Bemmel JH, Mc Cray A. Biomedical Informatics and Biomedical Statistics Education. Methods Inf Med. 2006; 45: 289-321.

21. http://www.cittadella.cz/cbi2012/index.php7pHn-dex&site=en (last access January 10th, 2013)

22. http://www.hl7.cz/cz/info/news.html (last access January 10th, 2013)

23. http://www.mefanet.cz/ and http://www.cittadella. cz/cbi2012/index.php?p=index&site=en (last access January 10th, 2013)

24. Zvarova J, Svacina S, Dostalova T, Seydlova M, Zvara K, Papikova V, et al. Biomedical Informatics Education at Charles University in Prague for Undergraduate and Doctoral Degree Studies. European Journal for Biomedical Informatics. 2011; 7(2): 72-78.

25. Svacina S, Zvarova J, editors. Semantic Interoperability in Biomedicine and Healthcare. European Journal for Biomedical Informatics. 2011; 7: 1-74.

26. Zvarova J, Svacina S, Rauch J, Haase J, Grunfel- dova H. EuroMISE Center: Research and Education in Biomedical and Healthcare Informatics. In: Blobel B, Engelbrecht R, Shifrin MA, editors. Large Scale Projects in eHealth. Amsterdam: IOS Press; 2012: 53-56 .

27. Masic I, Kern J, Zvarova J, de Lusignan S. Task force of the EFMI journals: background, rationale and purpose. Stud Health Technol Inform. 2009; 150: 94.

28. www.ejbi.org (last access January 10th 2013)

29. Haux R. On the methodology and Scientific Fundamentals of Organizing Representing and Analyzing Data, Information and Knowledge in Biomedicine and Health Care. Methods Inf Med. 2011; 50 (6): 487- 490.

30. van Bemmel JH. The structure of medical informatics. Med Inform (Lond). 1984; 9(3-4): 175-180.

31. Gremy F. Crisis of Meaning and Medical Informatics Education: A burden and/or a relief? Methods Inf Med. 1989; 28(4): 189-195.

32. Moehr JR. Teaching medical informatics: Teaching on the seams of disciplines, cultures, traditions. Method Inf Med. 1989; 28: 273-280.

33. Zvarova J. On the medical informatics structure. Int J Med Inform. 1997; 44: 75- 81.

34. Zvarova J, Vesely A, Vajda I. Data, Information and Knowledge. In: Berka P, Rauch J, Zighed D. editors. Data Mining and Medical Knowledge Management. Information Science Reference. Hershey, PA: IGI Global; 2009: 1-36.

35. Ball M. Medical informatics – back to the future. Keynote lecture MEDINFO 2010, Cape Town, 2010.

36. Healy JC. The WHO eHealth resolution – eHealth for all by 2015? Methods Inf Med. 2007; 46: 2-5.

37. Zvarova J, Zvara K. e3Health: Three Main Features of Modern Healthcare. In: Moumtzoglou A, Kastania A. editors. E-Health Systems Quality and Reliability: Models and Standards, Information Science Reference, Hershey, PA: IGI Global; 2011: 18-27.

38. Blobel B, Hasman A, Zvarova J, editors. Data and Knowledge for Medical Decision Support. Amsterdam, IOS Press, 2013.

16

Casimir A. Kulikowski

THE 50TH ANNIVERSARY IMIA HISTORY OF MEDICAL INFORMATICS PROJECT

The IMIA Board meeting in Hiroshima in 2009 approved the creation of the IMIA History History Taskforce, consisting of representatives from the various international regions that comprise IMIA: George Mihalas (Europe); Hyeoun-Ae Park (Asia); Sedick Isaacs (Africa); Alvaro Margolis (Latin America), Casimir Kulikowski (North America –Chair). With the passing of Sedick Isaacs in 2012, representation for Africa has been assumed by Lyn Hanmer.

There have been meetings of the IMIA History Taskforce at Medinfo 2010 in Cape Town, and at two IMIA-sponsored regional meetings since then (INFOLAC 2011 and APAMI 2013). A number of original contributions to the IMIA History Project have been solicited and are beginning to be published as articles in the IMIA Yearbook (1, 2, 3, 4).

These add to the growing collection of published materials, including recollections of IMIA leaders such as (5) and pioneering historical informatics work from the USA's National Library of Medicine (6), of Morris Collen (7), and the Nursing Informatics History Project (8, 9).

During 2013 George Mihalas, Jana Zvarova and Casimir Kulikowski organized a panel on the history of EFMI at the EFMI STC in Prague (10), in April, and a workshop was organized by Casimir Kulikowski at the World Congress of Medical Informatics (Medinfo 2013) held in Copenhagen in August (11). Both these meetings were very successful in eliciting many commitments to contribute archival documents and

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

produce new historical papers from biomedical and health informatics researchers and practitioners from around the world. This paper is an updated version of the presentation at the EFMI STC meeting in Prague, and joins those from other European contributors at that meeting.

PROTOTYPE MEDIA PRESENTATION REPOSITORY FOR IMIA ARCHIVAL AND HISTORICAL MATERIALS

To help collect original IMIA-specific documents and other archival materials, and making them available to the authors contributing to the 50^{th} Anniversary volume, we have built a prototype media presentation repository, or wiki, at Rutgers University's Department of Computer Science, focusing on those who have contributed to IMIA over the past five decades, and the events and publications they have been involved in (http://infohistory.rutgers.edu) (12). A screen shot of a timeline with selected medical informatics events related to the evolution of IMIA is illustrated on Figure 1.

The wiki supports visual and graphical summaries, with timelines connecting events and people mentioned in documents, providing a spatial and temporal indexing that facilitates navigation through the original materials, also facilitating the analysis of their contents.

Materials comprising the major original documentary contents currently available through the repository at Rutgers include:

- Correspondence related to the formation of IMIA and its Bylaws;
- Board and General Assembly meeting notices and minutes;
- Correspondence about decisions regarding the World Congresses of Medical Informatics (Medinfos), and the preparations and other documents, flyers, and minutes of meetings;
- Correspondence about special (usually Working Group) conferences sponsored by IMIA and links to resulting publications;
- Correspondence and documents related to IMIA's relations to regional and (national) member societies.

In addition, we are producing short summaries of notable events involving IMIA, together with short biographical sketches (profiles) of IMIA contributors. Both include photographic records of people and locations, focusing on IMIA-related activities, and pictures of the research and publications of the IMIA participants designed to illustrate the contributions of the members to medical informatics. These materials have been scanned and made available by former IMIA Secretary, Diarmuid UaConaill,

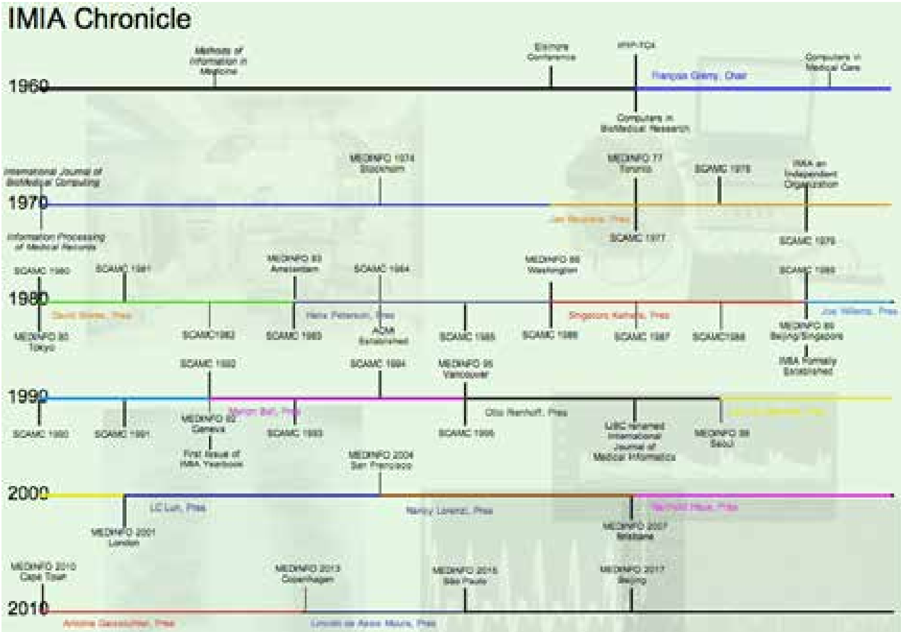


Figure 1. IMIA Chronicle - a screen shot of a timeline with selected medical informatics events from 1960 to 2010

and the current CEO of IMIA, Peter Murray, while also drawing on the records of Steven Huesing, the first IMIA Executive Director. Besides the correspondence materials related to significant IMIA events along the association's timeline, we have added links to the tables of contents from the *IMIA Yearbook of Medical Informatics*, and major journals of the Association: *Methods of Information in Medicine*, and the *International Journal of Medical Informatics*. We are also gradually adding tables of contents of conferences associated with IMIA, its Newsletter, and predecessor activities – like the Elsinore Conference in 1966 that served as the catalyst for the formation of IFIP-TC4. In addition, we are gradually adding links to tables of contents from other early journals in the discipline like *Computers in Biomedical Research*, and *Computers in Biology and Medicine*. The purpose is to have available as much material as possible so text analysis methods can be used to carry out temporal correlation analyses of participations and contributions to IMIA events and publications.

FUTURE PLANS

The challenge facing the IMIA History Taskforce and the Editorial Board of the 50th Anniversary History Project, is how to summarize the international dimensions of the evolution of a highly interdisciplinary scientific and technological field like biomedical and health informatics (14, 15). The prototype repository at Rutgers provides a preliminary version of an easily accessible archive for the documents of IMIA, and information about its contributors, events, and organizational evolution. The overview timeline provides a convenient point-of-entry to compile and search for specific dates, periods, and people. The indexing by document-type will enable the writers of the history to access the items of interest by region, country, or working group, and special interest group, as well as the World Congresses on Medical Informatics (Medinfos) and other meetings sponsored by IMIA. In addition to conventional archival media-based approaches, we will be exploring more recent software analytics tools for analyzing the text in the documents and correlating the contents with that in the published literature, so as to develop a detailed picture of the participation of different researchers and research groups in the activities of IMIA throughout its history. This can show how "professional social networks" of scientists, practitioners, and education specialists have led the activities of the organization, complementing conventional citation analyses. The patterns of participation and interaction between different regional and world-wide activities of IMIA will be clearly outlined and displayed on maps and correlated to summaries of the subfields of specialization of medical informatics. In this way, the main themes that have dominated the discourse and publications in our discipline can be more clearly defined, and included in the interpretive historical narratives. The sessions at EFMI-STC in Prague (12) and the Workshop at Medinfo 2013 (11, 13) have led to the commissioning of the histories of the different national and regional societies and associations that comprise IMIA so they can be included in the 50^{th} Anniversary IMIA History volume. By investigating the use and development of new analytical summarization and visualization methods, these activities also contribute to the development of specialized informatics methods in support of historical research. And, they will be doing this to produce comprehensive, interesting narratives about the accomplishments and challenges of a unique international professional organization in informatics itself: IMIA.

REFERENCES

1. Peterson HE, Lundin P. Documenting the Use of Computers in Swedish Health Care up to 1980. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2011: 169-174.

2. Van Bemmel JH. People and Ideas in Medical Informatics – A Half-Century Review. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2011: 175-182.

3. Yacubsohn V. A Short History of the Beginnings of Hospital Information Systems in Argentina. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2012: 163-168.

4. Fieschi M. The Development of AI in Medicine and the Research Environment of the SPHINX Project at the Start of the 1980s. IMIA Yearbook of Medical Informatics. Schattauer, Stuttgart, 2012: 153-160.

5. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics. IMIA Yearbook on Medical Informatics. Schattauer, Stuttgart, 2007: 165-175.

6. Lindberg DAB. The Evolution of Medical Informatics. In: Myers JD. (ed) Medical Education in the Information Age. Proc Symp on Medical Informatics. Washington, DC, Assoc of Amer Med Colleges. 1986[a]: 86-95.

7. Collen, MF. A History of Medical Informatics in the United States. AMIA, Indianapolis, IN, 1995.

8. The Nursing Informatics Project. http://www.amia.org/programs/working-groups/nursing-informatics/history-project

9. Ozbolt J, Saba V. A brief history of nursing informatics in the United States of America. Nurs Outlook. 2008; 56(5): 199.

10. Mihalas G, Zvarova J, Kulikowski C. History of Medical Informatics in Europe. Int J Biomed and Healthcare. 2013: 59.

11. Kulikowski C, UaConnail D, Mihalas G, Park HA, Murray P. Workshop on the 50th Anniversary IMIA History of Medical Informatics Project. Proc Medinfo 2013: 1152.

12. Mihalas G, Zvarova J, Kulikowski C, Ball M, Bemmel vanJ, Hasman A, Masic I, Whitehouse D, Barber B. History of Medical Informatics in Europe: a Short Review by Different Approach. Acta Inform Med. 2014 Feb; 22(1): 6-10. doi: 10.5455aim/2014.22.6.10.

13. Kulikowski A. C. The 50th Anniversary IMIA History of Medical Informatics Project. Acta Inform Med. 2014 Feb; 22(1): 68-70. doi: 10.5455/aim.2014.22.68-70.

14. Kulikowski C, McGrew C. An Informatics Approach to Chronicling the History of IMIA. Proc Medinfo. 2013: 1130.

17

Jacob Hofdijk, Izet Masic, Patrick Weber, John Mantas, George Mihalas, Assa Reichert, Rolf Engelbrect

A SHORT FACTOGRAPHY ABOUT IMIA AND EFMI

THE INTERNATIONAL MEDICAL INFORMATICS ASSOCIATION - IMIA

The The International Medical Informatics Association (IMIA) is an independent organization originally established in 1967 as Technical Committee 4 of the International Federation for Information Processing (IFIP) (1-5). The IMIA is the most important organisation for health and biomedical informatics. The Association acts as a bridging organisation, together the constituent organisations and their members. IMIA provides leadership and expertise to the multidisciplinary, health focused community and to policy makers, to enable the transformation of healthcare in accord with the world-wide vision of improving the health of the world population (6-8).

IMIA plays a major global role in the application of information science and technology in the fields of healthcare and research in medical, health and bio-informatics. The basic goals and objectives of the association are to:

- promote informatics in health care and research in health, bio and medical informatics;
- advance and nurture international cooperation;
- to stimulate research, development and routine application;

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Association for Health Informatics of Nigeria (AHIN)	Association of Medical & Bio-Informatics Singapore (AMBIS)	Belgian Medical Informatics Association	British Computer Society (BCS Health)	Cameroonian Health Informatics Society (CAHIS)
Chilean Health Informatics Society	China Medical Informatics Association	COACH: Canada's Health Informatics Association	Colombian Association of Health Informatics Argentine Association of Medical Informatics	Croatian Society for Medical Informatics
Cuban Society of Medical Informatics	Czech Society for Biomedical Engineering and Medical Informatics	eHealth Association of Pakistan (eHAP)	French Medical Informatics Association (AIM)	Finnish Social and Health Informatics Association (FinnSHIA)
German Association for Medical Informatics, Biometry and Epidemiology (GMDS)	Ghana Health Informatics Association	Greek Health Informatics Association	Health Informatics New Zealand	Health Informatics Society of Australia Ltd. (HISA)
Health Informatics Society of Sri Lanka	Healthcare Informatics Society of Ireland	Hong Kong Society for Medical Informatics	Indian Association for Medical Informatics (IAMI)	Iranian Medical Informatics Association
Italian Medical Informatics Society (AIIM)	Ivorian Society of Biosciences and Health Informatics (ISBHI)	Japan Association for Medical Informatics	John von Neumann Computer Society (Hungary)	Kenya Health Informatics Association
Medical Informatics Association of Malawi (MIAM)	Mexican Medical Informatics Association	Norwegian Society for Medical Informatics	Peruvian Association of Biomedical Informatics	Philippine Medical Informatics Society
Romanian Society of Medical Informatics	Society for Medical Informatics of Bosnia and Herzegovina	South African Health Informatics Association	Spanish Society of Health Informatics	Swedish Federation for Medical Informatics (SFMI)
Swiss Society for Medical Informatics	Taiwan Association for Medical Informatics (TAMI)	Thai Medical Informatics Association	The Danish Society for Medical Informatics	The Israeli Association for Medical informatics
The Mali Society of Biomedical and Health Information (SOMIBS)	The Saudi Association for Health Informatics (SAHI)	The Ukrainian Association for Computer Medicine (UACM)	Togolese Association of Medical Informatics and Telemedicine (ATIM-TELEMED)	Turkish Medical Informatics Association (TURKMIA)
Uruguayan Society of Health Informatics	Venezuelan Association of Computer Science in Health (AVIS)	VMBI, Society for Healthcare Informatics (The Netherlands)	Working Group Medical Informatics and eHealth of the Austrian Computer Society (OCG) and the Austrian Society for Biomedical Engineering (ÖGBMT)	

Table 1. National societies as offical members of IMIA (54 countries as official members)

- move informatics from theory into practice in a full range of health delivery settings, from physician's office to acute and long term care;
- further the dissemination and exchange of knowledge, information and technology;
- promote education and responsible behaviour;
- represent the medical and health informatics field with the World Health Organization and other international professional and governmental organizations.

In its function as a bridge organization, IMIA's goals are:

- moving theory into practice by linking academic and research informaticians with care givers, consultants, vendors, and vendor-based researchers;
- leading the international medical and health informatics communities throughout the 21st century;

- promoting the cross-fertilization of health informatics information and knowledge across professional and geographical boundaries;
- serving as the catalyst for ubiquitous worldwide health information infrastructures for patient care and health research.

With the continued evolution and recent diversification of informatics, IMIA has seen differing generations of professionals join its numbers. As well, with the sharply increasing political interest in the eHealth revolution, IMIA has embraced new and emerging nations into the "family". This is a testament to those early pioneers whose vision of informatics as an integrate component of the health of the word's population has proven to be the "right" direction. As a volunteer organization, IMIA has been shaped by its presidents and their boards in their leadership roles. All have left their mark on the organization. Through the years, IMIA has grown and changed.

THE HISTORICAL DEVELOPMENT OF IMIA

IMIA was originally established in 1967 as Technical Committee - TC4 of the International Federation for Information Processing (IFIP) (1). IFIP was a non-governmental, non-profit umbrella organization for national societies working in the field of information processing (2). IFIP was established in 1960 under the auspices of UNESCO as a result of the first World Computer Congress held in Paris in 1959 with 1800 participants from 37 countries. Some representatives of national societies (executives were Isaac L. Auerbach and Anatol A. Dorodnicyn) written statutes, approved at first Council meeting held in Rome in June 1960 by representatives from 15 countries (Belgium, Canada, Czechoslovakia, Denmark, Finland, FR Germany, Japan, The Netherlands, Spain, Sweden, Switzerland, USSR, UK, USA) formed IFIP - International Federation for Information Processing. First three Technical Committees (TCs) were established in 1963 and TC 4 in 1967. TC4 (Health Care and Biomedical Research) chaired by Francois Gremy (France), chairman, J. M. Forsythe (UK), as vice-chairman. First Working Group (WG-1) (Education of Medical and Paramedical Personnel) chaired by Jan Roukens. In 1979, it evolved from a Special Interest Group of IFIP to its current status as a fully independent organization.

IMIA continues to maintain its relationship with IFIP as an affiliate organization (accepted by IFIP untill 1980 as independent Special Interest Group). IMIA also has close ties with the World Health Organization (WHO) as a NGO (Non Government Organization), and with the International Federation of Health Information Management (IFHIMA) (1). Parallel with IFIP, IMIA organized World congresses in Stockholm in 1974, and Toronto (Canada) in 1977. From 1980 IMIA became independent from IFIP, after inaugurate meeting held in Salle Capituami in Paris on 11. 05. 1979 (inaugural speaches gave: prof. Bailey, representative of WHO, prof. Pierre Bobillier, president of

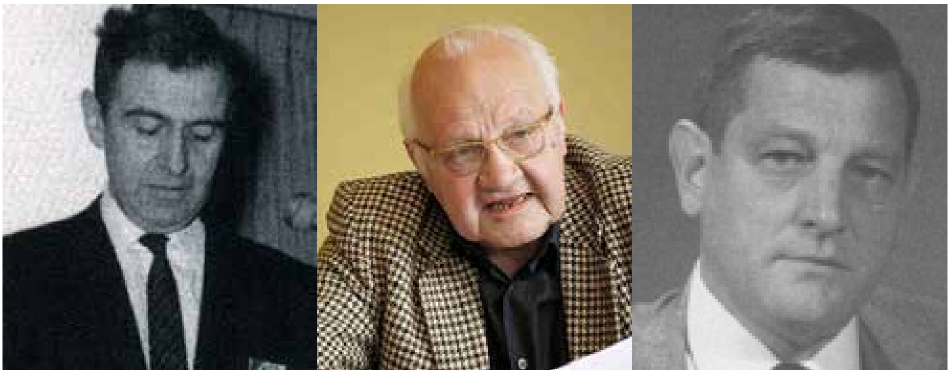


Figure 1. First Presidents of IMIA: Francois Gremy (1968-1975), Jan Roukens (1975-1980), David B. Shiers (1980-1983)

IFIP, prof. Francois Gremy and Jan Roukens, chair of TC4. New IMIA Board consists of: David Shires, president, Hans Peterson, vice-president, William Abbot, secretary, Shigekoto Kaihara, Newsletter Committee chair, Peter Leo Reichhertz, Publication Committee chair.

MEMBERSHIP

Generally, membership to IMIA is limited to organizations, societies, and corporations. Member Societies: in each country, one society or a group of societies or an appropriate body which is representative of activities within the field of medical informatics may become a Member Society. In an country where no representative societies exist, IMIA accommodates involvement through "Corresponding" members, especially within developing countries. IMIA Member Societies may organize into regional groups. Currently, 54 societies joined the IMIA, and are named as presented on Table 1. Institutional Members*:* there are two categories, corporate and academic members. Corporate members include vendor, consulting, and technology firms as well as national professional organizations. Academic members include universities, medical centres, research centres and like institutions (1): a) American Health Information Management Association (AHIMA); b) Health On the Net Foundation (HON); c) Healthcare Information & Management Systems Society (HIMSS); d) IBM Corporation; e) Schattauer GmbH, and f) Siemens Medical Solutions.

Affiliate Members*:* international organizations that share an interest in the broad field of health and biomedical informatics (1). a) International Federation for Information Processing; b) International Federation of Health Information Management (IFHIMA), and c) World Health Organization

Honorary Fellows*:* these are individuals who have demonstrated exceptional merit in furthering the aims and interests of IMIA; Fellowship is conferred for life (1).

IMIA Presidents		
1968-1975	François Grémy	France
1975-1980	Jan Roukens	the Netherlands
1980-1983	David B. Shiers	Canada
1983-1986	Shigekoto Kaihara	Japan
1986-1989	Hans Peterson	Sweden
1989-1992	Jos L. Willems	Belgium
1992-1995	Marion J. Ball	USA
1995-1998	Otto Rienhoff	Germany
1998-2001	Jan H. van Bemmel	the Netherlands
2001-2004	Kwok Chan (KC) Lun	Singapore
2004-2007	Nancy Lorenzi	USA
2007-2010	Reinhold Haux	Germany
2010-2013	Antoine Geissbühler	Switzerland
2013-2015	Lincon de Assis Moura Jr.	Brasil

Table 2. IMIA Presidents during period 1968-2015

GOVERNANCE

IMIA is governed by its General Assembly, which comprises one representative from each IMIA Member, Honorary Fellows, Chairs of IMIA's Working and Special Interest Groups and a representative from IFIP, the World Health Organization, and each of IMIA's Regions. Only IMIA Member Societies have full voting rights. The General Assembly meets annually; it meets at MEDINFO in the years that a MEDINFO event is held, and general at other major events in non-MEDINFO years (1).

IMIA PRESIDENTS

The Officers, i.e. the President, Secretary and Treasurer, shall be elected by the General Assembly from among its Member Societies (not necessarily their appointed representatives). The President has the right to appoint a permanent alternate from among members of the Board during his/her term of office (1). (Table 2).

IMIA activities during presidency of Shigekoto Kaihara (1983-1986)

When Shigekoto Kaihara became a President of IMIA in 1986, he was confronted with the folowing two issues that required a certain amonunt of consideration. First wether medical informatics was in fact an independent scientific entity, and second, how it cuold be transformed into an international organization, as the name indicated. In 1986, IMIA was not an independent organization; instead, it was a part of the IFIP and was known as a Special Interest Group (SIG) of IFIP. During the IFIP GA meetings, Shigekoto Kaihara realized that the IFIP GA was more interested in IMIA′s budget as opposed to its scientific contents. IFIP was involved in computer technology, while IMIA was concerned with its medical applications. Consequently, the president of IMIA thought it would be more beneficial, if both organization became independent. Mr. Aage Melbye and Shigekoto Kaihara submitted the proposal to the IFIP GA in 1987. The proposal had been approved by IFIP. In 1986, IMIA was still a European-based organization. Most of the adninistrative and scientific activities such as board meeting and working conferences were held in European countries. At the time, members of IMIA that implicitly believed that medical informatics could only be applied to developed countries.

However, Dr. Salah Mandil, from WHO; always stated that medical informatics should also be applied to developing countries since it has the potencial of tackling their health issues. Since Shigekoto Kaihara held the same opinion as Dr Mndil did, he decided to test this concept by organizing as many activities as possible in those countries, where informatics was in nascent stage. Subsequently, the IMIA board meetings were held in Beijing, East Berlin, and Rabat in Morocco. Further, when Dr. Marion Ball was President of IMIA, Shigekoto Kaihara help her to organize a meeting in Tbilisi in the Georgian Republic with the help of Prof. Gayos Sh. Vasadze. However, the Beijing MEDINFO in 1989 was particulary eventful.

The organizing committee chaired by Mr. Ouyang worked extremely hard for two and half years in order to make this conference a success. The Tiananmen Square Incident took pace in 1989. Soon after that Shigekoto Kaihara began receiving a hundred lettters from participants stating that they would be unable to attend the MEDINFO in China and that IMIA should hold the meeting in some other city. After considerable deliberation, it was decided that the first part of the conference should be held in Beijing, but the second part will be held in Singapore fot those, who would be unable to participate in the Beijing MEDINFO. The Beijing MEDINFO as well as the Singapore MEDINFO were equally successful. More than 600 participians attended to each conference. After this experience, IMIA has envolved into a strong international organization based on the mutual trust and friendship of all members across the globe (6).

IMIA activities during presidency of Hans Peterson)1986-1989)

Hans Peterson served as President of IMIA from 1983 through 1986. His election as an International Associate of the College recognizes these sustained achievements. In 1983, after three years as president elect, Hans Peterson became president of IMIA. "What I remember best", he says, "is that there was no money." MEDINFO 83 had diminished already limited funds, and money was simply not available for what was needed for MEDINFO 86 and subsequent activities. IMIA's officers ended up providing IMIA with free services, from printing and stationery to mailing and telephones. Grants to working conferences were impossible, and IMIA's officers had to spend almost all their time on finances. The final blow came when IMIA closed its permanent secretariat in Amsterdam and its small remaining treasury vanished. The bottom line was "very little time for accomplishments and achievements. The goal was to survive."

Figure 2. IMIA General Assembly, Dresden (Germany), 23. 9. 1994. (Photo: Izet Masic)

Figure 3. EFMI Council meeting, Lisbon (Portugal), 22. 3. 1994. (Photo: Izet Masic)

IMIA activities during presidency of Marion J. Ball (1992-1995)

At the conclusion of MEDINFO 92 in Geneva, Marion J. Ball received the gavel from Jos Willems. Soon she faced a crisis when Brasil withdrew as the site for MEDINFO 95. She turned to her colleagues and the IMIA members, and Canada took on the challenge of hosting an international congress with only two years lead time, thanks to Kathryn Hannah and Steve Huesing. With the guidance of the board, IMIA distributed governance to five new vice-presidents and implemented Jos Willems´s vision of a professionally-run organization with a permanent secretariat. To make IMIA a bridge organization across sectors and regions, she worked to create institutional membership, make IMIA more visible in the USA and foster working conferences. She was also able to lend support to the Asia Pacific Association for Medical Informatics (APAMI), newly and succesfully formed by KC Lun. With the support of board, she was able to make a substantive progress in key areas, including strengthening IMIA organizationally and fostering health informatics regionally. As IMIA`s first President from the USA, she was determined to give IMIA more visibility in the USA and the Americans. During her Presidency, IMIA sponsored four working conferences in the USA. One of these focused on organizational issues, one on nursing informatics, and a third on hospital information systems. The fourth, which she co-chaired, focused on health professional workstations; its findings have served as a roadmap for many of the advanced made in the years since

Figure 4. IMIA General Assembly, Newcastle (Australia), 10. 8. 1997. (Photo: Izet Masic)

then. She brought AMIA and IMIA closer together. In supporting regionalisam, the spring 1995 Board meeting was held in conjuction with Info Medica, sponsored by the Mexican Medical Informatics Association and IMIA-LAC; and IMIA-LAC obtained funding from the Kellog Foundation for 19 Latin American fellows to attend MEDINFO in Vancouver, Canada. She and her fellow board members also did all we could to support informatics in Africa. The designation of Helina as its regional group came after her presidency, but she has been involved in encouranging its advocates. Recent developments as a result of meeting in January 2007 in Mali have solidified Helina, and Sedick Isaacs has accepted the first presidency (6).

IMIA activities during presidency of Jan H. van Bemmel (1998-2001)

Jan H. van Bemmel was IMIA president during period 1998-2001. Hi`s interest in the upcoming field of medical informatics was much reinforsed after having attended in 1996 the very first European conference on computers in medicine, held in Elsinore where he met for the first time people like Hubert Pipberger and Cesar Caceres, who had started a few years earlier the computer processing of electocardiograms. From then on he collaborated closely with Hubert over many years. Making international bridges is one of the great advantages of an association like IMIA. He started to use computer in 1963 for biomedical research and clinical applications. He received in 1967 a grant from WHO to describe the state of affairs of computers in European hospitals. In the mean time, they established in 1970 in the Netherlands one of the first European professional societies in the medical informatics, the Vereniging (Society) for Medical and Biological Information processing - VMBI. Jan Roukens became its first chairman and Jan van Bemmel its second. A most inneresting period for him was the editing of IMIA`s Yearbooks , a job done together with Alexa McCray, and with the help of many others colleagues. During

Figure 5. Celebration of 40 anniversary of IMIA, Brsibane (Australia), 20. 08. 2007. (Photo: Izet Masic)

the years 1992-2000. since then, Reinhold Haux and Casimir Kulikowski have taken over the Yearbooks. His Presidency started in Seoul, Korea and ended in London, UK. He wrote a song that was performed by about 50 of IMIA`s officials at the great conference dinner during MEDINFO 98 in Seoul. During the period 1998-2001, he defined a short agenda for IMIA, having a roadmap in mind, consisting of the folowing elements:

- Strengthen IMIA as professional organization;
- Build bridges to other organizations;
- Tap the experience of former officersand honorary members;
- Make IMIA better visiable to the outside world;
- Make MEDINFOs still better and MEDINFO 2001 the largest ever.
- During his serving IMIA, they established a true Permanent Office,

The IMIA office was envolved in:

- giving assistance to IMIA`s Board and General Assembly,
- long-range planning; preparation of policy and its execution,
- with member societies, working groups, and affiliated societies,
- facilitation of regional and working conferences, consultation activities, and MEDINFOs,

Figure 6. EFMI Council meeting in Athens (March 2005) - Assa Reichert, Rolf Engelbrecht, Alexander Horsch, Izet Masic, George Mihalas (from left to right) (Photo: Izet Masic)

- contants with and giving service to industrial and academic instituional members.
- publications, newsletters, Yearbooks, conference proceedings, etc.,
- promoting medical/health/nursing informatics to industry,
- raising financial resources from IMIA services and activities.

At the end of his presidency, MEDINFO 2001 took place in London at a very new venue in the Docklands. The conference was a great success. In London he handed the gavel to his successor, K.C. Lun from Singapore (6).

IMIA activities during presidency of Kwok Chan (KC) Lun (2001-2004)

Prof. K.C. Lun from Singapore was president of IMIA during 2001-2004. In September 2001 he became the second Asian to become the IMIA President. During his 3-year term, KC steered IMIA through a period of global economic slowdown to end his term of office with an operating budget sure plus and probably the most financially successful MEDINFO to-date in San Francisco in September 2004. In recognition of his leadership, he was presented a plaque by IMIA and made an IMIA Honorary Fellow at the closing ceremony of MEDINFO 2004 in San Francisco. Commenting on the recognition, KC Lun said, “I am pleased to have had the opportunity to serve IMIA and grateful for the friendship that I have made with colleagues from all over the world, dating back to 1986 when I first started this wonderful relationship with IMIA".

IMIA ACTIVITIES: PUBLICATIONS, CONFERENCES, OTHER ACTIVITIES

MEDINFO Conferences

IMIA organises the internationally acclaimed "World Congress on Medical and Health Informatics" - commonly know as MEDINFO. The event, currently triennial, but biennial after 2013, provides both a high quality scientific exchange of current research and thinking in health and biomedical informatics and an opportunity for formal meetings and informal networking of IMIA's members. The event is jointly hosted by IMIA and one of its Member Societies. The selection of the host society is determined through a vote of the IMIA General Assembly. Up to now the IMIA has organized the great number of scientific and expert meetings, every working group has its year scientific assemblies. The World Congresses of medical informatics (MEDINFO) held by the following sequence; Stockholm (1974), Toronto (1977), Tokyo (1980), Amsterdam (1983), Washington (1986), Beijing/Singapore (1989), Geneva (1992), Vancouver (1995), Seul (1998), London (2001), San Francisco (2004), Brisbane (2007), Cape Town (2010), Copenhagen (2013). The 15th World Congress on Health and Biomedical Informatics will be held in August 2015 in São Paulo, Brazil. The Conference will be organized by the Brazilian Health Informatics Association (SBIS).

IMIA Publications

The IMIA Yearbook of Medical Informatics, founded in 1992, showcases contributions from the best state-of-the-art research, and has become one of the most visible and valuable IMIA publications, drawing on, and adding to the great and impressive variety of books, proceedings and journal articles produced under IMIA sponsorship (6). It is designed to present an overview of the most original, excellent state-of-the-art research in the area of health and biomedical informatics of the past year; to provide surveys about recent developments, and comprehensive reviews on relevant topics in this field; and to provide information about IMIA. Beginning in 2014, the IMIA Yearbook will be published in an online open access format and the print version will be discontinued. IMIA's three official journals are: a) Applied Clinical Informatics; b) International Journal of Medical Informatics, and c) Methods of Information in Medicine.

Other Initiatives

IMIA continues to develop its communication capabilities through its website, which is undergoing expansion and development, and contains profiles on its members, working groups and activities. IMIA is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large. [6]

IMIA Visions

IMIA‘s vision is that there will be a world-wide systems approach for healthcare. Clinicians, researchers, patients and people in general will be supported by informatics tools, processes and behaviors that make it easy to do the right thing, in the right way, at the right time to improve health care for all. (8).

The IMIA Strategic Plan

The IMIA strategic plan is based on three guiding principles. The principles are:

a) IMIA will help to ensure a holistic, systems approach to collaboration and networking about biomedical informatics to maximize impact world-wide

b) IMIA will uphold an ethical approach to informatics systems as identified by IMIA‘s seven ethical principles

c) IMIA will promote biomedical informatics based on evidence and best practice to ensure impact on health is high quality, safe, efficient and sustainable and that makes it easy to do the right thing, in the right way, at the right time world-wide.

The most important mandate for IMIA is to contribute, through the use of Information and Communication Technology (ICT), to the improvement of biomedical research, clinical practice and public health. It is envisioned that, in the coming years, a more complete knowledge on the different factors that contribute to the development of disease (genetics, environment) will be increasingly available for developing new preventive, diagnostic and therapeutic solutions. IMIA has a key role to play in anticipating new challenges for informatics in the most important trends of future medicine (regenerative, genomic, longevity, patient-centred, preventive).

In terms of health care perhaps the most important challenge for biomedical informatics is to facilitate a fast and reliable translation of the biomedical research findings into real-use clinical solutions. From this perspective a major goal is to facilitate “translational research”, improving the diagnostic arsenal with new imaging systems and micro devices suitable for "point of care" solutions, promoting rational drug design and supporting the development of personalized therapeutic strategies that can guarantee efficacy and patient safety.

New experimental approaches (cell therapy, tissue engineering) raise important issues to be addressed by ICT in health. Informatics can substantially contribute to the advance of these fields. This knowledge must be applied not only at an individual level, in terms of patient care, but also to improve the health of populations, through new public health studies and programs. The aggregation of electronic health records and informatics infrastructures to facilitate longitudinal and bio-bank-based association studies poses new opportunities for health informaticians.

Biomedical informatics is a multi-disciplinary area that involves multiple content areas. It is one of the fastest growing subject/content areas in the world. The use of informatics is expected to enhance research efforts in areas such as genomics and proteomics, for example, and also to change the way medicine is practiced in the 21st century. Research in informatics ranges from the theoretical to applied efforts. The demand for more research in biomedical informatics and for biomedical informatics to support other researchers escalates daily.

Knowledge is the core for IMIA's existence. IMIA's role will be to stimulate and connect researchers to enable their research. IMIA has numerous roles to play in providing leadership in the development and delivery of education, and where appropriate through collaborating with other organizations in contributing to the development of education across the entire spectrum of people impacted by informatics.

IMIA's direct role in education relates to education for biomedical informaticians, but it also has important indirect roles in ensuring the highest quality of education for all other groups of individuals who have a direct or indirect interaction with the practice of biomedical informatics.

IMIA has a role in developing educational and research opportunities within biomedical informatics, and mechanisms for fostering the development of 'the next generation' and discovering the currently unrecognised and underdeveloped talent of existing biomedical informatics students.

THE FUTURE OF IMIA

Developing informatics tools to support the writing of the history of biomedical and health informatics is an important endeavour given the approaching 50th Anniversary of IMIA in 2017. The need is to archive, index, and produce readily accessible recollections from the pioneering days of our field. The Rutgers History Informatics project has developed a MediaWiki to experiment with ways of collecting, indexing and visualizing the materials that related to the evolution of IMIA. The wiki allows access to documents, biosketches and short descriptions of historical events for IMIA, together with timeline summaries which place them in context. The prototype system will be augmented with audio material, and will serve as an archival repository for historical research, including software tools for text analysis and extraction of the information that can be used by authors contributing to the 50th Anniversary IMIA History, which is planned as an edited volume of contributions from all world regions and societies that are members of IMIA. Contributions to the IMIA History Project are already being published as articles in the IMIA Yearbook (8). The analysis of materials on the MediaWiki should help in studying the participation of different researchers and research groups in the activities of IMIA, and the "social networks" of scientists, practitioners, and education specialists that have led the activities of the organization, supplementing conventional citation analyses. The patterns of participation and interaction between different regional and world-wide activities of IMIA will be clearly outlined and visualizable on maps and correlated to summaries of the subfields of specialization of medical informatics, and the main themes that have dominated the discourse and publications in our discipline will also be more clearly analyzable. This represents a novel informatics-based community-building enterprise, very much like Wikipedia content development, but focused on the specific discipline of biomedical and health informatics, and for its specific worldwide association: IMIA.

THE EUROPEAN FEDERATION FOR MEDICAL INFORMATICS - EFMI

In 1974, during MEDINFO '74 Conference held in Stockholm, three persons: Jan Roukens (Holland), Jan van Egmond (Belgium) and Mogens Jorgensen (Denmark), started establishing of EFMI. They wtitten statues and other documents and propsed to other delegates from 10 European countries to accept it. The European Federation for Medical Informatics (EFMI) has been established in 1976 in Copenhagen, Denmark on September 10th and as chairman was elected dr. Antoine Remond from France, and two members of Preliminary Executives: Barry Barber from UK, as Secretary and Peter Leo Reichertz from FR Germany, as Treasurer.

The European Federation for Medical Informatics Association (4) is now the leading organisation in medical informatics in Europe and represents 32 countries. EFMI is organized as a nonprofit organisation concerned with the theory and practice of Information Science and Technology within Health and Health Science in a European context.

Country	Representative	Institution
Austria	Elske Ammenwerth	University for Health Informatics and Technology Tyrol, Austria
Belgium	Etienne De Clercq	Catholique University of Louvain, Belgium
Bosnia-Herzegovina	Izet Masic	Medical Faculty, University of Sarajevo, Bosnia & Herzegovina
Croatia	Mira Hercigonja-Szekeres	Hrvatsko Zagorje Polytechnic Krapina; Croatia
Cyprus	Antonis Jossif	The Cyprus Society of Medical Informatics, Cyprus
Czech Republic	Jana Zvarova	EuroMISE Centre, Pargue, Czech Republic
Denmark	Stig Kjaer Andersen	The Aalborg University, Denmark
Finland	Pirkko Nykanen	STAKES Unit for eHealth and eWelfare, Finland
France	Brigitte Seroussi	AIM Association d'Informatique Médicale, France
Germany	Prof. Dr. Alexander Horsch	TUM Technische Universität München, Germany
Greece	John Mantas	The National and Kapodistrian University of Athens, Greece
Hungary	Surjan Gyorgy	National Institute for Strategic Health Research, Budapest, Hungary
Iceland	Arna Hardardottir	Landspitali , Reykjavik, Iceland
Ireland	Gerard Hurl	The Healthcare Informatics Society of Ireland, Ireland
Israel	Assa Reichert	SAREL Supplies & Services for Medicine Ltd., Israel
Italy	Cristina Mazzoleni	Fondazione Salvatore Maugeri, Clinica del lavoro e della riabilitazione, Pisa, Italy
Moldova	Victor Vovc	State Medical and Pharmaceutical University "N. Testemitanu", Moldova
Netherlands	Ronald Cornet	University of Amsterdam, The Netherlands
Norway	Anne Moen	Norwegian Society for Medical Informatics, Oslo, Norway
Poland	Edward Kacki	The Technical University of Lodz (Politechnika Łódzka), lodz, Poland
Portugal	Altamiro da Costa Pereira	Faculty of Medicine of Oporto University, Portugal
Romania	George Mihalas	The Victor Babes University of Medicine and Pharmacy of Timisoara, Romania
Russian Federation	Michael Shifrin	N. N. Burdenko Neurosurgical Institute, Moscow, Russia
Serbia	Vesna Uroševic	Institut for Public Health of Serbia, Belgrade, Serbia
Slovenia	Andrej Orel	Marand Inzeniring d.o.o., Lasko, Slovenia
Spain	Carlos Luis Parra Calderón	Sociedad Española de Informática de la Salud , Spain
Sweden	Ragnar Nordberg	The Karolinska Institutet, Sweden
Switzerland	Prof. Christian Lovis	University Hospital of Geneva, Switzerland
Turkey	Osman Saka	Akdeniz University, Antalya, Antalya, Turkey
Ukraine	Oleg Mayorow	The Ukrainian Association of Computer Medicine, Kharkiv, Ukraine
United Kingdom	Simon de Lusignan	Primary Care Informatics Division of Community Health Sciences St. George's, University of London

Table 5. National representatives at EFMI Council in the year 2014

All European countries are entitled to be represented in EFMI by a suitable Medical Informatics Society. The term medical informatics is used to include the whole spectrum of Health-/Socialcare Informatics and all disciplines concerned with Health-/ Socialcare and Informatics.

EFMI organizes two main series of conferences: the Special Topic Conferences (EFMI-STC) and Medical Informatics Europe (EFMI-MIE). In conjunction or independent of the main congress series, working groups in addition organize topic specific workshops, tutorials and seminars.

Objectives of EFMI

The objectives of EFMI are to:

a) advance international co-operation and dissemination of information;

b) promote research and development;

c) promote high standards in the application;

d) encourage high standards in education in this field;

e) EFMI publishes scientific papers from its congresses in the Medical Informatics and in the International Journal of Medical Informatics (1).

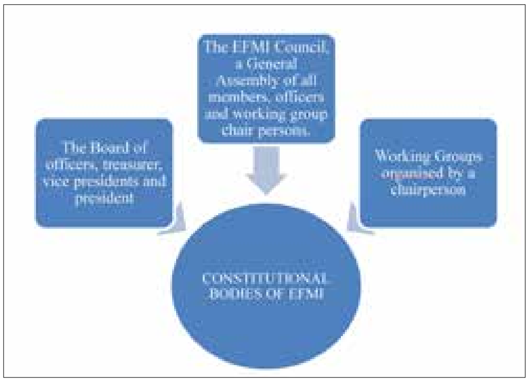


Figure 7. Organizational structure of EFMI

EFMI has organized 25 European congresses of medical informatics, including the Medical Informatics Europe (MIE) congresses in Cambridge (United Kingdom, 1978), Berlin (Germany, 1979), Oslo (Norway, 1988), Glasgow (Scotland, 1990), Vienna (Austria, 1991), Jerusalem (Israel, 1993), Lisbon (Portugal, 1994), Copenhagen (Denmark, 1996), Thessaloniki (Greece, 1997), Ljubljana (Slovenia, 1999), Hannover (Germany, 2000), Budapest (Hungary, 2002), St. Malo (France, 2003), Geneva (Switzerland, 2005), Maastricht (the Netherlands, 2006), Gothenburg (Sweden, 2008), Sarajevo (Bosnia and Herzegowina, 2009), Oslo (Norway, 2011), Pisa (Italy, 2012) and Istanbul (Turkey, 2014). The MIE congress in 2015 will be held in Madrid, Spain (8).

The challenge IMIA/EFMI is facing is how to summarize the international dimensions of the evolution of a highly interdisciplinary scientific and technological field like biomedical and health informatics (8).

Through its working groups EFMI contributes very well to the scientific development of medical informatics. The Working Group Chairmen regularly organize tutorials workshops and many of them participate in teaching medical informatics in their homeland as well as on international courses. There are several working groups like Education in Health Informatics (EDU), Electronic Health Records (EHR), Health Informatics for Interregional Cooperation (HIIC), Medical Imaging Processing (MIP), Safety, Security and Ethics (SSE), etc.

EFMI is running another series of meetings: the Special Topic Conferences (STC). Its concept has the following components: Organization by a member society in combination with its annual meeting, EFMI council meeting is integral part, Topic defined to the needs of the member society, Relevant EFMI Working groups are engaged for the content, Contributions mostly on invitation, Small 2-day conference with more than 100 participants.

The STC conferences took place in: Bucharest (Romania, 2001), Nicosia (Cyprus, 2002), Rome (Italy, 2003), Munich (Germany, 2004), Athens (Greece, 2005), Timisoara (Romania, 2006), Brijuni (Croatia, 2007), London (United Kingdom, 2008), Antalya (Turkey, 2009), Reikjavik (Iceland, 2010), Laško (Slovenia, 2011), Moscow (Russia, 2012), Prague (Czech Republic, 2013), Budapest (Hungary, 2014).

1976-1977	Antoine Remond	France
1978-1980	Peter L. Reichertz	Germany
1981-1983	Barry Barber	United Kingdom
1984-1986	Francis Roger France	Belgium
1987-1990	Rory O'Moore	Ireland
1991-1992	Stellan Bengtsson	Sweden
1993-	Rolf Hansen	Norway
1994-1995	John Bryant	United Kingdom
1996-1997	Jean-Raoul Scherrer	Switzerland
1998-1999	Attila Naszlady	Hungary
2000-2002	Rolf Engelbrecht	Germany
2002-2003	Assa Reichert	Israel
2004-2005	Robert Baud	Switzerland
2006-2008	George Mihalas	Romania
2009-2010	Jacob Hofdijk	Netherlands
2011-2012	John Mantas	Greece
2013-2014.	Patrick Weber	Switzerland

Table 6. EFMI Presidents during period 1968-2014

The most important meeting, however is the regular Council Meeting (twice a year) where council members can exchange opinions and have opportunity to discuss problems of medical informatics.

Through its work, EFMI provides leadership and expertise to the multidisciplinary, health focused community and to policy makers, enables the transformation of healthcare in accord with the worldwide vision of improving the health of the world population (8-10).

EFMI MEDICAL INFORMATICS JOURNALS

EFMI offical journals are: Methods of Information in Medicine, European Journal for Biomedical Informatics, International Journal of Medical Informatics and Acta Informatica Medica. EFMI has Task Force of Medical Informatics journals chaired by Izet Masic. The European Journal for Biomedical Informatics reacts on the great European need to share the information in the multilingual and multicultural European area. The journal publishes peer-reviewed papers in English and other European languages simultaneously. This opens new possibilities for faster transfer of scientific-research pieces of knowledge to large international community of biomedical researchers, physicians, other health personnel and citizens (8). International Journal of Medical Informatics provides an international medium for dissemination of original results and interpretative reviews concerning the field of medical informatics. The Journal emphasizes the evaluation of systems in healthcare settings.Methods of Information in Medicine has stressed the methodology and scientific fundamentals of organizing, representing and analyzing data, information and knowledge in biomedicine and health care. Covering publications in the fields of biomedical informatics,

Figure 8. EFMI Council meeting, Copenhagen (Denmark), 18. 8. 1996. (Photo: Izet Masic)

medical biometry, and epidemiology (8). Acta Informatica Medica is Medical informatics journal published in B&H as official journal of Academy of Medical Sciences of Bosnia and Herzegovina, covering, beside medical informatics topics: science editing, scientometrics, bibliometrics, etc.

The scope of all Medical informatics journals covers:

- Information systems, including national or international registration systems, hospital information systems, departmental and/or physician's office systems, document handling systems, electronic medical record systems, standardization, systems integration, etc.;
- Computer-aided medical decision support systems using heuristic, algorithmic and/or statistical methods as exemplified in decision theory, protocol development, artificial intelligence, etc.
- Educational computer based programs pertaining to medical informatics or medicine in general;
- Organizational, economic, social, clinical impact, ethical and cost-benefit aspects of IT applications in health care.

IN CLOSING

Through its work, EFMI provides leadership and expertise to the multidisciplinary, health focused community and to policy makers, enables the transformation of healthcare in accord with the world-wide vision of improving the health of the world population. EFMI is constantly striving to further the services it provides to its members and the informatics community in general by promoting free interaction among and between its member network and the bio-medical and health informatics community at large.

REFERENCES

1. IMIA: The International Medical Informatics Association. Available at: http://www.imia-medinfo.org. Accessed: on April 03, 2014.
2. IFIP: The International Federatin for Information Processing. Available at: http://www.ifip.or.at/ Accessed: on April 03, 2014.
3. Lindberg AB, Ball MJ. Morris F. Collen at 100: A Tribute to "The Father of Medical Informatics". Methods Inf Med. 2013; 52: 371-3.
4. Degoulet P, Haux R, Kulikowski C, Lun KC. François Grémy and the birth of IMIA. 1st IMIA/UMIT Medical Informatics Award of Excellence given to Professor Grémy. Methods Inf Med. 2005; 44(3): 349-51.
5. Haux R. Medical informatics: past, present, future. Int J Med Inform. 2010; 79(9): 599-610. doi: 10.1016/j.ijmedinf.2010.06.003.
6. Kulikowski AC. The 50th Anniversary of Medical Informatics Project. Acta Inform Med. 2014 Feb; 22(1): 68-70. doi: 10.5455/aim.2014.22.69-70.
7. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics. IMIA Yearbook of Medical Informatics 2007; [cited January 19, 2014].
8. EFMI: European Federation for Medical Informatics. Available at: http://www.efmi.org. Accessed: on April 02, 2014.
9. Masic I, Kern J, Zvarova J, de Lusignan S, Vidmar G. Task Force of the European Federation of Medical Informatics Journals: Background, Rationale and Purpose. Acta Inform Med. 2009; 17(4): 180-182. doi: 10.5455/aim.2009.17.180-182.
10. Naszlady A. Contribution of EFMI to development of medical informatics. European Federation for Medical Informatics. Med Arh. 1999; 53(3 Suppl 3): 11-2.
11. Hofdijk J, Weber P, Mantas J, Mihalas G, Masic I. A Short Factography About IMIA and EFMI. Acta Inform Med. 2014 Feb; 22(1): 71-78. doi: 10.5455/aim.2014.22.71.78.
12. Masic I. Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-48. doi: 10.5455/aim.2014.22.44-48.

18

Izet Masic

THE MOST INFLUENTIAL SCIENTISTS IN DEVELOPMENT OF MEDICAL INFORMATICS

Medical informatics as a discipline is still relatively young compared to other medical disciplines. Its development could be traced back 70 years in direct correlation with the advent and widespread in use of digital computers and the development of information and communication tools based just on these computers.

In previous decades, society in general terms, and thus the medicine and health care have changed significantly, to great extent thanks to these developments. Today, we can hardly imagine diagnostic procedures, such as, for example, computerized tomography, or access to medical knowledge without access to numerous databases, or electronic storage of data relating to patients, without information technology in medicine. At the very beginning of its development, Mdical informatics is considered as discipline that could be helpful but not necessary discipline.

However, today it is one of the bases in medicine and health care in general. That is why, a lot is expected of Medical informatics, in terms of providing support to health care services in all parts of the world as well as in contributing to its quality and efficiency, and innovation in biomedicine and research in biomedical sciences.

When talking about the development of medical informatics, the important place have an international non-profit organization IMIA (International Medical Informatics Association) and its branch associations, especially European Federation for Medical Informatics (EFMI) that their work covers all continents, comprises more than 70 academic institutions and more than 50,000 individuals. Its role in this rapid development of Medical informatics presented by its objectives: promotion of ICT in

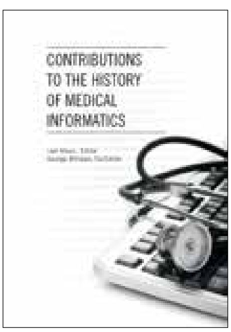
*This text is republished from Acta Inform Med journal, issues printed from 2014 until 2021 with permission of the Publisher: © Avicena d.o.o. Sarajevo, Mis Irbina 11, 71000 Sarajevo, Bosnia and Herzegovina, Some parts are corrected and edited by Editor of this book.

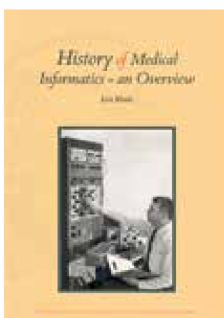
health care, public health and biomedical research; stimulating research, development and everyday application; promotion of education and responsible behaviour, moving ICT from theory to practice in all areas of health care and stimulation of progress, implementation of new technologies and research.

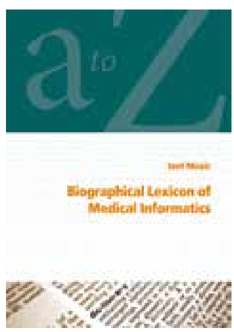
Everything mentioned above couldn't be realized without contributions of the great scientists and their discoveries and achievements. Thanks to them today we can speak about great improvement of health care protection on every level of the health care systems in almost every country in the world.

In this chapter we will try to describe a short facts about some of the most influential medical informaticians during the history of development of this scientific discipline (1-31). Author of this chapter described bioscathces of a few most influential biomedical experts in the scientific and academic field of biomedicine with their important contributions in the biomedical informatics. The number of top 31 published CVs in the biomedical journal "Acta informatica Medica" were printed in the issues published from 2014 until 2021 years and deposited in PubMed Central, Scopus and other databases.

The list of the references where mentioned CVs published in the issues of Acta Informatica Medica journal are stored at the end of this chapter and at the end of this book. Mentioned published articles are re-published with permision of the author of the published papers and Publisher "Avicena", Sarajevo and Academy of Medical Sciences of Bosnia and Herzegovina.







THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (1): FRANCOIS GREMY (1929-2014)

Francois Grémy (1929–2014) has a Master's in Physical Sciences, a Master's in Mathematics (1). He was interned in Paris Hospitals as a Doctor of Medicine, and late he become University Professor at several universities in France. Diploma of Higher Education in Theory of Probabilities he received from the Statistical Institute of Paris (1). Early in his career he worked at the Faculty of Medicine of Tours. This experience led him to the Faculty of Medicine, Pitié-Salpêtrièr, where for 23 years, he was professor of Biophysiques, Biostatistics and Medical Informatics, a hospital biologist and Department Head of Medical Informatics in Paris Hospitals, as well as Director of the U-88's Research Unit: 'Public Health and Economical and Social Epidemiology' at INSERM. In the Faculty of Medicine at Montpellier-Nimes, Professor Grémy was Professor of Biostatistics and Medical Informatics, and Department Head of Bioinformatics at the Regional University Hospital Center, Montpellier. Between 1990 and 1996, in the same center, Professor Grémy was Professor of Public Health and Department Head of Medico-Hospital Economy and Preventive Actions. He was President of the Board of Directors of the National School of Public Health of Rennes, member of the National Universities' Council of the High Committee of Public Health, and of the Scientific Council of PM.S–I. He founded in 1967 the International Medical Informatics Association (IMIA). He is also the co-founder of the European Federation for Medical Informatics, and served as a member in the European Commissions' activities evaluating informatics technologies in medicine. His scientific career, is distinguished because of his significant contribution as a researcher and as a forerunner in the field. His influence has ranged from hard sciences to clinical medicine, and he is recognized as a philosopher among medical informaticians. He acquired specific competence in Cardiology and Neurology, especially in neurophysiology. But he also got degrees in mathematics, biophysics, and more recently philosophy. He created the first laboratory for Medical informatics in the mid-60s at the Pitié-Salpêtrière School of Medicine in Paris. As founder of IFIP TC4 that gave rise to IMIA he is considered to be the IMIA father and a key European figure in the field. During MEDINFO 2004 Conference in San Francisco Francois Gremy received the first IMIA Award of Excellence for his outstanding contributions to IMIA and to health informatics. François was one of the founders of IMIA and his extensive research especially during his time at the University of

Montpellier had left a lasting impression on his colleagues, students and friends in Europe and many other parts of the world. Francis Gremy was not only a pioneer in the Medical/Health informatics as new field, he had a holistic view on the large variety of medical informatics applications, with humanistic values to be respected and ethical guidelines to propose to follow. His ability to clarify complex matters and his sense of humor were part of his great teacher talents, associated to his very open mind to perform research in a multidisciplinary approach. His social engagement was also exceptional. He was an emblematic figure who opened new roads leading to patient centered Medical informatics, one of the best examples of the French culture, a Master and a friend (1). As the first President of IMIA and for his collaboration when he was President of the School of Public Health of Rennes, Université Catholique de Louvain, acknowledged his key-role in the development of Medical informatics by nominating him "Doctor Honoris Causa" (1). François Grémy deals with evaluation of health information systems, where he was involved and describes the evolution of his personal ideas. He proposes the main distinction between systems where the user(s) remain(s) external from the running program, from the ones where the user(s) interacting with the program become(s) the main component of the system (1). Francois Gremy "addresses conventional methods of evaluation used in Medical Technology Assessment, how the whole knowledge in anthropology may contribute strongly to evaluation, and how the subjectivity of the user(s), how he (or they) react(s) with the computing machinery, is a main key to the success or failure of the whole system. He asserts that the temptation of the eradication of subjectivity as a condition for progress is deleterious for our civilization threatened by a comeback of barbarity, and is scientifically wrong (1)." His honors include the Janssen Prize from the Academy of Medicine; Silver Core International Federation for Information Processing; Chevalier Legion of Honor; Prize in Medicine and Public Health from the Institute of Health Sciences; and an Honorary Doctorate from Catholic University in Louvain, Belgium (1).

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (1): Francois Gremy. Acta Inform Med. 2014 Aug; 22(4): 287. doi: 10.5455/aim.2014.2.287-287.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (2): MORRIS F. COLLEN (1913-2014)

Morris F. Collen (1913-2014) was born in St. Paul, Minnesota. He attended the University of Minnesota, where he earned a bachelor's degree in electrical engineering in 1935 (1). In 1938 he earned his MD "with distinction" from the School of Medicine and completed a residency in internal medicine at USC/Los Angeles County General Hospital. Dr. Morris Collen has had a profound influence, not only on the creation of the field of informatics, but also on healthcare delivery and the creation of new models of payment and prevention. Dr. Collen's remarkable career began in 1942 when he was selected by Dr. Sidney Garfield, a surgeon, to join him as an internist in a California group practice. Drs Garfield and Collen subsequently worked with the industrialist Henry Kaiser, who is credited with creating one of the first comprehensive prepaid health plans for both office and hospital care. This led to the establishment of Kaiser Permanente in the post-World War II period plus a comprehensive infrastructure of hospitals in the Bay Area near San Francisco and near Portland, Oregon. In the subsequent decades, the Kaiser organization grew to become a nationwide healthcare provider with millions of enrollees. Collen became a nationally recognized authority on the treatment of pneumonia during World War II. His gift for research showed early in his published studies in The Permanente Foundation Medical Bulletin of which he was long-time editor. After two decades as an internist with Kaiser Permanente, his career took a turn into early medical information technology. Collen and his team set to work to automate the 10-year-old multiphasic health screening exam to develop a prototype electronic health record. Within a decade, Dr. Collen accumulated several millions of health checkup data sets on more than a million subjects, creating in the process not only a prototype electronic health record, but also a phenomenal and unique basis for research, and this despite the immaturity of the technology available in the fifties and sixties. For the pursuit of the scientific aspects of his work, Dr. Collen founded the Medical Methods Research Division within Kaiser Permanente in Oakland, to which he added the Division of Technology Assessment in 1979 that he directed until his retirement in 1983, at age 70.

He was elected to membership in the Institute of Medicine of the National Academy of Sciences (1971), and has served in many capacities on many committees of the National Library of Medicine. By the time of his retirement that year, Dr. Collen listed some 150 publications in his scientific output and had held appointments at multiple first-class universities, including Johns Hopkins and Stanford. His work „Hospital Information Systems“ and „Multiphasic Health Testing Services“, both became classics (1).

REFERENCES

1. Masic I, The Most Influential Scientists in the Development of the Medical Informatics (2): Morris F. Collen. Acta Inform Med. 2014 Oct; 22(5): 350. doi: 10.5455/aim.2014.22.350-350.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (3): PETER LEO REICHERTZ (1930-1987)

Peter Leo Reichertz (1930-1987) was a physician and university professor in the field of medical computer science. He studied physics, mathematics and medicine at the different universities throughout the Europe, in universities of Göttingen, Köln, Geneva, Munich and Bonn (1). During that period he persuaded PhD and directed himself toward internal medicine. His main scientific activity in this period was in the field of cardiology. The experiences in practice and the emerging possibilities of data processing have convinced him of the importance of computer science in medicine and made him a pioneer of medical computer science. His path led him in time from 1966 to 1969 to USA at the University of Texas and the University of Missouri. There Reichertz Peter led the radiological computer research was responsible in a project to create a medical information system in the hospital worked and was director of a general university computer center. In 1969 he returned to Germany and took over the Department of Medical computer science at the Medical School of Hannover, which he designed from the ground up. From that Hanover was one of the centers of medical computer science, nationally and internationally. Peter Reichertz ambition was to reject the medical computer science closely to the core computer science and to create an understanding of the problems and possibilities of each other's discipline and bring a discussion. The means to do so were joint meetings with the Society for computer science and GMDS to an Advanced Course in Medical Informatics. The external sign is that of him initiated certificate 'Medical Informatics', which is awarded jointly by the GMDS and GI. From 1975 to 1988 he was also a lecturer at the Technical University of Braunschweig. He was 1976/1977 President of the GMDS, co-founder of the IMIA (International Medical Informatics Association) and EFMI (European Federation for Medical Informatics), as its first president (1). His work on the international level, the term 'Medical Informatics' and its contents significantly affected. In his honor, Peter L. Reichertz Instituts für Medizinische Informatik was formed in 2007. It was founded by the Technical University Carolo-Wilhelmina on two locations, in Braunschweig and Hannover. Founding goal was the formation of a regional cluster of excellence.

REFERENCES

1. Masic I, The Most Influential Scientists in the Development of Medical Informatics (3): Peter Leo Reichertz. Acta Inform Med. 2014 Dec; 22(6): 415. doi: 10.5455/aim.2014.22.415-415.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (4): ALLAN MACLEOD CORMACK (1924-1998)

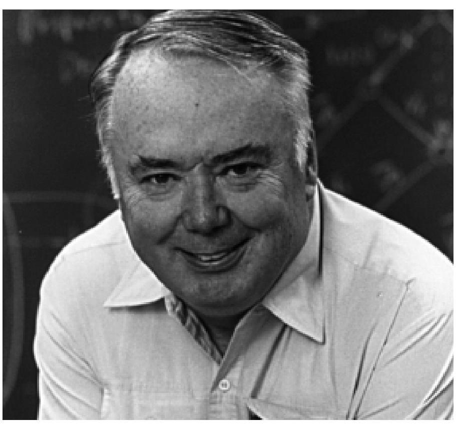
Allan MacLeod Cormack (1924-1998) was born in Johannesburg, South Africa, the son of George and Amelia, a civil service engineer and a teacher respectively, who had emigrated from Scotland to South Africa prior to World War I (1). At the University of Cape Town, South Africa, Cormack chose the field of engineering, but two years later he changed his major to physics, completing a baccalaureate of science in 1944. He remained at the University of Cape Town, completing a Master of Science degree in the field of crystallography in 1945. During the years that followed, Cormack became a lecturer in physics at the University of Cape Town and pursued graduate studies in the field of theoretical physics for two years at Cambridge University in England. In 1950 Cormack returned to South Africa from Cambridge and during this period he was asked to serve a six-month service as resident medical physicist in the radiology department in Cape Town, where he supervised the use of radioisotopes as well as the calibration of film badges used to measure hospital workers' exposure to radiation. At Groote Schuur, Cormack witnessed first hand how radiation was being used in the diagnosis and treatment of cancer patients. Baffled by deficiencies in the technology used for such procedures, Cormack began a series of experiments and analyses, the results of which were two papers published separately between 1963 and 1964 in the Journal of Applied Physics (1). Between 1956 and 1964, most of his research in connection with the development of computerized axial tomography was conducted on his own time. Neither of his two Journal of Applied Physics papers met with significant response, despite the fact that they proved the feasibility of his method for producing images of heretofore non visible or barely visible cross sections of the human body. Hounsfield was independently coming to conclusions similar to Cormack's, and developed the first CAT scanner as early as 1972. In 1979 Cormack and Hounsfield were awarded the Nobel Prize for physiology or medicine for their joint, though independent, development of CAT scan theory and technology. Unlike previous Nobel recipients, neither Cormack nor Hounsfield held a doctorate in medicine or science; further, their discovery was awarded the prize only after the Nobel Assembly voted the first choice of the selection committee; and, finally, it was highly unusual that the two men had never met or worked together, yet had worked on the same invention concurrently.

In 1990, as one of several scientists receiving the National Medal of Science, Cormack was recognized by President George Bush. Cormack is a member of the National Academy of Science and the American Academy of Arts and Sciences, and is a fellow of the American Physical Society. Cormack died of cancer in Massachusetts at age 74. He was posthumously awarded the Order of Mapungubwe for outstanding achievements as a scientist and for co-inventing the CT scanner.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (4): Allan Cormack. Acta Inform Med. 2015 Feb; 23(1). 65. doi: 10.5455/aim.2015.23.65-65.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (5): CHARLES EDWIN MOLNAR (1935-1996)



Charles Edwin Molnar (1935-1996) was a codeveloper of one of the first minicomputers and a pioneer in cochlear modeling research (1). As a young researcher at the Lincoln Laboratory of the Massachusetts Institute of Technology in 1962, Molnar with another engineer, Wesley A. Clark - led a team of designers in developing the Laboratory Instrument Computer, or LINC. The machine, which was one of the few unclassified projects a the laboratory in the early 60s, was intended for doctors and medical researchers. Although it would be considered of insignificant power compared to modern personal computers, it was a self-contained machine that had a simple operating system and a small display and stored its programs on a magnetic tape. The LINC originated decades before the advent of the personal computer. Its development was the result of a National Institutes of Health (NIH) program that placed 20 copies of an early LINC prototype in selected biomedical research laboratories nationwide. Later, the LINC was produced in greater numbers by Digital Equipment Corp. and other computer manufacturers Molnar received a bachelor's degree (1956) and a master's degree (1957) in electrical engineering from Rutgers University, and received a doctoral degree (1966) from MIT in electrical engineering. His dissertation topic was the mechanics of the inner ear and how it translates auditory signals into neural responses. After leaving MIT, he established the Institute for Biomedical Computing at Washington University in St. Louis, where he worked from 1965 until 1995, when he became a senior research fellow at Sun Microsystems in California. Molnar earned a worldwide reputation for his work in self-timed computer system theory, a design approach for ultrafast computers. While the operations of commercial computers are controlled by a single clock, most researchers in the field believe that significant speed breakthroughs await the advent of systems whose components can operate independently. At Sun, Molnar was continuing his work in this area. Molnar was known as an intensely curious researcher whose talents and interests ranged from physiology and bioengineering to electrical engineering and computers, music and furniture building, and hiking and canoeing. He started practice of sending computer programs by cable technology with his colleague Clark. In the 1960s, Molnar and Clark obtained a patent for sending computer programs over cable television lines to communicate data from central computers, which were expensive at the time, to less expensive bed side terminals in intensive-care units. The patent, which is now expired, turned out to be ahead of its time. Some companies are now starting to employ the cable technology, which allows users to send data much faster than by the more common telephone lines. Charlie Molnar was also well known as a pioneer in the modeling of the auditory system, especially numerical models of the function of the cochlea (the inner ear). Before death in 1996, he was working at Sun Microsystems on asynchronous circuits with Ivan Sutherland. He will be the most remembered by his pioneer work in making numerical models of cochlea function.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (5): Charles Edwin Molnar. Acta Inform Med. 2015 Apr; 23(2): 121. doi: 10.5455/aim.2015.23.121-121.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (6): HEINZ ZEMANEK (1920-2014)

Heinz Zemanek (1920-2014) was an Austrian computer pioneer who developed the first complete transistorised computer on the European continent in 1955 (1). Zemanek graduated from secondary school in Vienna in 1937. He started to study at the University of Vienna, but in 1940 he was drafted into the Wehrmacht, where he served in a “communication unit”, and also as a teacher in an Intelligence Service School. Returning to studying radar technology he earned his degree in 1944 with the help of University of Stuttgart professor Richard Feldtkeller. Zemanek designed and built the “May Breeze”, the first computer on mainland Europe to run purely on transistors instead of vacuum tubes, with the help of a group of students he enlisted at the Vienna University of Technology

(TUV). The computer was named Mailüfterl - German for “May breeze” - in reference to Whirlwind, a computer developed at MIT between 1945 and 1951. Mailüfterl contained 3,000 transistors, 5,000 diodes, 1,000 assembly platelets, 100,000 solder joints, 15,000 resistors, 5,000 capacitors and 20,000 meters switching wire. After the war Zemanek worked as an assistant at the University and earned his PhD in 1951 about timesharing methods in multiplex telegraphy. In 1952 he completed the URR1 (Universal Relais Rechner 1 i.e. Universal Relay Computer 1). The IBM Laboratory Vienna, also known as the Vienna Lab, was founded in 1961 as a Department of the IBM Laboratory in Böblingen, Germany, with professor Zemanek as its first manager. Zemanek remained with the Vienna Lab until 1976, when he was appointed an IBM Fellow. He was crucial in the creation of the formal definition of the programming language PL/I. The definition language used was VDL (Vienna Definition Language), a direct predecessor of VDM Specification Language (VDM-SL). For several years, Zemanek had been a lecturer at the Vienna University of Technology, where a lecture hall was named in his honor. Professor Zemanek was instrumental in creating TC4 on Medical Informatics in 1967, and during his Presidency of the International Federation for Information Processing (IFIP), he was responsible for the 1974 Congress in Stockholm, which included TC4 to IMIA. Professor Zemanek was, also, founding president of the Austrian Computer Society, as well as a member of the Austrian Academy of Sciences and a recipient of the Medal of Honour for services to the Republic of Austria.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (6): Heinz Zemanek. Acta Inform Med. 2015 Jun; 23(3): 184-184. doi: 10.5455/aim.2015.23.184-184.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (7): SHIGEKOTO KAIHARA (1937-2011)

Shigekoto Kaihara (1937-2011) was born in Hakusan, Tokyo and moved to Dailen, China soon after his birth due to his father’s work (1). Returning to Japan at the age of eleven, he proceeded to attend the middle school operated by Ochanomizu University, and then the Tokyo Metropolitan Hibiya High School, concentrating on his schoolwork, where he excelled, and on Japanese-style swimming. In 1955 he entered the University of Tokyo, studying medicine and receiving certification by the ECFMG (the

US Educational Commission for Foreign Medical Graduates) prior to graduation. His clinical training was received at the US Forces Tachikawa Hospital, where he honed his English-language skills. Subsequently he acquired a doctoral degree from the Medical faculty at the University of Tokyo for his research in nuclear medicine. In 1966, he went to the US to pursue additional studies at Johns Hopkins Hospital. After returning to the University of Tokyo, he was appointed as a 2nd internal medicine assistant in 1969, a lecturer in 1974, and an assistant professor in 1975. It was at this time that he began his early work on Medical informatics topics, and in 1978 he became the director of the Information Processing Division of the affiliated hospital. Throughout the 1980s, he investigated medical consultation systems using artificial intelligence methods and also trained young researchers. He organized several international symposia in the US and Germany. His many research trainees in Medical informatics and other related fields are now influential leaders, both in Japan and in other parts of the world. In Japan Dr. Kaihara was widely viewed as the country's pioneering authority in the field of Medical informatics, and he rapidly developed a similar reputation internationally. During the 70s, Medical informatics grew in prominence through the efforts of a variety of organizations, including the Japan Society of Medical Electronics and Biological Engineering (later, the Japanese Society for Medical and Biological Engineering), the Information Processing Society of Japan, and others. He was always insisting that the informatics faculty should break that kind of session and demand that methods and approaches be distinguished clearly so that the discussions that ensued could focus on key methodological elements and techniques. He brought that rigor to life for the larger community when he played a key role in assuring that the third MEDINFO (World Congress on Medical Informatics) was held in Tokyo in 1980). Internationally, Dr. Kaihara served as Editor in Chief of the Proceedings for MEDINFO 80 (Tokyo), as president of the International Medical Informatics Association (IMIA) from 1986 to 1989, and as a Program Committee chairman of MEDINFO '95 (Vancouver). In 1998, he was elected to fellowship by the American College of Medical Informatics. Remarkably, at a time of difficult political strife, during his IMIA chairmanship he successfully held MEDINFO '89 at two venues, Beijing and Singapore, a few months apart. This was a unique event in the history of IMIA and a reflection on his leadership skills and superb negotiating abilities. After retiring from his office at the University of Tokyo in 1996 and becoming an Emeritus Professor, he served as director of National Okura Hospital (later integrated as the National Center for Child Health and Development). He installed a hospital network that assured an outlet at each sickbed, and realized "Patient Participation" through the use of the developing electronic media, which enabled hospitalized children to see and talk with their parents via teleconference. Simultaneously, within the same site, he brought the first Ronald McDonald House, for parents of sick children, to Japan.

In 1994, Dr. Kaihara contributed an article to Iryo Johogaku (Medical Informatics), which is entitled “Medical informatics in Japan - Challenge in the coming five years”. Some 17 years later, his 5-year vision has been only partially achieved. Even today his colleagues continue to pursue the goals that he believed should have been achieved in 1999.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (7): Shigekoto Kaihara. Acta Inform Med. 2015 Aug; 23(4): 250-251. doi: 10.5455/aim.2015.23.250-250-251.

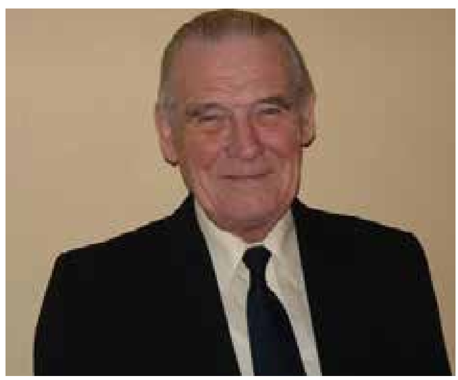
THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (8): JEAN RAOUL SCHERRER (1932-2002)

Jean–Raoul Scherrer (1932-2002) was a pioneer in the development and deployment of Clinical Information Systems (CIS) (1). He received in 2000 the Morris F. Collen Award of Excellence in Medical informatics. Jean-Rauol Scherrer was born in the Canton of Jura, Switzerland, in October 1932 but has lived most of his life in Geneva, Switzerland. He went to college in Fribourg, at a Jesuit School called College of Saint Michel, and followed the classical pathway - ancient Greek, Latin, and strong mathematics studies. In 1959, he graduated from the Medical School of the University of Geneva, where he studied Physiology and Internal medicine. From 1967 until 1969, Professor Scherrer did postgraduate work in Medical physics at Brookhaven National Laboratory, on Long Island, and then returned to Geneva and the Cantonal Hospital of the University of Geneva, where he began to design and build what was to become DIOGENE, the Hospital’s patient information system. The idea was to have a system that would be patient-centric. Professor Scherrer addressed the needs of the physician, and not only that, he did not encumber the physician with the need to learn the computer. The basic principle was : One puts orders in through the telephone. One could immediately see on the screen what he had ordered. Behind this outward façade was a bank of individuals who were keying in the information for orders, for medications, for laboratory work, and for radiology. But his objective was to see how the computer could be an enabling tool, to assist the health care provider in doing what he or she needed to do to be giving the best possible care for the patient. Starting with the mainframe-based patient-centered hospital information system DIOGENE in the 70s, Prof. Scherrer developed, implemented and evolved innovative concepts of man-machine interfaces, distributed and federated environments, leading the way with information systems that obstinately focused on the support of care providers and patients. Through a rigorous design of terminologies and ontologies, the DIOGENE data would then serve as a basis for the development of clinical research, data mining, and lead to innovative natural language processing techniques. In parallel, Prof. Scherrer supported the development of medical image management, ranging from a distributed picture archiving and communication systems (PACS) to molecular imaging of protein electrophoreses. Recognizing the need for improving the quality and trustworthiness of medical information on the Web, Prof. Scherrer created the Health-On-the-Net (HON) foundation. He had groups working on natural language processing and image processing and manipulation in the OSIRIS system. Another of his groups was determining protein constellations in human patients by the use of bi-dimensional electrophoresis of human serum, and correlating these patterns with the identification of genes, using several scattered remote data bases. This Web-based system is called ExPASy. This was one of the first bioinformatics groups assembled any place in the world. In Geneva in 1992, researchers at CERN, a high-energy physics laboratory, invented the World Wide Web. Luckily, the director of CERN was a neighbor of Professor Scherrer, and because of this neighborhood collaboration, the group at Geneva Hospital was really the first to apply World Wide Web technology in health care. They made their protein research databases available to colleagues around the world via the Web and were really the first to do this. Dr. Scherrer was Executive Vice President of IMIA (International Medical Informatics Association) in charge of Working Groups and Special Interest Groups from 1993 to 1996: and President of the EFMI (1996-1998).

REFERENCES

1. Masic I, The Most Influential Scientists in the Development of Medical Informatics (8): Jean Raoul Schrrer. Acta Inform Med. 2015 Oct; 23(5): 326-327.. doi: 10.5455/aim.2015.23.326-326-327.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (9): WILLIAM ABBOTT (1931-2011)

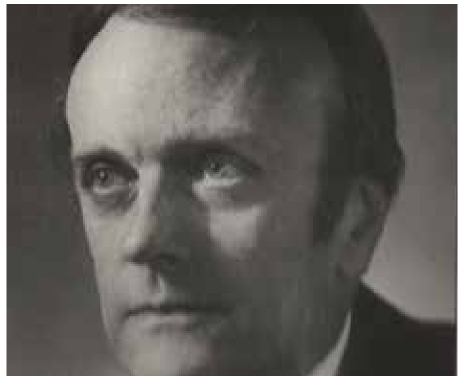


William “Bud” Abbott (1931-2011) was one of the pioneers of health informatics in the UK (1). Bud was one of the first generation of health informaticians who started operationally in the mid-1960s. In 1948, Bud joined The London hospital, became involved in the use of machine accounting and explored the use of computing towards the end of the 1950's. He was instrumental in the development of hospital computing, and played a leading role in both global activities through the International Medical Informatics Association and closer to home with the establishment of the 'Current Perspectives' in Health Computing conference and exhibition in 1984 which became the 'HC' event which still runs today. By the early 1970s, Bud was already 'Mr-NHS Computing' and led many of the British Computer Society Health Informatics Specialist Groups delegations to European and world events. He encouraged work and mobilized peers and novices to work together through the professional society. He had a knack of facilitating and fixing whilst also being a consummate diplomat. During organization of IMIA MEDINFO Conference in London in 2001, he was included there, playing a vital 'political' role in the Local Organizing Committee. He continued to guide Health informatics even when operationally retired, frequently appearing in Harrogate at HC congresses and always willing to chair sessions, sometimes at very short notice! He was a mentor to many, especially in the UK and Europe, over the years. His professional legacy will be both the iconic London Hospital System and the position of UK Health informatics world-wide. .

REFERENCES

1. Masic I, The Most Influential Scientists in the Development of Medical Informatics (9): William Abbott. Acta Inform Med. 2015 Dec; 23(6): 398-398. doi: 10.5455/aim.2015.23.398-398.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (10): MARSDEN SCOTT BLOIS (1919-1988)



Marsden S. Blois, Jr. (1919–1988), MD, PhD, was a visionary in health informatics (1). Professor of Medical information science and Dermatology at the University of California, San Francisco, he worked to bring together medicine and information science. Blois was of an opinion that there was an abundant literature on medical computing, and virtually none on medical information science as a science. As a response to that, he published a book "Information and Medicine" in 1984. It is thought to be one of the most comprehensive view of his work-work visible in his professional activities and publications. In his book, Blois turned to information science. He dealt with concepts ranging from theories of information, to the structure of descriptors and information processes. He brought the same analytical approach to the consideration of diseases and the clinical and diagnostic processes. As his work with the National Library of Medicine on a unified medical language attests, he was deeply interested in the creation and representation of medical information. He wanted for the task of Medical informatics as a new discipline, to better understand and define the medical information processes in order that appropriate activities that will be chosen for computerization, and to improve the man-machine system. Although a master informatician, Blois remained devoted to medicine, which he judged to be "the enterprise offering us the greatest opportunity for describing the nature of man in all the interrelated levels of his complexity." Some of his work includes: „Information and medicine: the nature of medical descriptions", „Free Radicals in Biological Systems: Symposium by Marsden S. Blois" and „The integration of hospital information subsystems". Dr. Blois was elected to be the founding President of the American College of Medical Informatics in 1984 (ACMI).

REFERENCES

1. Masic I, The Most Influential Scientists in the Development of Medical Informatics (10): Marsfen Scott Blois. Acta Inform Med. 2016 Feb; 24(1): 70-71.. doi: 10.5455/aim.2016.24.70-71.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (11): DAVID B. SHIRES (1931-2011)

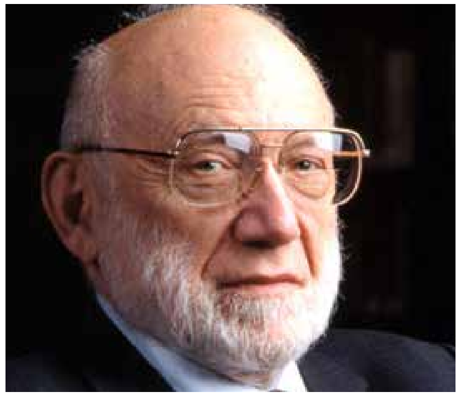
David Shires (1931-2011) was Professor of Family Medicine and Community Health and Epidemiology at Dalhouaie University, Canada (1). Dr. Shires has practiced medicine in Africa, United Kingdom and United States and has been a resident in Canada for the past 20 years. His early work includes development of a Computerized medical record system for the Apollo astronauts. Dr. Shires was elected President of the International Medical lnformatics Association (IMIA) in 1980, and holds Honorary Fellowship, in IMIA as well as the British Computer Society. In 1983 in Paris, he received the Silver Core award for meritorious services to international computing by the International Federation for Information Processing (IFIP). In 1974 he published a book on Computer Technology called "Computer Technology in the Health Sciences" and in 1986 he co-authored "Family Medicine: A Guidebook for Practitioners of the Art". David B. Shires assumed the IMIA presidency in

1980, one year after the transition from TC4. During his term (1980-1983), Shires reached agreements with the regional group for Central and South America, known as IMIA-LAC (Latin American Countries), and the most populous country in the world, the People's Republic of China (PRC), making them active participating members in IMIA. Shires saw IMIA as a family, within which "the then USSR and Eastern Bloc countries as well as other countries such as Cuba, could indulge in animated and mutually productive discussions with their western counterparts with each respecting the other's political differences." IMIA worked to become meaningful to developing countries and forged new bonds with the World Health Organization. In 1992, Shires reflected that "IMIA has grown considerably in reputation, recognition and credibility in the ten years since I left the presidency, largely due to the continuing hard work of Presidents Peterson, Kaihara and Willams." Today IMIA reflects Shires' goal for his presidency in its international constituency, which goes "beyond the Europe–North America-Japan axis to much greater world vision." Today, the IMIA family includes a newly invigorated African region (HELINA) and is well on its way to facilitating the establishment of a Middle East Region. (MedInfo 1983: Amsterdam, The Netherlands).

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (11): David B. Shires. Acta Inform Med. 2016 Apr; 24(2): 149. doi: 10.5455/aim.2016.24.149-149.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (12): JOSHUA LEDERBERG (1925-2008)



Joshua Lederberg (1925-2008) was an American molecular biologist known for his work in microbial genetics, artificial intelligence, and the United States space program. He was just 33 years old when he won the 1958 Nobel Prize in Physiology or Medicine for discovering about bacterial genetic information transfer. His father, Zvi Lederberg, was an orthodox rabbi; and his mother Esther a homemaker. Joshua felt drawn to science at an early age, stating in a homework assignment at age seven that his career aspiration was to become "like Einstein," to "discover a few theories in science." He graduated from Stuyvesant at the age of fifteen. At the Columbia University, his mentor Francis J. Ryan introduced him to the red bread mold, Neurospora, as an important new experimental system in the emerging field of biochemical genetics. In the United

States Navy's V-12 training program, he performed his military training duties and examined stool and blood specimen from malaria patients. After receiving his bachelor's degree in zoology in 1944, he enrolled in Columbia University's College of Physicians and Surgeons and continued to do his research. Lederberg carried out experiments with the intestinal bacterium Escherichia coli which demonstrated that certain strains of bacteria can undergo a sexual stage, that they mate and exchange genes. The most important of his discovery was the discovery of viral transduction, the ability of viruses that infect bacteria to transfer snippets of DNA from one infected bacterium to another and insert them into the latter's genome. The use of viruses in manipulating bacterial genomes became the basis of genetic engineering in the 1970s. In the year 1958 he received a Nobel Prize in Physiology or Medicine, along with Tatum and George W. Beadle, "for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria." The launch of Sputnik in 1957 led Lederberg toward an interest in astronomy that lasted 20 years. His concern about the risk of spacecraft returning to Earth with contaminants from space resulted in a quarantine for space travel that remains in effect today. He went on to design experiments intended to detect the presence of life on Mars, resulting in the Mars Viking lander. Lederberg became increasingly aware of the value of computers. He formed collaborations with researchers at Stanford to create a program for analyzing mass-spectrometric data of molecular structures, called DENDRAL, which led to further programs for disease diagnosis and management. It was the first expert system for specialized use in science. Over the course of his life, Lederberg was elected to the National Academy of Sciences, the Institute of Medicine, received the National Medal of Science, was named an honorary life member of the New York Academy of Sciences, was awarded Foreign Membership of the Royal Society of London and holds the title of Commandeur, L'ordre des arts et des lettres in France. Lederberg published over 300 scientific and policy-related articles and was the editor of several books, including Papers in Microbial Genetics: Bacteria and Bacterial Viruses (1951), Emerging Infections: Microbial Threats to Health in the United States (1992), and Biological Weapons: Limiting the Threat (1999). Interesting facts: As a child, his idol was Einstein; He was a member of Royal Society of London for Improving Natural Knowledge; He studied how astronauts from Sputnik can contaminate Earth with space organisms – modern space quarantine; He invented first expert system for specialized use in science; He won a Nobel Prize at the age of 33.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (12): Joshua Lederberg. Acta Inform Med. 2016 Jun; 24(3): 220-221- doi: 10.5455/aim.2016.24.220-221.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (13): MARGARET BELLE DAYHOFF (1925-1983)

Margaret Belle (Oakley) Dayhoff (1925-1983) was an American physical chemist and a pioneer in the field of Bioinformatics (1). She dedicated her career to applying the evolving computational technologies to support advances in biology and medicine, most notably the creation of protein and nucleic acid databases and tools to interrogate the databases. Dayhoff graduated from New York University in 1945 with a bachelor of arts and earned a PhD. in quantum chemistry in 1948 at Columbia University. She was a research assistant at the Rockefeller Institute from 1948 to 1951 and had been associate director of the National Biomedical Research Foundation in Washington, DC, since 1960. Dr. Dayhoff was widely known in the scientific community for establishing a large computer data base of protein structures as well as for being the author of the Atlas of Protein Sequence and Structure, a multivolume reference work. She initiated this collection of protein sequences in the Atlas, a book collecting all known protein sequences that she published in 1965. It was subsequently republished in several editions. This led to the Protein Information Resource database of protein sequences, which was developed by her group. It and the parallel effort by Walter Goad which led to the GenBank database of nucleic acid sequences are the twin origins of the modern databases of molecular sequences. The Atlas was organized by gene families, and she is regarded as a pioneer in their recognition. Her approach to proteins was always determinedly evolutionary. Her work is used in genetic engineering and medical research. As a noted archivist of proteins, Dr. Dayhoff contributed to the understanding of the evolutionary process by developing evolutionary "trees" based on correlations between proteins and living organisms. She and her staff made several discoveries, including one indicating that certain genes normally found in most body tissue cells are closely related to genes found in many cancer cells. She did postdoctoral studies at the Rockefeller Institute (now Rockefeller University) and the University of Maryland, and joined the newly established National Biomedical Research Foundation in 1959. She was the first woman to hold office in the Biophysical Society. She originated one of the first substitution matrices, Point accepted mutations (PAM). The one-letter code used for amino acids was developed by her, reflecting an attempt to reduce the size of the data files used to describe amino acid sequences in an era of punch-card computing.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (13): Margaret Belle Dayhoff. Acta Inform Med. 2016 Aug; 24(4): 299-299. doi: 10.5455/aim.2016.24.299-299.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (14): BRANKO CESNIK (1956-2007)

Branko Cesnik (1956-2007) earned MBBS in 1978 and MD in 1995. He was an Australian pioneer and an international leader in Health Informatics (1). Branko graduated as a doctor from Monash University. Following his graduation he worked in training posts in accident and emergency medicine and renal medicine in Australia before spending time working in South Africa. In 1988 Branko was appointed as a Senior Lecturer with the Department of Community Medicine and General Practice at Monash University. Under the visionary leadership of Professor Neil Carson AO, Branko went on to establish the first research and education unit for Medical informatics in any of the medical school in Australia. Branko's research focused on innovative ways to use information technology to support medical education and clinical care. Branko's work in medical education innovation received the Monash University Silver Jubilee Teaching Prize in 1993. In 1995 Branko was appointed as Associate Professor at Monash University and later Branko and Wendy and the members of their unit accepted an invitation to become part of the new Monash Institute for Health Services Research, established by the late Professor Chris Silagy AO. At the institute Branko continued his research activity on the establishment of successful postgraduate training programs for health professionals in health informatics. His vision for the use of IT in health care preceded the widespread development of the World Wide Web and the hypermedia applications which were to appear in the mid-1990s. Branko fostering the development of Health informatics especially in Australia and the Asia Pacific Region. In 1991 Branko was one of the founders of the Health Informatics Society of Australia. Since its establishment the Society has held an annual health informatics conference which has been instrumental in raising the profile of health informatics and facilitating the development of this discipline in Australia. In 1994 Branko co-founded the Asia-Pacific Association for Medical Informatics becoming its second President from 1997-2000. In 1997 he was responsible for bringing the second conference of the Asia Pacific Association for Medical Informatics to Australia. In 1999 Branko became a foundation Fellow of the Australian College of Health Informatics. Branko was the second President of the Australian College of Health Informatics from 2001-2003. In 2001 Branko was elected as Vice-President of IMIA, a mark of the level of respect that he engendered among his peers at an international level. His work helped to ensure that the 2007 conference of the MEDINFO, in Brisbane. He was involved especially in supporting the evaluation of health computing in Australian general practice. In recent years Branko also worked for Australia's National Health and Medical Research Council as a member of the Health Advisory Committee and as Chair of the Information Management Framework Committee. Branko was also appointed by the Australian Health Ministers Council as a member of the National Health Information Group, which is leading the development of electronic health records in each state and territory. Branko, also, worked as a clinician in the Emergency Department of the Knox Private Hospital in Wantirna for many years. In August 2005 Branko's leadership and life work was honored with the award of Life Membership of the Health Informatics Society of Australia, and Life Membership of the IMIA. These are rarely bestowed honors and they reflect the esteem of Branko's peers in Australia and around the world.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (14): Branko Cesnik. Acta Inform Med. 2016 Oct; 24(5): 375-375. doi: 10.5455/aim.2016.24.375-375.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (15): HOMER R. WARNER (1922-2012)

Homer Richards Warner (1922-2012), PhD, was an American cardiologist who was an early proponent of Medical informatics and one of the pioneers and fathers of Medical informatics in the world (1). Many aspects of computer applications in medicine is well known, discovered and introduced in the mid-1950's and late by Homer Warner. He began working on clinical decision support technology in the cardiology department at LDS Hospital. Dr. Warner and his colleagues developed the HELP (Health Evaluation through Logical Processing) system which is still in use today at Intermountain Healthcare. During Second Worls War he enlisted in the Naval Air Corps where he was trained to be a carrier-based fighter pilot. After the war he returned to the Utah where he met Katherine Ann Romney and they graduated together in 1946 and later married in the Salt Lake Temple. He graduated from the University of Utah medical school in 1949 and continued his training in Dallas, and then the University of Minnesota. He earned gis PhD in Physiology in 1953. He staretd to work at the Mayo Clinic where where he developed an equation for estimating the beat-by-beat stroke volume of the heart from the shape of the pressure wave in the aorta. His experience with Dr. Earl Wood at the Mayo Clinic was pivotal in his decision to pursue a career in medical research. Homer Warner received his bachelor's and medical degree from the University of Utah, and a doctorate degree in physiology from the University of Minnesota. Dr. Warner founded and became the first chair in the Department of Biomedical Informatics in the School of Medicine which existed under various names since 1972. Dr. Warner's legacy of excellence and innovation has persisted and the department remains a leader in informatics research, training, and implementation After that (in 1954) Homer returned to Salt Lake City and with an American Heart research fellowship he opened the Cardiovascular Laboratory at the LDS Hospital. Within four years he published his first article about the use of computers to analyze waveforms. Homer established the Department of Biophysics and Bioengineering (later renamed Medical Informatics) at the University of Utah in 1964 and served as Chair. In the 1960's Homer built an analog computer to represent mathematical models of the circulation. With this tool he was able to demonstrate for the first time in experiments on animals the amount of blood pumped by the heart during exercise was dependent upon the dilatation of the blood vessels in the exercising muscles. Then, with the digital computer, he developed a model of diagnostic reasoning that could diagnose patients with congenital heart disease more accurately than physicians could without this tool. Homer founded the journal Computers and Biomedical Research in 1968 and remained its Editor-in-Chief till 1992 (24 years). In 1977 while on sabbatical in Vancouver B.C., he authored a Medical Informatics textbook still used today. After his department moved to the medical school in 1985, Homer worked with Internal Medicine Faculty to develop a computer program called ILIAD. This program was used to teach diagnostic skills to medical students. The Homer Warner Center for Informatics Research at Intermountain Medical Center in Salt Lake City continues his pioneering work in computers and medicine. Thanks to the hard work and vision of Homer Warner and his colleagues, Intermountain has an outstanding legacy on which to build all of its future information systems. In USA today exists Homer R. Warner award. The award was created by the Object Management Group (OMG), selfdescribed as "an international, open membership, not-for-profit computer industry consortium". It includes a $1000 prize, and is presented each year at the American Medical Informatics Association (AMIA). It is named for Warner. For his excellent contribution to development of Medical Informatics Homer Warner received a lot of awards including Morris F. Collen award in 1994. For this work he also received a Career Research Award from the National Institutes of Health and went on to build, with his colleagues at LDS hospital, the first computer-based patient record system (HELP) that incorporated a knowledge base to improve decision-making by physicians and nurses. His unassuming demeanor, adventurous spirit and new ideas attracted people from all walks of life. He had a humble, patient, and gentle nature and took an interest in other people. People who were familiar with him thought that Homer had a rare mix of intellect and accomplishment coupled with warmth, humor and charm.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (15): Homer R. Warner. Acta Inform Med. 2016 Dec; 24(6): 422-423. doi: 10.5455/aim.2016.24.422-423-423.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (16): JOHN ANDERSON (1921-2002)

James Anderson (1921-2002), MD, MA BSc, MRCP, FRCP, was professor of medicine at King's College Hospital Medical School. He was essentially an innovator and pioneered developments in metabolic medicine, medical education and medical computing (1). His background was in history, having obtained a BA with honours in modern history at Durham University in 1942. After the war he took up the opportunity of free education to armed services' survivors to read medicine at Durham, and graduated MB BS with honours in 1950. He earned his MA in modern history in the same year. After house officer appointments at the Royal Victoria Infirmary in Newcastle-upon-Tyne, he was awarded an MRC scholarship in physiology and obtained a BSc with honours in 1952. An MRC research fellowship in Charles Dent's department at University College London he followed, working on calcium metabolism. With his colleagues at department he described the now well-known use of steroids in the differential diagnosis of hypercalcaemia (1). In 1956 he returned to Durham as first assistant in the Department of medicine. In the same year John obtained his MD with a thesis using a new technique of phosphate clearance by the kidney. Next year he was awarded a Rockefeller travelling fellowship to Harvard University and carried out studies on sodium transport in the isolated toad bladder at Massachusetts General Hospital, which he continued to research throughout his subsequent career. He was present at Harvard when 'real time' was discovered, a concept which revolutionised the development of computer technology, and which he realised could be applied to medical records with enormous advantage. He returned to Durham in 1957 to assume direction of the artificial kidney unit there. In 1959 he went to King's as senior lecturer in medicine and consultant in endocrine and metabolic medicine. He was a key figure in the development of renal medicine at King's during the 1960s when the first acute dialyses were performed. He established and directed the South East region artificial kidney unit at this time, which subsequently became based at Dulwich Hospital. He also set up the first Hypertension clinic in London. In 1964 he published, with Sidney Osbourne, the results of his noteworthy and courageous research, the world's first in-vivo neutron activation analysis. At the Atomic Energy Establishment (Harwell) they had both undergone neutron bombardment and demonstrated that this could be used to calculate the quantities of key elements such as sodium and calcium present in the whole body during life. Previous measurements had only been able to be obtained from the ash of cadavers. In 1965 he was appointed to the newly established chair in medicine at King's College Hospital Medical School. Although he continued to research in sodium transport and other metabolic projects, his main focus shifted to medical education and medical computing. In medical education, he reorganised the old curriculum, replacing the existing lecture courses with systems-based topic teaching. These integrated clinical subjects with basic medical sciences to illustrate and explain disease. These ideas have now become established throughout the country on the recommendation of the GMC. Between 1967 and 1970, with the support of the Department of Health, Anderson pioneered the development of Computerised medical record keeping at King's. Although there were multiple difficulties, a useable record was achieved, together with a system of automated discharge summaries from the record to general practitioners, which eliminated the usual delays. Unfortunately the system was too slow, cumbersome and expensive for wider implementation and was not continued. In 1969, he became a fellow of the British Computer Society and chairman of its medical specialist group. He continued to publish and lecture on informatics and electronic medical records throughout the rest of his career. Generations of students will remember his teaching and the way he said 'compuer'. He would be gratified to learn that technological advances have at last enabled his ideas to become a reality at King's, 30 years later. The price of being a visionary is that recognition tends to come too late!

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (16): John Anderson. Acta Inform Med. 2017 Mar; 25(1): 58-59. doi: 10.5455/aim,2017.25.58-59.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (17): EUGENE GARFIELD (1925-2017)

Eugene Garfield (1925-2017) is an American scientist, one of the founders of Bibliometrics and Scientometrics (1). He received a PhD in Structural Linguistics from the University of Pennsylvania in 1961. Dr. Garfield was the founder of the Institute for Scientific Information (ISI), which was located in Philadelphia, Pennsylvania. He founded the ISI in 1960 and developed an indexing system for science literature, based on the analysis of citations used within a given work. Works earn an "impact factor" (IF), a measure of citations to other science journals that serves as an indicator of their importance in the field. The more citations in reputable journals, the higher the impact factor. The ISI sold subscriptions to their publication the Science Citation Index (SCI), and over time grew to include the Social Sciences Citation Index (SSCI) and the Arts and Humanities Citation Index (AHCI). These databases now form the foundation of the online research tool called the Web of Knowledge. He is responsible for many innovative bibliographic products, including Current Contents (CC), the Science Citation Index (SCI), and other citation databases, the Journal Citation Reports (JCR), and Index Chemicus (IC). He is the founding editor and publisher of "The Scientist", a news magazine for life scientists. In 2007, he launched HistCite (HC), a bibliometric analysis and visualization software package. Following ideas inspired by Vannevar Bush's famous 1945 article "As We May Think", Garfield undertook the development of a comprehensive citation index showing the propagation of scientific thinking; he started the Institute for Scientific Information (ISI) in 1955. The creation of the Science Citation Index (SCI) made it possible to calculate impact factor, which measures the importance of scientific journals. It led to the unexpected discovery that a few journals like Nature and Science were core for all of hard science. The same pattern does not happen with the humanities or the social sciences. Garfield's work led to the development of several Information Retrieval algorithms, like HITS and Pagerank. Both use the structured citation between websites through hyper-links.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (17): Eugene Garfield. Acta Inform Med. 2017 Jun; 25(2): 145-145. doi: 10.5455/aim..2017.25.145-145.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (18): ISHAACK SEDICK (1940-2012)

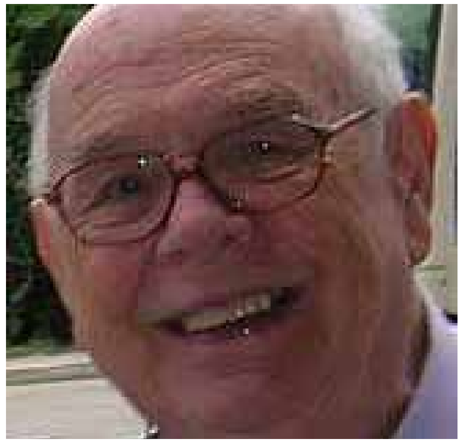
Isaacs Sedick (1940-2012), PhD, was born and grew up in the Bo-Kaap, Cape Town, Western Cape (1). From an early age, Isaacs was fascinated with science and was engaged in performing science experiments at home. At the age of 13, he was involved in distributing political pamphlets and attending meetings of the Teachers League of South Africa (TLSA) and the Non European Unity Movement (NEUM). After completing his education, Isaacs worked as teacher at Trafalgar High School in Cape Town. It was while teaching at the school that he met Achmad Cassiem. Isaacs with his knowledge of explosives tried to train some of his friends in the use of this. This attracted the attention of the security police who monitored their activities. Consequently, Isaacs, his friends Achmad Cassiem, Marnie Abrahams were arrested in 1964 following the testing of explosives at Strandfontein Beach, Cape Town. They were taken to Caledon Police Station. However, the guards caught them and as punishment their food privileges were stopped and their supply of toilet paper withdrawn. In the ensuing 'trial held on the Island, where the he was officially 'charged' for writing unauthorised letters (related to the hunger strike), the prison authorities found Isaacs guilty and sentenced him to be flogged. Furthermore, his study privileges were also withdrawn. After his release from solitary confinement, Isaacs resumed his duties as chair of the Education Committee in prison and later the chair of the First Aid Unit. He taught mathematics and physical science to his fellow inmates. Isaacs completed a Bachelor's degree in Mathematics while on the Island. When he attempted to enrol for postgraduate studies (a MSc degree), this was blocked. He was compelled to enrol for another undergraduate degree in Information Science, Mathematical Statistics and Computer Science. Upon his release, he became a Specialist Scientist in Medical Informatics and Statistics and then the Head of Department of Medical Informatics at Groote Schuur Hospital on Cape Town. Isaacs made five attempts to escape from the Island, albeit all unsuccessful. Upon his release, he was banned for seven years. He was even refused permission by the then Minister of Justice to attend the University of Cape Town (UCT) for postgraduate studies. Nevertheless, he managed to register at the UCT and was forced to meet with his lecturers, clandestinely, in the Cape Town Botanical Gardens. Due to his banning orders, it was extremely difficult to obtain employment even when vacancies were open to him.

He also obtained a visa to undertake a sabbatical in Germany in 1990 where he was able to complete his PhD. He was then elected Fellow of the Royal Statistical Society and a Chartered Member of the British Computer Society. In 2010, Isaacs was elected Honorary Fellow of the IMIA and in 2011, he was nominated as a Companion of Demontford University in the United Kingdom. Again, in 2010 Isaacs was nominated as a Sports Icon by the Department of Arts, Culture and Recreation for his contribution to Sport on Robben Island. He was a driving force behind the development of health informatics in South Africa, in Africa though HELINA, and internationally–in addition to the contributions and sacrifices he made for the freedom of his country, especially during the time he was imprisoned on Robben Island. Isaacs was 23 when he began a 13-year sentence for sabotage, sharing time with Nelson Mandela, after the apartheid police captured him in 1964.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (18): Ishaack Sedick. Acta Inform Med. 2017 Sep; 25(3): 206-207. doi: 10.5455/aim.2017.25.206-207.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (19): JOHN BRYDEN (1932-2012)



John Bryden (1932-2012) was Public health consultant in Glasgow. Scotland (1). John Bryden graduated in medicine at Glasgow University in 1956 and after completing his national service worked in orthopedics and became a GP covering Mosspark and Govan. An early interest in optical character recognition and computer programming led to a three-year fellowship in administrative medicine and a diploma in Social medicine from Edinburgh University. In his final year he was on the commissioning team for Woodside Health Center and set up its computerized patient index, improving preventive medicine. He became medical superintendent for Paisley and District Hospitals in 1971 and completed his MSc in industrial administration with reference to health services at Strathclyde University. Between 1973 and 1981, he led a Health Boards Informatics Team which jointly developed a community health register for a combined population of 1.4 million using optical character recognition. It was known as the Community Health Index (CHI) and the unique identification number is now used on all prescriptions and many medical communications throughout Scotland. His next post was senior epidemiologist with the head injury research team in the Southern General Hospital in Glasgow, where he was involved in research on post-head injury morbidity. In 1986 he designed a diary for new doctors starting in the hospital. He continued as epidemiologist and consultant in public and hospital health with Greater Glasgow Health Board and in 1990 brought the European Federation for Medical Informatics Conference to Glasgow. After retiring, he ran his own private company providing expertise and trouble-shooting in his specialty. He helped with the difficulties of starting a needle exchange clinic required because of an outbreak of Hepatitis B, and backed the Heartstart campaign, which encouraged all citizens to learn basic resuscitation. He became a Scottish Blue Badge Tour Guide qualified to guide in French as well as English, thanks to many Brittany holidays..

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (19): John Bryden. Acta Inform Med. 2017 Dec; 25(4): 280-280. doi: 10.5455/aim.2017.25.280-280.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (20): ROBERT S. LEDLEY (1926-2012)

Robert Steven Ledley (1926-2012) is one of the most influential Medical informatics scientists in the history of development of Medical informatics (1). Robert S. Ledley and his colleague Lee B. Lusted (1922-1994) wrote a seminal 1959 paper in Science that many people cite as the publication that launched the informatics field ("Reasoning Foundations of Clinical Diagnosis") (1). His contributions, however, extend well beyond informatics into a variety of other areas that reflect the breadth of his talents as an inventor and his drive to contribute to health care and science. He is often described simply as the inventor of the full-body Computer Tomography (CT) scanner, but he has had a large number of other inventions to his name and was among the first to anticipate the role of computers in managing and analyzing the expanding but already substantial amounts of biomedical and clinical data. Ledley was born in 1926 in New York City. He received a D.D.S. from the New York College of Dentistry in 1948. He went on to earn an M.A. degree in theoretical physics from Columbia University in 1950. He first worked for Washington D.C.'s National Bureau of Standards (later the National Institute of Standards and Technology) and then moved on to Johns Hopkins University where he was a physicist and research analyst. From 1968 to 1970, he was professor of Electrical Engineering in the School of Engineering and Applied Science at the George Washington University (1). In 1970 Ledley joined the School of Medicine, Georgetown University Medical Center, as a professor in the Department of Physiology and Biophysics. It was there, in 1973, that he developed the Automatic Computerized Transverse Axial (ACTA) x-ray scanner, known as the first whole-body CT machine. The machine has had a revolutionary impact on diagnostic medicine; it is able to generate visual models of internal organs not possible for conventional x-ray machines to produce. The three-dimensional reconstructions, created by transmitting X-ray beams through transverse axial slices of the body, allow physicians to view soft tissue in the body with detail unlike any they were able to see before, improving diagnosis of cancers, heart disease, bone disease and other irregularities. The technology is also used in radiation therapy planning. In 1974 Ledley became a professor in the Medical Center's Department of Radiology. In 1975 he was appointed Director of the Medical Computing and Biophysics Division. He has contributed to a number of areas within the field of diagnostic medicine. For example, he patented the image processor (originally called the Texture Analysis Computer or TEXAC). He also wrote the first comprehensive textbook for engineers on digital computer engineering. He developed computer systems for organizing the often very large volume of medical data required for precise diagnosis. He co-produced the first large-scale biotechnology databases, Protein Information Resources (PIR), to organize all known protein and DNA sequences. He also invented the instrumentation and computer algorithms used for automated chromosome analysis for prenatal diagnosis of birth defects. PIR is used by almost all in the field of molecular biology. Also, his vision of computers led to the early development of a genetics database "Genbank", the premier, universally used genetics database. In the 1970s, he studied the use of computer technology in diagnosing and treating patients. Ledley's research on cost containment in a concentrated care center was a" landmark study that led to the creation of critical care units in hospitals." In 1979-1980, Dr. Ledley developed the computerized electroneutral-ophthalmograph (CENOG), an integrated system for analysis of ocular motility, which helps in the diagnosis of seizure patients (1).

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (20): Robert S. Ledle (1926-2012). Acta Inform Med. 2018 Mar; 26(1): 71-72. doi: 10.5455/aim.2018.26.71-72.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (21): ANTOINE REMOND (1917-1998)

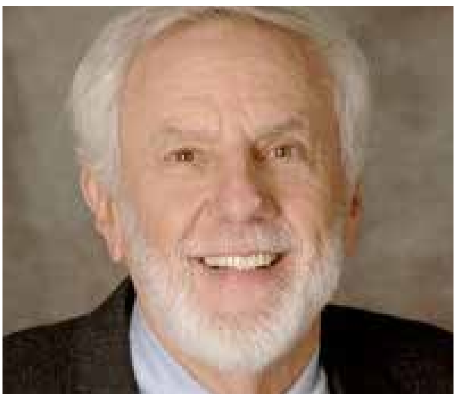
Antoine Remond (1917-1998) is a French researcher, neurologist and clinical electrophysiologist. He is considered one of the founders of Cognitive Neuoscience (1). He was born in Argentina in 1917 in a scientific family. After his graduation as a doctor, his parents suggested that he "do his medicine", seeing his fascination by brain and its waves. His father, a chemist, remembers an uncle in a hospital in Paris who was interested in similar problematics. Remond remembered an invitation by his parents uncle, Alphonse Baldwin, Professor of General Pathology at the Faculty of Medicine of Paris, who also had a service at the Hôtel-Dieu. After hearing for work of Hans Berger, he went to see him. Then, on his return to Paris, he found ways to implement instrumentation electroencephalography, one of the first in France. When Remond was the first year of medicine at Paris in 1936, he was working at his uncle's hospital and learning about the pathology with the highly respected and feared anatomy professor André Hovelacque (1880-1939).

When war broke out, Remond managed to escape. He spent the war hidden in the pathology laboratory in Sainte-Anne and discovered electroencephalographic experimentation with his wife, Fischgold who have already published some articles with A. Baldwin, R. and J. Caussé Lerique. On a device with two feathers and another four feathers, the laboratory technician is able to achieve a six feathers; the Faraday cage. Remond also had the opportunity to work at the end of the war with Pierre Puech, in its new service Neuro-psycho-surgery Sainte-Anne supported by Baldwin, where he experimented with psycho-surgery, but also the location of tumors brain by Electroencephalography, after the pioneering work of Grey Walter, and patients with encephalitis or epilepsy. The first International Congress of Electroencephalography held in London in 1947, and gave Remond opportunity to visit the laboratory of Grey Walter in Bristol, pioneer of Electroencephalography, in which he met the neurologist Marseille, Henri Gastaut, who practices electroencephalography for the clinical diagnosis of epilepsy. In 1948, the French society for electroencephalography formed and Remond became its secretary. In 1957-1958 Remond opened a private practice and conducted experiments in treatment of parkinsonism and stereotactic ablative stimulation, like those practiced in the same period. He has been elected as Honorary Fellow of European Federation for Medical Informatics (FEFMI) in 1985.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (21): Antoine Remond (1917-1998). Acta Inform Med. 2018 Jun; 26(2): 144-145. doi: 10.5455/aim.2018.26.144-145.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (22): WARNER V. SLACK (1933-2018)



Warner V. Slack (1933-2018), MD, FACMI works at Harward Medical School (1). Dr. Warner Slack received his bachelor's degree from Princeton University, his medical degree from Columbia University's College of Physicians and Surgeons, and his medical internship and residency training in neurology at the University of Wisconsin. Over the past 40 years he has focused his research on the use of computers to improve communication in the field of medicine and to empower both patients and doctors for better health care. From 1989 through 1998, he was Editor in Chief of the journal MD Computing. He was Professor of Medicine at Harvard Medical School, a member of the Division of Clinical Informatics, Department of Medicine, and Department of Psychiatry at Beth Israel Deaconess Medical Center, and, with Howard L. Bleich, MD, co-president of the Center for Clinical Computing in Boston. Prof Slack was Division co-Founder Dr. Warner Slack was given the Medical Alumni Resident Citation Award at the 2012 Wisconsin School of Medicine and Public Health Alumni Awards ceremony. The award, presented to Dr. Slack in Madison, Wi, honors an individual who has achieved distinction in the practice of medicine, in academic activities and in research accomplishment. Division Faculty member Dr. Warner Slack wrote an editorial on Patient-computer Dialogue. The editorial was recently published in the proceedings of the Mayo Clinic. Division Faculty member Dr. Warner Slack was highlighted in the book The Decision Tree by Thomas Goetz of Wired.com fame. Dr. Slack's accomplishments in promoting the importance of Patient-Centric medicine and his ground breaking work in proving the effectiveness and importance of the open exchange of information with the patient are the focus of the book's final chapter. He is the 2001 recipient of the Morris F. Collen Award of Excellence from the American College of Medical Informatics.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (22Warner V. Slack (1933-2018). Acta In-

form Med. 2018 Sep; 26(3): 208-209. doi: 10.5455/aim.2018.26.208-209.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (23): ATTILA NASZLADY (1931-2015)

Attila Naszlady (1931-2015), MD, PhD. was born in Budapest, Hungary. He was one of the prominent and influential Medical informatics experts and most famous pioneers of Medical informatics in South-Eastern Europe, recognizable internationally (1). Graduated at Faculty of medicine at Semmelweis University in Budapest in the year 1958. Specialist in Internal medicine he became in 1965. Member of European Society of Cardiology he became in 2000. He has been elected as member of Academy of Science of St Stephen in 1967 and member of Hungarian Academy of Sciences in Budapest in 1979. His professional and academic career was very rich: Resident physician, Municipal Hospital, Esztergom, Hungary (1958-1960); research fellow, National Institute Cardiology, Budapest (1960-1964); assistant professor, 4th Medical Clinic of Semmelweis University of Budapest (1964-1970); honorary professor, 4th Medical Clinic of Semmelweis University of Budapest (1980); head Cardiopulmonary department, National Institute Pulmonology, Budapest (1970-1996); General director, National Institute Pulmonology, Budapest (1992-1995); medical general director, Malthese Charity Svc. Hungary, Budapest (since 1996). Consultant College Cardiology Hungary (since 1985), College Pulmonology Hungary (1990-1996), College Medical Informatics Hungary (since 1990). Professor Attila Naszlady was recipient of Academy prize of Hungarian Academy of Sciences (1974, 1978); named Eminent Physician, Ministry of Welfare, Hungary (1991), Eminent University Teacher (1988); World Health Organization fellow (1969, 1980-1990). He was knighted Ordo Equestris Sancti Sepulchri Hierosolymitani in 1993. Professor Naszlady has been National representative of International Measurement confederation (since 1985). His important achievements included patents for Saniform Memory Chip System (1). He has been member and fellow of a lot of professional, scientific and academic associations: Ministerial commissioner Ministry of Welfare, Hungary (1992-1995); Representative of Social Security (1993-1996). Member of Pontificia Academy Tiberina, He was member of Council of European Federation Medical Informatics –EFMI (1994-2002), Secretary of EFMI (1996-1998), President of EFMI (1999-2000), member of General Assembly of International Association of Medical Informatics – IMIA (1994-2002) and EFMI Vice-President of IMIA (2002-2004). Professor Naszlady also has been member of John von Neuman Society Computer Sciences and President Biomedical section (1985-1998), Hungarian Society Pulmonologists Board directors (1980-1996) and Hungarian Society Cardiologists (since 1984), Central Sport Office Club. Attila Naszlady was author and co-author a lot of books and monographs and 120 other publications in several scientific and academic fields. He chaired a lot of Conference sessions, including MIE 2002 held in Budapest in 2002..

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (23): Attila Naszlady (1931-2015). Acta Inform Med. 2019 Mar; 27(1): 64-64. doi: 10.5455/aim.2019.27.64-64.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (24): EUGENE ACKERMAN (1920-2014)

Eugene Ackerman (1920-2014), PhD, FACMI, Emeritus Professor of Laboratory Medicine and Pathology at the University of Minnesota (1). He studied Physics at Swarthmore College and Brown University, where he met and married Dorothy Hopkirk in 1943. His studies were interrupted by serving as a Conscientious Objector during World War II. After completion of a doctoral degree in Biophysics at the University of Wisconsin-Madison, he joined the Physics faculty at Pennsylvania State University, with several sabbaticals at the University of Pennsylvania in the Biophysics laboratory of Dr. Britton Chance. In 1960 he became Associate Professor of Biophysics at Mayo Clinic, working on mathematical models of physiological systems. He was instrumental in obtaining one of the first National Institutes of Health (NIH) resource grants for Biomedical Computing Facilities, followed by many research grants modeling ultrasonic behaviors of cells, enzyme kinetics, blood glucose regulation, and patterns of infectious disease epidemics (1). As adjunct Professor of Biophysics and Computer Science at the University of Minnesota, he developed a Mayo satellite program awarding a MS degree in Biophysics. In 1967 he left Mayo Clinic for the University of Minnesota, becoming Hill Family Foundation (now Northwest Area Foundation) Professor of Biomedical Computing and Professor of Biometry. A NIH grant to establish a Biomedical Computing Facility had been awarded to the University of Minnesota in 1965, and Eugene Ackerman became its director in 1968 after the illness of its first director, Dr. Eugene Johnson. With the establishment of the Academic Health Center in 1969, the entire biomedical computing program became the Division of Health Computer Sciences in the Medical School's Department of Laboratory Medicine. Charged with developing core and collaborative research, training, dissemination and a service unit, the growing cadre of informatics faculty, fellows and graduate students helped develop departmental computer systems in the clinical laboratories, surgery, electrocardiography, pulmonary function, and nuclear medicine (1). Eugene was a superlative scientific educator and writer. One of the first and longest funded National Library of Medicine training grants in health computing was awarded to the University of Minnesota, which eventually trained over a hundred fellows from the health sciences, including ones from medicine, nursing, pharmacy, dentistry and public health. He personally directed the graduate theses of nearly a hundred students and postdoctoral fellows. Over his long career, he published hundreds of journal articles, conference abstracts, book chapters and monographs; as well as three books: Biophysical Science (in two editions), Mathematical Models in the Health Sciences, and Simulation of Infectious Disease Epidemics. He was editor of the Biophysical Journal from 1984-1987 (1).

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (24): Eugene Ackerman (1920-2014). Acta Inform Med. 2019 Jun; 27(2): 143-144. doi: 10.5455/aim.2019.27.143-144.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (25): ROLF HANSEN (1931-1993)

Rolf Hansen (1931-1993) was one of pioneers of Medical informatics from Oslo, Norway (1). He was an organized and pragmatic medical informatician who developed respected and pioneering health information systems at the Norwegian Institute of Public Health. At the time of his death he had just become the President of the European Federation for Medical Informatics (EFMI) after having played an active and important role in the development of the EFMI since participating in its foundation 1976 in Copenhagen. He had been a member of the Executive Board from 1982 to 1986, Secretary from 1989 to 1990 and Vice President from 1991 to 1992. He took responsibility as the Chairman of the Organizing Committee for the very successful MIE-1988 congress in Oslo. He also worked in the Editorial board of Medical Informatics from its inception. Rolf Hansen will be recognized as one of the Medical informatics experts who have had great contribution to the development of Medical Informatics worldwide.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (25): Rolf Hansen (1931-1993). Acta Inform Med. 2019 Sep; 27(3): 214-216. doi: 10.5455/aim.2019.27.214-216.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (26): WILFRID J. DIXON (1915-2008)

Wilfrid J. Dixon (1915-2008) received his BA. in mathematics from Oregon State College in 1938, his MA. in mathematics from the University of Wisconsin in 1939, and his PhD. in mathematical statistics from Princeton in 1944 (1). At UCLA, Dixon had a joint appointment in the Department of Preventive Medicine in the School of Medicine and in the Biostatistics Division in the School of Public Health. He was the first tenured statistician in each of these schools. In addition, Dixon initiated the Biostatistics Division, started its graduate program and served as its first Chief. He organized the Department of Biomathematics in the School of Medicine and served as chair of this department from its inception in 1967 until 1974. In 1973 he was appointed Professor of Psychiatry. As a member of the U.S. - U.S.S.R. Joint Working Group on Computer Software (1974-1980), Dixon served as liaison to the Kolmogorov Laboratory at the University of Moscow. Many of his over 120 publications result from long-term collaborations in pharmacology, physiology, surgery, neurology, cytology and psychiatry. His commitment to statistical consulting, coupled with his idea to parameterize computer programs in 1960, led to the development of one of the first general statistical software packages, BMD, Biomedical Computer Programs, which has evolved into BMDP Statistical Software. Dixon organized the Statistical Computing Sections of both the American Statistical Association and the International Statistical Institute. He made major contributions to non-parametric statistics, serial correlation, adaptive (up-and-down) experimental designs, robust statistics and the analysis of incomplete data. He was a Fellow of the American Statistical Association, the Institute of Mathematical Statistics, the Royal Statistical Society and the American Association for the Advancement of Science and received the ASA's 1992 Wilks Medal. While at the University of Oregon (1951), Dixon coauthored with Frank Massey a first-of-its-kind statistical textbook for non-mathematicians that sold over 300,000 copies. Dixon: "Statistics is a science in itself, not a branch of mathematics… statistical consulting can be as imaginative and creative as any artistic endeavor." Dixon's greatest contribution was his ability to bridge the gap between theory and applications and therefore, bring insight to difficult applied problems. Wilfrid J. Dixon finished his academic career at UCLA as professor emeritus and a pioneer in statistics.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (26): Dixon J. Wilfrid (1915-2008). Acta Inform Med. 2019 Dec; 27(4): 292-293. doi: 10.5455/aim.2019.27.292-293.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (27): BARRY BARBER (1933-2021)

Barry Barber (1933-2021) was born in Hove, England, and educated at the Friends (Quaker) School Saffron Walden and Christ's College Cambridge (1). He studied Mathematics and Physics taking the theoretical option. He was then appointed to Medical Physics Department of The (now Royal) London Hospital and during the next 11 ½ years he learned the professional activities of a medical physicist under the tutelage of Dr. Lloyd Kemp. He specialized in precision radiation dosimetry in the course of which he earned his Ph.D. from the University of London. He started exploring the opportunities for using some of the Operational Research techniques developed during WWII to improve the organization of the hospital. He collaborated with William (Bud) Abbott from the Finance Department to make the case for the hospital's purchase of an Elliott 803 computer in 1964 to enable the hospital's finance systems to progress as well as to provide a tool for scientific and medical research. He became the Director of the Operational Research Unit in 1966 and remained at the hospital until the NHS re-organization of 1974 took him to the North East Thames Regional Health Authority as Chief Management Scientist. Meanwhile, he looked after the scientific and medical research activities that could be developed, mainly on a "do it yourself" basis. The computer had an immediate access store of 8k of 39-bit words with a backing store of 35mm magnetic film and a 256μsec cycle time. Unknown to us at the time the fast 5-hole paper tape readers and printers must have been based on the technologies developed at Bletchley Park. Three years of exploration of the opportunities provided by the computer was enough for us to outline ideas for the award and department-based Patient Administration for the hospital. This fitted in with the Department of Health's of "Experimental Real-Time Computer Program" and led to the implementation of the first Patient Administration System in the UK at The London Hospital using a fast Univac, 418/III, message switching system installed in March 1971. The system was developed in modules by hospital staff overseen and directed by a Computer Executive including a Professor of Medicine, Robert Cohen, a senior nurse, Maureen Scholes, and a senior Administrator, Michael Fairey, and subsequently David Kenny. Interestingly, the software was run on three different computer platforms and finally de-commissioned after an amazing 36 years. During this time Barry Barber was closely involved with the Institute of Physics, the Operational Research Society, and the British Computer Society. He was a founder member of the EFMI, sometime Secretary, Vice President, and President as well as Vice President (Europe) of the IMIA and chairman of IMIA Working Group 4 (Data Protection and Security). After leaving The London Hospital, his initial focus was on the use of Operational Research techniques to assist with the development of the 5-year Plans for Health Care Services across the Region. Subsequently, this developed into the need to address the issues of Data Protection and Security across the Region and for his last decade with the NHS he provided a national focus for this work after being seconded to the newly formed NHS Information Management Center in Birmingham. Naturally, Data Security led directly into issues of standardization and Patient Safety. This move provided opportunities for sharing NHS activities with other European countries in various EU Data Security projects such as SEISMED, ISHTAR, EUROMED-ETS, MEDSEC - an involvement which lasted several years after retirement from the NHS. Barry Barber was one of the founders of the European Federation for Medical Informatics (EFMI). Through its work, EFMI provides leadership and expertise to the multidisciplinary, health-focused community and policymakers, enables the transformation of healthcare in accord with the worldwide vision of improving the health of the world population.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (27): Barry Barber (1933-2019). Acta Inform Med. 2020; 28(2): 144-145. doi: 10.5455/aim.2020.2.144-145.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (28): HANS PETERSON (1928-2021)

Hans Peterson (1928-2021), MD, PhD, FEFMI, FACMI, FIMIA, FIAHSI (1928-2021), became a certified physician in

Sweden in 1958 and was awarded a doctorate in Medicine in 1967 (1). He was an ophthalmology fellow at the Karolinska Institute, Stockholm University, and was appointed to faculty positions in Ophthalmology and Medical Informatics at the Karolinska in the late 1970's. At the time of his election to the College Dr. Peterson was an internationally prominent and profilic author, with more than 100 published papers. He served as editor for textbooks on Communication Networks in Health Care and Human-Computer Communications in Health Care. He has served on the editorial boards of a number of journals, including Methods in Information in Medicine, Medical Informatics, Lecture notes in Medical Informatics, and the Journal of Clinical Computing. He has served on numerous government committees in Sweden, helping to create legislation for patient records and the creation of national information structures for health care (1). Dr. Peterson was named an Honorary Fellow of the European Federation for Medical Informatics and a Honorary Fellow of the International Medical Informatics Association. He also served as President of IMIA from 1983 through 1986. His election as an International Associate of the College recognizes these sustained achievements. Hans Peterson has been one of the ten representatives of national Medical informatics societies from European countries who with (Barry Barber (UK), Antonio Perens de Talens (Italy), Francois Grémy (France), Rolf Hansen (Norway), Mogens Jorgensen (Denmark), Hans Peterson (Sweden), Peter Leo Reichertz (Germany), Jan Roukens (Holland), Jan van Egmond (Belgium) and Ilkka Vaananen (Finland) in Copenhagen on September 11th 1976 by their signatures adopted the Statute of the European Federation for Medical Informatics and founded the EFMI. But, before establishing of EFMI in 1976 Hans Peterson organized the first World Congress of Medical Informatics - MEDINFO (in parallel with the IFIP Congress) in Stockholm, Sweden in 1974 (the Second MEDINFO congress was organized in Toronto, Canada in 1977). In 1980 IMIA became independent Medical informatics association from IFIP. The inaugurate meeting took place on May 11, 1979 in Salle Capituami, Paris with speeches of Professor Bailey (WHO representative), Professor Bobillier, President of IFIP, Professor Francois Gremy (Paris) and Dr. Jan Roukens (Holland) as Chair of TC4. At the General assembly meeting the following new board was elected: Dr. David Shires (USA) as President, Dr. Hans Peterson (Sweden) as Vice-president and Chair By-Laws Committee, William Abbott, (U.K) was Secretary, Dr. Shigekoto Kaihara (Japan) was Chair Newsletter Committee and Professor Peter Reichertz (Federal Republic Germany) was Chair of Publication Committee. One year after the MEDINFO Congress in Stockholm (1974) (Chair of SPC was Professor John Anderson, UK) (1). In 1983, after three years as President Elect, Hans Peterson became President of IMIA (1986-1989). "What I remember best", he says, "is that there was no money." MEDINFO '83 had diminished already limited funds, and money was simply not available for what was needed for MEDINFO '86 and subsequent activities. IMIA's officers ended up providing IMIA with free services, from printing and stationery to mailing and telephones. Grants to working conferences were impossible, and IMIA's officers had to spend almost all their time on finances. The final blow came when IMIA closed its permanent secretariat in Amsterdam and its small remaining treasury vanished. The bottom line was "very little time for accomplishments and achievements. The goal was to survive." Now, after completing his 18th year as national representative for Sweden in 1993, Peterson continues to work for the recognition and acceptance of Medical Informatics. In his view, growing decentralization makes standardization critical. For Peterson, "an international body free from political and governmental influence is absolutely necessary. In this body we have to cooperate also with the industry and get a mutual understanding that cooperation is the only way out." For his great contribution to development of Medical informatics, recognized internationaly, Hans Peterson has been elected as Founding member of International Academy of Health Sciences Informatics (IAHSI) in 2017.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (28): Hans Peterson (1928-2021). Acta Inform Med. 2021 Jun; 29(2): 134-135. doi: 10.5455/aim.2021.29.134-135.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (29): FRANCIS ROGER FRANCE (1941-2021)

Francis Roger France (1941-)2021, MD, PhD, was born on 24 July 1941 in Brussels, Belgium (1). He was Docteur en médecine, UCL, Master fi Sciences in Biometry and Epidemiology, of University of Minnesota, Spécialiste en médecine interne et en gestion de données de santé, Agrégé de l'Enseignement Supérieur, UCL and Professeur Emérite de l'Université Catholique de Louvain. Also, Francis Roger was Consultant spécial Honoraire de la Commission Européenne, Professeur au Collège Belgique de l'Académie Royale de Belgique, Founding Member of the International Academy of Health Sciences Informatics (IAHSI), Honorary Fellow of the European Federation for Medical Informatics, and finaly he was Commandeur de l'Ordre de la Couronne Médaille civique de Première Classe veuf de Madame Anne-Marie Wouters (1). He graduated as MD at the Faculty of Medicine of the Catholic University of Louvain in 1967 and as MSc in Biometry (major) and Epidemiology (minor) in 1972 at the School of Public Health of the University of Minnesota. He was a postgraduate Research Fellow in the Unit of Health Computer Sciences headed by Professor Eugene Ackerman. He contributed to the Minnesota Coronary Survey initiated by Ancel Keys and Henry Backburn with his MS thesis entitled "An evaluation of Serum Lactate Dehydrogenase in a diet heart survey". Between 1967 and 1972, he was trained in internal medicine in Louvain and at the Mayo Clinic in Rochester, Minnesota. He graduated as PhD (Agrégation de l'Enseignement Supérieur) in Medicine at the University of Louvain in 1982 by defending a thesis on "The electronic Medical Record Summary, an indicator of performance and quality of care". Between 1972 and 1982, he created a Medical Record Summary for all hospital inpatients, using coding standards, first in Belgium, then for all countries members of the European Union, called the MBDS (Minimum Basic Data Set). The linkage between a diagnostic information list with procedures and billing data by patient hospital stay allowed comparisons of length of stay, costs and results of care by groups of diagnoses. Dr Roger France was among the firsts to introduce the DRGs (Diagnosis Related Groups) in Europe. This model developed by Bob Fetter in the Yale School of Public Health was adopted as a new tool for financing and managing hospital care in Belgium by the Minister of Public Health Jean-Luc Dehaene in 1984. Professor F. Roger France was appointed as the Head of the Center for Medical Informatics (CIM), in charge of the development of the electronic Health Record by patient in the new teaching hospital of the University of Louvain (Saint-Luc) in Brussels. The CIM was a research unit of the Department of Public Health, which explains why he could be elected by his pairs as President of the School of Public Health of the University of Louvain (1995-2001). He followed Baron Michel Lechat, well known epidemiologist and Robert Lauwerijs who contributed to industrial medicine. About 600 students from various countries were registered. It was the largest University School of Public Health in French language, with the largest number of DrPH theses. The public health program for developing countries was awarded the first prize by the Belgian Ministry for Cooperation to Development. Francis worked also as Associated Chief of service for General Internal Medicine in St-Luc Hospital (1988-2006) and as Head of the Medical Record Department. He was teacher of the first courses of medical informatics and of the evaluation of quality of care in Belgium. He initiated a course on Palliative and Continuous Care in collaboration with oncologists and ethicists. He was appointed as expert to the European Commission in the Biomedical Working Group chaired by Peter Reichertz in 1973 and as President of the AIM Requirements Board (1991) that led to a large number of international research and development EEC projects in Advanced Informatics in Medicine (AIM) and in eHealth. He participated to several projects and had a special interest for hospital management, medical record security, aid to medical diagnosis, quality of care and telemedicine. He has been President of scientific societies in health informatics (MIM in Belgium, EFMI in Europe) and Vice-President of IMIA. He worked as expert in public health for WHO, the Council of Europe, the World Bank and the EEC. He has been admitted as Professor Emeritus of the University of Louvain in 2006. Thereafter, he was invited as Professor to the "Collège Belgique" of the Royal Academy of Medicine in Belgium and Special Advisor to the European Commission (2013-2015). When my book "Biographical Lexicon in Public Health", English Edition was translated to Graek language three years ago Francis Roger France, as reviewer of English version of the book, sent me the letter with this text: "When opening your Public Health Lexicon in Greek, I was happy to see the picture of Henry Blackburn who was the Promotor of my M.S. thesis in Public Health (Biometry, major, Epidemiology, minor) at the University of Minnesota in 1972. The " small world" of Public health and Information sciences pioneers owes you very much for your publication of their names and achievements that, otherwise would be quickly forgotten, like some names on pictures taken during scientific conferences. Thanks again for your work".

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (29): Francis Roger France (1941-2021). Acta Inform Med. 2021; 29(4): 293-294. doi: 10.5455/aim.2021.29.4.293-294..

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (30): ASSA REICHERT (1941-2015)

Assa Reichert (1943-2015) directed the first computer Department in the Israel Ministry of Health (1). Assa holds a BA in Life sciences and a MA in Life science s and Computer science from Bar-Ilan University, Israel. He was assistant director of Sheba Medical Center, the largest in Israel, and VP of COMET, an Israeli-American software house specializing in medical institution management & EMR software. He currently serves as consultant to the MOH. Assa was appointed aa a member of EFMI Council since 1994 as Israel national representative, later as Working Group chair, and Board member. He served EFMI as President (2002-2003), and represented EFMI in IMIA as Vice-President (2003-2005). Also, he chaired a lot of sessions and committees at MIE Conferences.

REFERENCES

1. Masic I. In Memoriam on Assa Reichert (1943-2015). Acta Inform

Med. 2015 Jun; 23(3): 185-186. doi: 10.5455/aim.2015.23.185-186.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (31): JANA ZVAROVA (1941-2017)

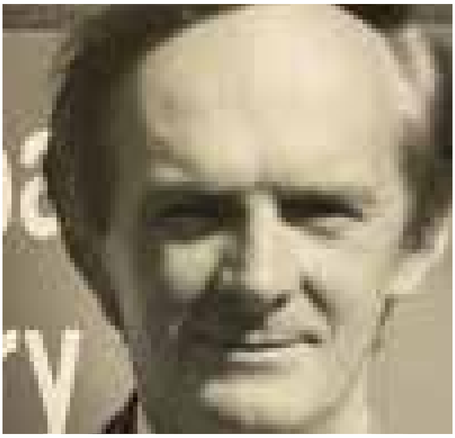
Jana Zvárová (1943-2017) was born in Prague, Czechoslovakia (1). On July 5th passed away academician professor Jana Zvarova, one of pioneers and one of most influential Medical informatics scientist and expert in Europe and in the world. After graduating in mathematics in 1965 at the Faculty of Mathematics and Physics, Charles University in Prague she has been working with several faculties of Charles University in Prague. She completed external doctoral studies under the supervision of Prof. Dr. Albert Perez, member of IFIP. He brought her attention to the field of Medical informatics and opened the contacts with founders of IMIA. Jana Zvárová founded the Medical informatics section of the Czech Society of biomedical engineering and Medical informatics in the year 1978. The same year, she received PhD scientific degree at Charles University in Prague. She passed the habilitation at Charles University in 1991 and she was nominated by the president of the Czech Republic Vaclav Havel as Full Professor at Charles University in Prague in 1999. She reached the highest Czech scientific degree, Doctor of Sciences in 1999 at the Academy of Sciences of the Czech Republic.Professor Jana Zvárová has delivered presentations and published internationally on Medical informatics and statistics issues and systematically sought to apply new theoretical knowledge in biomedicine, particularly in relation to Epidemiology and Public health and their subsequent transfer to the educational process. Since 1994 she has chaired the European Center of Medical Informatics, Statistics and Epidemiology of Charles University and Academy of Sciences CR (EuroMISE Center), and between 2006-2011 professor Jana Zvárová was the director of the Center of Biomedical Informatics. She was the representative of the Czech Republic to the Councils of International Medical Informatics Association (IMIA) and European Federation for Medical Informatics (EFMI). She had significant professional participation in national and international initiatives in biomedical informatics and statistics, especially in the field of research, higher education and continuing education using new information technology. She founded two biomedical journals: European Journal for Biomedical Informatics (EJBI) and International Journal on Biomedicine and Healthcare (IJBH), and, also, she has been a member of the editorial boards of several international journals. She has served as the expert in the field for the EC and Czech governmental institutions. The results of Professor Jana Zvárová's research activities are presented in 10 monographs and more than 300 articles in peer-reviewed journals. The total number of citations of her work is more than 600 and she was the main author of three patents directed to biomedicine. She has initiated the development of Ph.D. studies in Biomedical Informatics under the School of Postgraduate doctoral studies of biomedicine of Charles University and Academy of Sciences of the Czech Republic, and she was chairing the board of Biomedical Informatics. Within European projects she opened new lines of research and education concerning electronic health record, knowledge representation in clinical guidelines, decision support systems and methods for evaluation of knowledge in the Czech Republic. In addition to extensive publishing activities Dr. Zvárová has delivered a number of invited lectures at national and international conferences and universities, worked in scientific boards of several universities, national and international societies and editorial boards of professional journals. She served in the program committees of many national and international conferences and conducted fairly extensive peer review activities, including expert services for the European Commission. She was the member of the working group on Electronic Health Care of the Czech Medical Society. Professor Jana Zvarova organized several IMIA and EFMI international conferences and workshops in Prague. She has initiated the foundation of the EuroMISE Mentor Association focused on the international cooperation in mentoring activities.

For results in science and education Prof Dr. Zvárová has received the following awards: Honorary membership Romanian Society of Medical Informatics (1997), Medal of Erasmus University Rotterdam, Department of Medical Informatics (1998), Honorary membership in the Foundation Grigore C. Moisil for Applied Informatics (1999), University medal of University for Health Informatics and Technology, Tyrol (2004), Honorary membership in the Czech Society of Biomedical Engineering and Medical Informatics (2004), Medal of Charles University, Faculty of Science (2005), Medal of Charles University, 1st Faculty of Medicine (2008), Honorary membership in the Society for Cybernetics and Informatics (2010). In the year 2015 Jana Zvarova has been elected as Honorary Fellow of European Federation of Medical Informatics (FEFMI) and in 2017 she has been elected as member of International Academy of Health Informatics Sciences (FIAHSI).

REFERENCES

1. Masic I. In Memoriam: Prof Jana Zvarova, PhD. (1943-2017). Acta Inform Med. 2017 Jun; 25(2): 147-148. doi: 10.5455/aim.2017.25.147-148.

THE MOST INFLUENTIAL SCIENTISTS IN THE DEVELOPMENT OF MEDICAL INFORMATICS (32): RORY O'MOORE (- 2022)



Rory O'Moore (- 2022), PhD, was professor of Healthcare Informatics in Dublin, Ireland, and former President of the Irish Computer Society, which was the representative voice of Ireland's IT professionals (1). Professor Rory O'Moore was for long time chairman of the Section of Healthcare Informatics in the Royal Academy of Medicine in Ireland and past chairman of HISI Health Care Informatics Society of Ireland. Also, he was President of the European Federation for Medical Informatics (1987-1990) (1). In the early 1970s Rory founded the Medical Specialist group of the Irish Computer Society and was its first chair. Chris Nolan had being its Secretary and they worked together for many years where Rory represented HISI in Europe and Internationally putting Ireland in the forefront of this new discipline. A great mentor and working in healthcare computing. Rory was the founder of the Biochemistry Department, St James's Hospital and ensured throughout his tenure that this laboratory reflected an ethos of quality and diagnostic excellence, which continues to this day. Moreover, he left an indelible legacy, including the Porphyrin Laboratory, which he established and which remains the only diagnostic service of its kind in Ireland. He had great foresight and vision in terms of future developments in laboratory medicine, including the application of computational approaches to diagnostic support and outpatient services. In many respects he was ahead of his time on such matters. Rory played in providing the opportunity to pursue Chemical Pathology as a career. As great mentor in this discipline with excellent acknowledge Rory was named as the "Father of Chemical Pathology" in the Republic of Ireland (1). In the early 1980s Rory O'Moore was very active in Openlabs, which developed novel solutions to improving efficiency and effectiveness in clinical laboratories, while Synapses developed a simple and secure method of sharing electronic health records. The results of Synapses and its follow-on project Synes, were a major influence on the evolving CEN standards for health records. The concept of the Synapses Federated Healthcare Records Server was extended to support the integration of records and clinical protocols/guidelines in a major national initiative, MediLink. This developed the concept of the active electronic health record which monitors the record, automatically generating alarms and alerts to manage the patients workflow. The Healthcare Informatics Society of Ireland (HISI) has awarded the O' Moore Medal to individuals or organizations who have made a major contribution to Healthcare Informatics in Ireland. The award is named after Professor Rory O'Moore, who received the award in 2003 when it was inaugurated by then Taoiseach Bertie Ahern, as a Chairman of the Section of Healthcare Informatics in the Royal Academy of Medicine in Ireland and past chairman of HISI. The award was presented to Professor O'Moore for his pioneering work in the Irish healthcare informatics field. After Rory O'Moore as recipient of Medal in 2003, other important and influential health informatics experts in Ireland received it: in 2005 - Georges De Moor; in 2007 - Jane Grimson; in 2008 - Glyn Hayes; in 2009 - H. Stephen Lieber; in 2011 - Kieran Hickey; in 2018 - Richard Corbridge (FBCS). In addition to conducting research the Centre also runs a highly successful interdisciplinary postgraduate diploma and master's programmes in health informatics. Professor Rory O'Moore actively participated in organization of EFMI and IMIA Conferences from 1982 until 1990 charing of scientific sessions and as Editor-in-Chief of the Proceedings: "Medical Informatics Europe 82", by Editors: Rory R. O'Moore, Barry Barber, P.L. Reichertz, published on March 1st 1982 by Springer, UK); "Medical Informatics Europe '84", Brussels, Belgium, September 10–13, 1984. Editors: F. H. Roger, J. L. Willems, R. R. O'Moore, B. Barber, "Medical Informatics Europe `88", Oslo, Norway, August 17 20, 1988, by Editors: Rolf Hansen, Bjarte G. Solheim, Rory R. O'Moore. "Medical Informatics Europe '90: Glasgow. Editors: Rory O'Moore, Stellan Bengtsson, John R. Bryant, John S. Bryden, Glasgow, Scotland, August 20–23, 1990 (1).

IMIA and EFMI associations lost good man, friend and their very active member. I met Rory in Glasgow in 1990 at MIE '90 and Lisbon in 1994 at MIE '94 Conference when I came from Sarajevo during very terrible wartime (1992-1995), to be accepted as official member of EFMI Council. In that time Rory O'Moore was Vice President of EFMI Council and he cordially offered to me his help to the BHSMI to continue participation in EFMI events, because of the very difficult wartime in Bosnia and Herzegovina. His colleagues and friends recognized him as unique with a remarkable intelligence that always raced ahead of whatever else was happening around him (1).

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (32): Rory O'Moore (- 2022). Acta Inform Med. 2022 Jun; 30(2): 133-134. doi: 10.5455/aim.2022.30.133-134.

REFERENCES

1. Masic I. The Most Influential Scientists in the Development of Medical Informatics (1): Francois Gremy. Acta Inform Med. 2014 Aug; 22(4): 287. doi: 10.5455/aim.2014.2.287-287.
2. Masic I. The Most Influential Scientists in the Development of the Medical Informatics (2): Morris F. Collen. Acta Inform Med. 2014 Oct; 22(5): 350. doi: 10.5455/aim.2014.22.350-350.
3. Masic I. The Most Influential Scientists in the Development of Medical Informatics (3): Peter Leo Reichertz. Acta Inform Med. 2014 Dec; 22(6): 415. doi: 10.5455/aim.2014.22.415.
4. Masic I. The Most Influential Scientists in the Development of Medical Informatics (4): Allan Cormack. Acta Inform Med. 2015 Feb; 23(1). 65. doi: 10.5455/aim.2015.23.65-65.
5. Masic I. The Most Influential Scientists in the Development of Medical Informatics (5): Charles Edwin Molnar. Acta Inform Med. 2015 Apr; 23(2): 121. doi: 10.5455/aim.2015.23.121-121.
6. Masic I. The Most Influential Scientists in the Development of Medical Informatics (6): Heinz Zemanek. Acta Inform Med. 2015 Jun; 23(3): 184. doi: 10.5455/aim.2015.23.184-184.
7. Masic I. The Most Influential Scientists in the Development of Medical Informatics (7): Shigekoto Kaihara. Acta Inform Med. 2015 Aug; 23(4): 250-1. doi: 10.5455/aim.2015.23.250-250-251.
8. Masic I. The Most Influential Scientists in the Development of Medical Informatics (8): Jean Raoul Schrrer. Acta Inform Med. 2015 Oct; 23(5): 326-7.. doi: 10.5455/aim.2015.23.326-326-327.
9. Masic I. The Most Influential Scientists in the Development of Medical Informatics (9): William Abbott. Acta Inform Med. 2015 Dec; 23(6): 398.. doi: 10.5455/aim.2015.23.398-398.
10. Masic I. The Most Influential Scientists in the Development of Medical Informatics (10): Marsfen Scott Blois. Acta Inform Med. 2016 Feb; 24(1): 70-1.. doi: 10.5455/aim.2016.24.70-71.
11. Masic I. The Most Influential Scientists in the Development of Medical Informatics (11): David B. Shires. Acta Inform Med. 2016 Apr; 24(2): 149. doi: 10.5455/aim.2016.24.149-149.
12. Masic I. The Most Influential Scientists in the Development of Medical Informatics (12): Joshua Lederberg. Acta Inform Med. 2016 Jun; 24(3): 220-1- doi: 10.5455/aim.2016.24.220-221.
13. Masic I. The Most Influential Scientists in the Development of Medical Informatics (13): Margaret Belle Dayhoff. Acta Inform Med. 2016 Aug; 24(4): 299. doi: 10.5455/aim.2016.24.299-299.
14. Masic I. The Most Influential Scientists in the Development of Medical Informatics (14): Branko Cesnik. Acta Inform Med. 2016 Oct; 24(5): 375. doi: 10.5455/aim.2016.24.375-375.
15. Masic I. The Most Influential Scientists in the Development of Medical Informatics (15): Homer R. Warner. Acta Inform Med. 2016 Dec; 24(6): 422-3. doi: 10.5455/aim.2016.24.422-423-423.
16. Masic I. The Most Influential Scientists in the Development of Medical Informatics (16): John Anderson. Acta Inform Med. 2017 Mar; 25(1): 58-9. doi: 10.5455/aim,2017.25.58-59.
17. Masic I. The Most Influential Scientists in the Development of Medical Informatics (17): Eugene Garfield. Acta Inform Med. 2017 Jun; 25(2): 145. doi: 10.5455/aim..2017.25.145-145.

18. Masic I. The Most Influential Scientists in the Development of Medical Informatics (18): Ishaack Sedick. Acta Inform Med. 2017 Sep; 25(3): 206-7. doi: 10.5455/aim.2017.25.206-207.

19. Masic I. The Most Influential Scientists in the Development of Medical Informatics (19): John Bryden. Acta Inform Med. 2017 Dec; 25(4): 280. doi: 10.5455/aim.2017.25.280.

20. Masic I. The Most Influential Scientists in the Development of Medical Informatics (20): Robert S. Ledle (1926-2012). Acta Inform Med. 2018 Mar; 26(1): 71-72. doi: 10.5455/aim.2018.26.71-72.

21. Masic I. The Most Influential Scientists in the Development of Medical Informatics (21): Antoine Remond (1917-1998). Acta Inform Med. 2018 Jun; 26(2): 144-145. doi: 10.5455/aim.2018.26.144-145.

22. Masic I. The Most Influential Scientists in the Development of Medical Informatics (22) Warner V. Slack (1933-2018). Acta Inform Med. 2018 Sep; 26(3): 208-209. doi: 10.5455/aim.2018.26.208-209.

23. Masic I. The Most Influential Scientists in the Development of Medical Informatics (23): Attila Naszlady (1931-2015). Acta Inform Med. 2019 Mar; 27(1): 64-64. doi: 10.5455/aim.2019.27.64-64.

24. Masic I. The Most Influential Scientists in the Development of Medical Informatics (24): Eugene Ackerman (1920-2014). Acta Inform Med. 2019 Jun; 27(2): 143-144. doi: 10.5455/aim.2019.27.143-144.

25. Masic I. The Most Influential Scientists in the Development of Medical Informatics (25): Rolf Hansen (1931-1993). Acta Inform Med. 2019 Sep; 27(3): 214-216. doi: 10.5455/aim.2019.27.214-216.

26. Masic I. The Most Influential Scientists in the Development of Medical Informatics (26): Dixon J. Wilfrid (1915-2008). Acta Inform Med. 2019 Dec; 27(4): 292-293. doi: 10.5455/aim.2019.27.292-293.

27. Masic I. The Most Influential Scientists in the Development of Medical Informatics (28): Barry Barber (1933-2019). Acta Inform Med. 2020; 28(2): 144-145. doi: 10.5455/aim.2020.2.144-145.

28. Masic I. The Most Influential Scientists in the Development of Medical Informatics (29): Hans Peterson (1928-2021). Acta Inform Med. 2021 Jun; 29(2): 134-135. doi: 10.5455/aim.2021.29.134-135.

29. Masic I. The Most Influential Scientists in the Development of Medical Informatics (30): Francis Roger France (1941-2021). Acta Inform Med. 2021; 29(4): 293-294. doi: 10.5455/aim.2021.29.4.293-294..

30. Masic I. In Memoriam on Assa Reichert (1943-2015). Acta Inform Med. 2015 Jun; 23(3): 185-6. Doi: 10.5455/aim.2015.23.185-186.

31. Masic I. In Memoriam: Prof Jana Zvarova, PhD. (1943-2017). Acta Inform Med. 2017 Jun; 25(2): 147-8. doi: 10.5455/aim.2017.25.147-148.

32. Masic I. The Most Influential Scientists in the Development of Medical Informatics (32): Rory O'Moore (- 2022). Acta Inform Med. 2022 Jun; 30(2): 133-134. doi: 10.5455/aim.2022.30.133-134.

19

Marion Ball, Donald A. B. Lindberg, Izet Masic

SPECIAL TRIBUTE ON MORRIS F. COLLEN: CHARISMATIC LEADER OF MEDICAL INFORMATICS

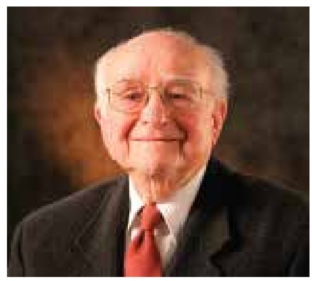


Figure 1. Morris Collen (1913-2014)

Dr. Morris Collen (Figure 1, 2, 3) started his career in 1942, as a young doctor in the Richmond Shipyards administering to Henry J. Kaiser Richmond shipyard workers. During World War II he became a nationally recognized authority on the treatment of pneumonia. In 1948, Dr. Collen became one of the seven founding physicians of the Permanente Medical Group. From 1953 to 1961, he served as physician-in-chief at Kaiser Permanente in San Francisco. In 1961, Collen was named founding director of Kaiser Permanente's Medical Methods Research - now the Division of Research - known today for research in drug safety, risk-factor epidemiology, and genetics (1). He ended his tenure in 1979 when he became director of the Division of Technology Assessment. His greatest influence was his friend, mentor, and colleague Sidney R. Garfield, MD (2). Before engaging in medicine, Dr. Collen had obtained a degree in electrical engineering. Therefore, he had a vision of conjugating two of these by applying computer technology to improve care in medicine. He himself predicted that computers will probably have "the greatest technological impact on medical science since the invention of the microscope."(2)

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Figure 2. Morris Collen at Northern California Research Department

Dr Collen started his work in medical informatics by creating the multiphasic health checkup. The checkup was composed of tests and procedures that screened conditions such as heart disease, diabetes, cancer and other illnesses (1). This method was widely accepted in public health medicine for its preventive aspect as well as saving physicians' time.

Thereafter, he developed a prototype electronic health record. Collen's early foray into electronic collection and storage of patient data was Kaiser Permanente's first step on the road to becoming a leader in health records technology.

The Journal of the American Medical Informatics Association (*JAMIA*) and *Methods* recognized his worth and his greatness describing him as "a world-class scientist, an advisor to American presidents, and a profound humanist, who started out as an exemplary clinician. Dr. Collen's qualities put him, from the start, in the midst of an environment rife with innovation and opportunity, and marked by other giants"(3).

He accomplished much of his work in many capacities with the National Library of Medicine (NLM), the Institute of Medicine of the National Academy of Sciences of the United States, the American Medical Informatics Association and many others.

His scientific publications include over 200 articles and numerous books in the areas of internal medicine, preventive medicine, health services research, multiphasic testing, technology assessment, and medical informatics (4). As an NLM Scholar-in-Residence from 1987-1993, he made a historical review of health care information system published in the book *The History of Medical Informatics in the United States*, which is considered as classics.

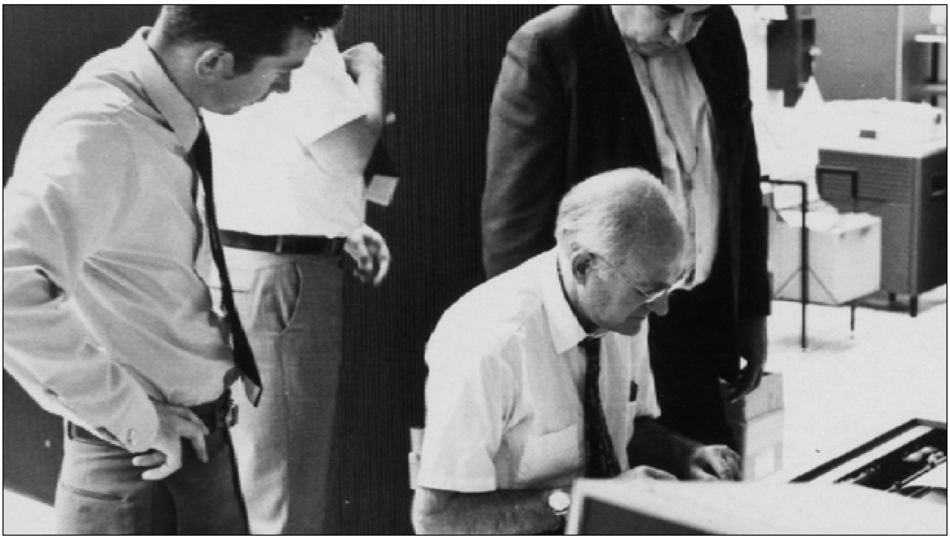


Figure 3. Collen at computer terminal

Dr Collen's awards are too numerous to list in this review. One of his greatest distinction was definitely the Medal for Outstanding Contributions to the Field of Medical Informatics, honored by the by the American College of Medical Informatics (ACMI) in 1993. The Morris F. Collen Medal is an award given in his name to exceptional achievers in medical informatics (3).

Although a centenarian, Dr. Collen still accomplishes much. Till last days of his life he worked on the second edition of his book entitled *The History of Medical Informatics in the United States*.

THE TRIBUTES

By reading the tributes of his colleagues, we will get the full sense of the great visionary Morris F. Collen, or Morrie - how was he amid colleagues and friends named.

One of his colleagues, Robert Pearl, MD, Executive Director and CEO of The Kaiser Permanente Medical Group, described Morrie Collen's phenomenal legacy in this way. "When I think of Morrie Collen, I think of two words, pioneer and vision. He was not just a year or two ahead of his time, he was decades ahead of his time.…Morrie understood that to be successful, Kaiser Permanente had to not just practice great medicine; it had to create great medicine. He created a focus on research…He understood that our members would be our members for decades to come. And so, it was essential that we invest in systems and approaches that would make them healthier…"(5)

Bruce Sams, MD, second Executive Director of Kaiser Permanente said “One of the things that was most impressive about Morrie is his keen, analytical mind. He sees things very clearly; he analyzes them as a very logical way of approaching a problem. … He had visions of other things that could be done - particularly in the computer world - and he was so far ahead of his time”(5, 6, 7, 8).

CONCLUSION

Dr. Collen is unambiguously the guru of medical informatics. His work is characterized by quality, breadth of coverage, and the spirit of service. It reflects the intensity and the quality of the man himself. Therefore, Dr. Morris F. Collen deserves respect and thanks for the great job done, with a wish to carry out much productive work in the coming times.

REFERENCES

1. Lindberg DA, Ball MJ. Morris F. Collen at 100: A Tribute to “The Father of Medical Informatics”. Methods Inf Med. 2013; 52(5): 371-3.
2. Kaiser Permanente. Morris F. Collen, MD, Director Emeritus. Available at: http://www.dor.kaiser.org/external/DORExternal/research_report/collen_tribute.aspx. Accessed: January 07, 2014.
3. Moehr JR. To Morris F. Collen: Happy ninetieth! J Am Med Inform Assoc. 2003; 10: 613-5.
4. TPMG Awards. Morris F. Collen Research Award. Available at: http://xnet.kp.org/ncal/tpmgawards/collen/about.html; Accessed January 07, 2014.
5. Morris F. Collen, M.D. Tribute (videotape), 2009. Available at: http://xnet.kp.org/ncal/tpmgawards/collen/about.html; Accessed January 07, 2014.
6. Masic I. The History and New Trends of Medical Informatics. Donald School J Ultrasound Obstet Gynecol. 2013; 7(3): 301-12.
7. Ball M, Lindberg D, Masic I. Special Tribure on Morris F. Collen: Charismatic Leader of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 4-5. doi: 10.5455/aim.2014.22-4-5.
8. Masic I. History of Informatics and Medical Informatics. Avicena. Sarajevo, 2013: 61-62. ISBN978-9958-720-50-5.

20

Patrice Degoulet, Reinhold Haux, Casimir A. Kulikowski, K. C. Lun

FRANÇOIS GRÉMY AND THE BIRTH OF IMIA

At the 2001 General Assembly of the International Medical Informatics Association (IMIA) in London, IMIA approved the establishment of a Medical Informatics Award of Excellence to be given every three years.

The recipient of this Medical Informatics Award of Excellence is an individual whose personal commitment and dedication to medical informatics has made a lasting contribution to medicine and healthcare through her or his achievements in research, education, or development or applications in the field of medical informatics.

The first award was jointly given by IMIA and by UMIT, the University for Health Sciences, Medical Informatics and Technology at Innsbruck/Hall, Austria. The Award consists of a diploma and a prize in the amount of 10,000 EUR. The diploma contains the mission statements of IMIA andUMIT.

The winner of the award is invited to give an Award Lecture at a plenary session at the subsequent World Congress of Medical Informatics (MEDINFO).

The first IMIA/UMIT Medical Informatics Award of Excellence was given in 2004 at the closing ceremony of MEDINFO 2004 in San Francisco. The recipient was selected by a Nomination Committee consisting of two members nominated by IMIA, the then President of IMIA K. C. Lun, Singapore, and IMIA Vice-President for MEDINFOs, Patrice Degoulet, Paris, and two members nominated by UMIT, the then Rector of UMIT Reinhold Haux, Innsbruck, and Casimir Kulikowski, New Brunswick, Adjunct International Faculty of UMIT.

We were delighted that Prof. François Grémy, Uzes, France, who was unanimously selected by the committee as the first recipient of the IMIA/UMIT Medical Informatics

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

Award of Excellence, kindly accepted the award.

François Grémy was born on March 3, 1929 in Neuilly sur Seine, west of Paris. Having completed his college degree at the age of l6, he is torn between a purely scientific career and medical studies and finally chooses to follow a dual education. At the age of 19, having completed two master degrees in mathematics and in physics, he immediately started his medical studies at the Medical Faculty of Paris. At 23, he passed the highly selective Paris resident fellows' competitive examination, the "Internat de Paris", and starts clinical work in neurophysiology to present his MD thesis on the oscillographic study of dysarthria. In 1958, at the age of 29, he is appointed as tenured professor in biophysics at the Faculty of Medicine of Tours. He is the youngest professor of his generation. Two years later, he is appointed tenured professor in biophysics at the Pitié-Salpêtrière school of medicine in Paris where he will stay until 1983.


UNIVERSITÉ DE PARIS — FACULTÉ DE MÉDECINE

Année scolaire 1966-1967

CHAIRE DE BIOPHYSIQUE

Professeurs A. DOGNON et A. DJOURNO

CENTRE DE CALCUL ET DE STATISTIQUE

Professeur F. GRÉMY

Le Centre de Calcul et de Statistique organise un enseignement sur les :

TECHNIQUES DU TRAITEMENT DE L'INFORMATION

Cet enseignement comprendra trois parties :

– **Fonctionnement des machines informatiques.**
  - Description technologique des Machines informatiques.
  - Langages de Programmation : langage machine, langages symboliques, langages évolués.
  - Systèmes d'exploitation : programmes de service, assembleurs, compilateurs, moniteurs et superviseurs.

– **Cours de programmation FORTRAN** et notions de calcul numérique. Cette partie comprend des Travaux pratiques.

– **Principales applications médicales des machines informatiques.**

Un examen ... aura lieu à la fin de l'enseignement. Celui-ci aura lieu au premier semestre, les mardi et vendredi de 17 h 30 à 19 h 30, Salle K, 1er étage, à la Nouvelle Faculté. Le premier cours aura lieu le mardi 15 Novembre 1966.

Au second semestre auront lieu des enseignements spécialisés consacrés cette année à la **Théorie de l'information** et à **l'Analyse des signaux neuro-physiologiques.**

DROITS D'INSCRIPTION : **50 francs**

L'inscription a lieu l'après-midi entre le 1er et le 15 OCTOBRE 1966 au Centre de Calcul et de Statistique — Nouvelle Faculté — 1er étage, porte 7 133 — (Mme PIERCY) Téléphone :
...

Le Doyen de la Faculté : **Georges BROUET.**

Figure 1. The 1966 Medical informatics curriculum

Between 1966 and 1971, he published five comprehensive textbooks in the three scientific domains that he had engaged in up to then: biophysics in 1966 and 1971, biomathematics in 1969, and biostatistics in 1969 (1-4])

Very soon François recognized the key role played by information sciences in medicine and initiates at Pitié-Salpêtrière in 1966 a curriculum on the medical applications of computing techniques (Figure 1). He participates in September 1966 to the 4th international meeting on cybernetic medicine and is immediately convinced by the need for an international association in medical informatics. In 1967 he established within the International Federation for Information Processing (IFIP) the Technical Committee 4 (TC4) on medical informatics. The first meeting of TC4 was held in Paris in April 1968. A dozen nations were represented and François Grémy was elected as president.

During his presidency term, François Grémy initiates within TC4 several working groups that will represent as many emerging subfields for this new discipline. With J. Anderson, J. M. Forsythe (the TC4 secretary), J. and M. Site, he organizes in Lyon (April 6.10.1970) the first TC4 meeting on the Information Processing of Medical Records (5) (Figure 2). It will be followed by multiple meetings including signal processing (6), education (7), decision support, and data protection.

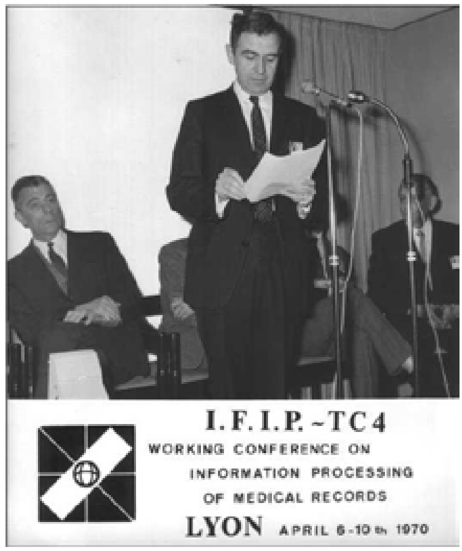


Figure 2. François Grémy at the first IFIP-TC4 working conference on information processing of medical records

In 1973 François Grémy negotiates during the preparation of the IFIP meeting in Stockholm for the creation of a separate structure devoted to the healthcare field and the disposition of dedicated meeting rooms. This was the first MEDINFO 1974 held in Stockholm at the same time and same location as the IFIP meeting (August 5-10). François Grémy acted as the chairman of the MEDINFO 74 Programme Committee. The International Medical Informatics Association (IMIA) was constituted as a Special Interest Group of IFIP and Jan Roukens, the Dutch representative, in TC4 was elected as his first president.

In 1984 François Gremy is appointed as Professor of Medical Informatics in Montpellier and chair of the Medical Information Department of the Lapeyronie University hospital where he will publish his first comprehensive textbook on medical informatics.

He progressively focusses his research on the applications of health informatics, the assessment of medical informatics technology (10), and finally to public health (11). He is appointed in 1990 as Professor of Public Health at the Montpellier-Nîmes Faculty of Medicine. In 1996 he became one of the two first Europeans recognized as an International Associate of the American College of Medical Informatics.

As the first chairman and moderator of TC4, Grémy is considered to be the first President of its renamed and refocused successor, the International Medical Informatics Association (IMIA). The role of IFIP-TC4 in bringing together early health informaticians cannot be underestimated. Although TC4 was composed in large part of computer professionals interested in medical applications, Grémy recruited the first generation of IMIA officers and members from the medical and health care communities. Intellectually as well as organizationally, IFIP-TC4 was the true predecessor of lMIA.

The IMIA/UMIT award celebration took place on September 11, 2004. Prof. Grémy's Medical Informatics Award of Excellence Lecture, entitled "Hardware, Software, Peopleware, and Subjectivity: A Philosophical Promenade", is now published jointly in this issue of Methods of Information in Medicine (12). Now aged 76, François Grémy is retired in the wonderful city of Uzes, in the south of France, but still very active, completing a doctoral thesis in philosophy.

REFERENCES

1. Grémy F, Leterrier F. Eléments de biophysique. Tome 1. Paris: Flammarion Médecine-Sciences; 1966: 772 pages.
2. Grémy F, Perrin J. Eléments de biophysique. Tome 2. Paris: Flammarion Médecine-Sciences; 1971: 829 pages.
3. Hermann L, Grémy F. Bases mathématiques pour la recherche médicale et biologique. Tomes 1&2. Paris: Dunod; 1969: 1092 pages.
4. Grémy F, Salmon D. Bases statistiques pour la recherche médicale et biologique. Paris: Dunod; 1969: 424 pages.
5. Anderson J, Forsythe JM. (eds). Information Processing of Medical Records. Proceedings of the IFIP-TC4 Working Conference on Information Processing of Medical Records (Lyon, April 6-10, 1970). North-Holland, Amsterdam, 1970.
6. Zywietz C, Schneider B. (eds). Computer Application on ECG and VCG Analysis. Proceedings 2nd IFIP-TC4 Working Conference (Hannover 1971). North-Holland, Amsterdam, 1973.
7. Anderson J, Grémy F, Pagès JC. (eds). Education in Informatics of Health Personnel. North-Holland, Amsterdam, 1974.
8. De Dombal FT, Grémy F. (eds). Decision Making and Medical Care. North-Holland, Amsterdam, 1976.
9. Grémy F. Informatique Médicale. Introduction à la méthodologie en médecine et santé publique. Médecine-Sciences Flammarion, Paris, 1987; 469 pages.
10. Flagle C, Grémy F, Perry S. Assessment of Medical Informatics Technology. Proc Joint IMIA/ ISTAC/EN-SP Conference (Montpellier, October 22-26, 1990). ENSP, Rennes, 1991.
11. Grémy F. Onaencore oublié la santé! Propositions pour une médecine de qualité et de solidarité. Editions Frison-Roche, Paris, 2004: 274 pages.
12. Grémy F. Hardware, Software, Peopleware, and Subjectivity: A Philosophical Promenade. Methods Inf Med. 2005; 44: 352-8.

21

Gustav A. Wagner, Donald A.B. Lindberg

IN MEMORIAM TO PETER L. REICHERTZ

We sadly announce the death of Prof. Dr. Peter L. Reichertz, co-editor of this journal, on August 6, 1987. He was 57. The editors, publishers, and his colleagues deeply regret the loss of a friend (1). The spectrum of scientific fields in which Peter Reichertz was competent was astonishing. It included his early interests, with which he never lost touch - pharmacology and drug research, cardiology and electrophysiology, endocrinology and general clinical medicine - and the fields with which the readers of this journal are especially familiar - computer diagnostics, research on health systems, hospital information systems, and practice-based computerized information systems.

Hermann Leo-Peter Reichertz, the son of Dr. med. Fritz Reichertz, a general practitioner, was born in Speicher in the Eifel on September 20, 1930. After finishing school in Bitburg/Eifel, Wernigerode, and Trier, he studied medicine in Mainz, Gottingen, Geneva, Cologne, Munich, and Bonn, where he passed his final examination in 1955. After serving his internship at the Medical University Hospital in Bonn and studying under scholarhip at the Institute of Veterinary Pharmacology of the Free University of Berlin, he began special training in internal medicine under Prof. F. Tiemann at the Medical Policlinic of Bonn University where he was awarded the venia legendi in 1964.

Although his early scientific interests focused on cardiology, electrophysiology, and drug research, he began to be fascinated with the potential of electronic processing of clinical data and research findings. Together with C. Win-

*This text is republished from the book “Contributions to the History of Medical Informatics” (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.

kler and G. Kloss, he published his first papers on computer diagnosis of thyroid diseases in 1965.

In the next year, Dr. Reichertz accepted an invitation from John E. Overall at the University of Texas Medical Branch in Galveston and he took a position as Fellow in Internal Medicine and Associate Director of the Research Computation Center there. He devoted himself to computer applications, in particular vector cardiographic investigations. The following year he accepted an offer as Associate Professor and Director of the Department of Radiology Computer Research at the University of Missouri (Columbia.

Dr. Reichertz arrived at the University of Missouri in time to join in the excitement of developing the U.S. Regional Medical Program. He began there his lifelong personal and professional relationship with Dean Vernon E. Wilson, Gwilym Lodwick, and Donald Lindberg. Dr. Reichertz served consecutively as Associate Professor of Radiology, Associate Director of the Medical Computer Center, and Director of the University of Missouri Computer Center. He contributed substantially to the radiology, diagnostic reporting system that became known as MARS, and also to developing the innovative operating systems that made possible the Missouri Integrated File of patient clinical and laboratory records. This constituted one of the earliest hospital information systems.

Through his extensive and influential publications he acquired an enviable international reputation. Thus, it is not surprising that when the new Medizinische Hochschule Hannover was searching for an experienced physician expert in medical informatics, the name of Peter Reichertz was at the top of the list and he was offered the position. Over the next several years he created the well-known “Medical System Hannover” (MSH), an integrated hospital information system. In 1970, he was appointed Director of the Institute for Medical Informatics and Head of the Medical Computing Center of the Hochschule, functions he held until his premature death earlier this year. In his 17 years at the Medizinische Hochschule Hannover, Peter Reichertz was known as an inspiring mentor who filled his colleagues and students with enthusiasm.

He was a zealous promoter of medical informatics, organizing many congresses and seminars. He even managed to combine avocation and vocation; an enthusiastic private pilot, he became a certified civilian flight surgeon and a recognized expert in aviation medicine.

A special interdisciplinary interest of Peter Reichertz’s was the development of combined courses that would integrate medical informatics into both the study of medicine and the study of informatics. One result of this interest in training was the creation of the title “Certificate Specialist in Medical Informatics”. Four of his former students have gone on to become full professors of medical informatics.

His profound knowledge, his scientific activity, his diplomatic character, and his polyglot proficiency in German, English, and French predestined him for numerous high offices in national and international organizations. Thus, at various times, he was President of the German Society for Medical Documentation, Informatics, and Statistics, Vice President of the Working Group for Biomedical Information of the European Community, Chairman of the Committee for Medical Applications of the German Computer Sciences Association, and Vice President of Salutis Unitas.

He was a founder of both the International Medical Informatics Association and the European Federation for Medical Informatics (of which he was the first President). In 1983 he founded the Professional Association of Specialists in Medical Informatics, a professional interest group in the Federal Republic of Germany, whose President he remained until his death. The New York Academy of Medicine made him a member. He was a member of numerous steering and program committees of international professional societies. His final commitment was as senior editor of the planned MEDINFO '89 proceedings. Peter Reichertz's judgment on scientific questions was much sought after by government officials. He was a scientific consultant to health ministries in Germany, Iceland, countries in the Middle East, and the United States.

He leaves a legacy of 110 published scientific articles, 137 chapters in books, 17 books he authored or co-authored, and 36 other published reports, lectures, etc. Dr. Reichertz was co-editor of several well known series, including "Medical Informatics and Statistics" and "Lecture Notes in Medical Informatics".

He was on the editorial boards of five speciality journals. In his work with the Editorial Board of "Methods of Information in Medicine", his expert opinions were always objective and professional; authors were grateful for his improvements in their manuscripts. It was planned that Peter Reichertz should take over the editorship of "Methods" in 1988. Gustav Wagner, who has held the position for many years, would gratefully step down. Unfortunately, Atropos, the goddess of fate, stepped in.

The premature and unexpected death of Peter Reichertz is mourned by thousands of friends, pupils, and colleagues around the world. His passing leaves a gap in our professional ranks that will never be filled. He has done the profession great honor, and we honor his memory.

REFERENCES

1. Wagner AG, Lindberg BD. In Memoriam of Peter L. Reichertz. Methods of Information in Medicine. 1987: 26(4): 179-82.

22

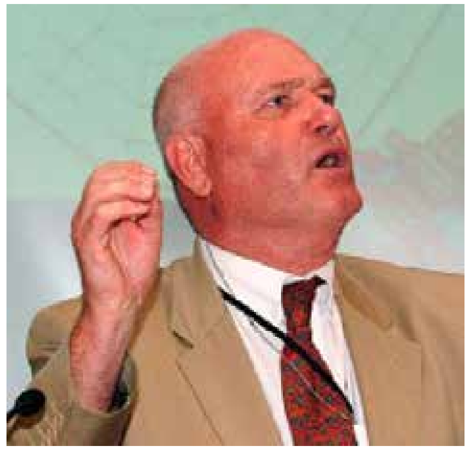
Ilias Iakovidis

A TRIBUTE TO JEAN-CLAUDE HEALY, A FREE THINKER AND VISIONARY LEADER FOR BIOMEDICAL INFORMATICS

On 21st of March, 2008, the Medical Informatics community lost a free thinker, a true optimist and a humanitarian who tirelessly worked towards a new era of eHealth in Europe and beyond. Jean-Claude Healy passed away very prematurely and suddenly, in his house in Arenas, Saint Jean du Gard at the age of 65 (1).

Under Jean-Claude's supervision, the medical informatics research community strengthened its world-wide impact and established the European Union as a world leading institution supporting medical informatics. Under his leadership the funding of the EU medical informatics (health telematics, eHealth) programs has increased fivefold. Jean- Claude himself was the driving force behind the concepts and initiatives that focused on providing tools and intelligent environments directly to patients, supporting them in health promotion and lifestyle management. He was the originator and strong supporter of the Health- grid concept, dreaming of connected health research communities freely sharing information and knowledge. In 2001 we have taken a bold decision to bring diverse scientific fields of medical informatics, bioinformatics and neuro-informatics together under the umbrella of Biomedical Informatics field. Our ambitious goal of providing the integrated view of human physiology and diseases from the level of molecule to the levels of organ, system and population is now becoming a mainstream research target, supported by the EU and other international research programs.

*This text is republished from the book "Contributions to the History of Medical Informatics" (Eds.: Masic I, Mihalas G.), Avicena, Sarajevo, B&H. 2014: ISBN: 978-9958-720-56-7, with permission of the Publisher. Some parts are corrected and edited by Editor of this book.



Jean-Claude's main strength was to bring the right people together when there was a call for action. He convinced his staff in 2003 that the time was ripe to call for an EU-wide eHealth Action Plan. We have gathered the Health Ministers, under the first eHealth Ministerial conference, to lay the evidence in front of them and commit them to action. These actions are already bearing fruit. Deployment of beneficial eHealth solutions on local, regional and national scales has accelerated tremendously, directly or indirectly influenced by the EU's call for action. Jean-Claude took even bolder steps in committing authorities to eHealth by working relentlessly for 2 years in the WHO until the eHealth Resolution (WHA 58 28) and the WHO eHealth action plan was adopted for all 193 WHO Member States.

The achievements of Jean-Claude were based on his previous 30 years of experience as Professor in the areas of biophysics and medical informatics. Jean-Claude Healy, MD, PhD (University of Paris) was a Professor of Biophysics and Medical Informatics at the Universities of Paris, Strasbourg, and St. Etienne from 1965 to 1995. In 1995 he joined the European Commission as Head of the Health Telematics unit, a position which he held until 2004. From 2004 to 2006 he was advisor to WHO where he held the position of a Director in the Office of External Relations and Governing Bodies in charge of the WHO eHealth strategy. Before his retirement from the European Commission in November of 2007, Jean-Claude held also a Senior Advisor position for several months in the United Nations office for Global Alliance for ICT and Development (GAID) striving to promote worldwide deployment of tools and skills needed to reap the benefits of technology. The diversity and richness of his 250 publications span from basic research in biophysics to experimental work in medical informatics to policy documents such as the WHO eHealth Resolution and eHealth Action Plan and the EU-WHO eHealth report for the World Summit on Information Society. Jean-Claude was a friend, with a generous and enthusiastic nature, with a permanent sense of humour. I had the privilege and fun to work with Jean- Claude for over 10 years as colleague and later as his deputy of the eHealth unit of the European Commission. I will cherish the memory and be always thankful for the trust and freedom he provided me all these years. I am committed to pursue his visions and activities which we started together and in this way keep him alive in our community. I will finish with his favorite quote:

"The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man."

- George Bernard Shaw

REFERENCES

1. Iakovidis I. A Tribute to Jean-Claude Healy, a Free Thinker and Visionary Leader for Biomedical Informatics. IMIA Yearbook of Medical Informatics. 2008: 16.

23

Izet Masic

JANA ZVAROVA MEMORIAL CONFERENCE 2018, PRAGUE, CZECH REPUBLIC, MAY 4TH, 2015

In Prague on 4th May 2018 was organized Special Topic Conference dedicated to acknowledging and honoring of Prof. Jana Zvárová, founder and Editor in Chief of both this European Journal for Biomedical Informatics and the International Journal on Biomedicine and Healthcare, who suddenly and unexpectedly passed away in July 2017.

Prof. Zvárová was one of pioneers of Biomedical Informatics in former countries of “Eastern block”(former socialistic countries) of the World.

In the Editorial of special issue of the European Journal for Biomedical Informatics edited by professors Bernd Blobel and Arie Hasman, as Guest Editors, published online in this journal on April 30th 2018, Bernd and Arie expressed their opinions and some facts about her, as they said, “unforgettable friend and colleague” Jana Zvarova (EJBI. 2018; 14(2): 1-2):

Jana Zvarova “was an extraordinary personality, who influenced the development and improvement of health and social care by means of medical informatics, biomathematics and biostatistics as well as epidemiology both nationally and globally. She dedicated her excellent work based on a broad education and huge practical experience to the benefit of patients and health professionals, but first of all to teaching undergraduate, PhD and PostDoc students from the Czech Republic as well as other countries, acknowledging the importance of educating and training current and future

*This text is republished from the journal Acta Inform Med. 2018; 26(2): 146-148. doi: 10.5455/aim.2018.26.146-148. with permission of Publisher: © Avicena d.o.o. Sarajevo, Mis Irbina 11, 71000 Sarajevo, B&H. Some parts are corrected and edited by Editor of this book.

Figure 1. Karel Zvara opening Jana Zvarova Memorial Conference 2018

Figure 2. Paricipants of the Jana Zvarova Memorial Conference in Pargue, 4th May 2018

Figrue 3. Izet Masic as presenter at Jana Zvarova Memorial Conference 2018

Figure 4. Invited speakers at Jana Zvarova Memorial Conference 2018, Prague May 4th, 2018

staff for best serving the community. Due to this engagement Jana Zvárová received a big number of awards, fellowships, medals, etc. during her professional life that lasted until her last breath. Frequently in cooperation with the Editors, authors and other colleagues, Jana Zvárová has organized quite a number of conferences and educational events covering such diverse topics as biomathematics, biostatistics, medical informatics, eHealth, mobile health, medical documentation, EHR systems, clinical decision support, interoperability challenges and related standards, but also clinical, social and legal aspects. At EuroMISE and also later at the Center for Biomedical Informatics at Charles University Prague (launched in 2006, based on an agreement between the Charles University Prague and the Czech Academy of Sciences) lecture series on advanced eHealth, knowledge representation and management, medical and clinical guidelines, ontologies, EHR systems and interoperability were organized by Jana. With the establishment of the EuroMISE Mentor Association (EMA) in 2013, mentoring courses addressing regular and PhD students were organized in cooperation and coordination with, and on the topic of, some of those international conferences organized in Prague. Jana Zvárová specifically supported the series of International HL7 Interoperability Conferences (IHIC) by giving them a publication platform at the European Journal for Biomedical Informatics".

Figure 6. Slides from presentation of Izet Masic at Jana Zvarova Memorial Conference in Prague, May 4th, 2018

Mentioned topics from some of the fields Jana was interested has been presented at Special Topic Jana Zvarova Memorial 2018 Conference in Prague, held on May 4th of the 2018. Almost all presented contributions invited speakers, and distinguished Medical Informatics experts and academics, friends of Jana Zvarova, and also some of them, former teachers of Charles University EuroMise center, chaired by professor Jana Zvarova.

Presentations at this STC are printed in Special Issue of the European Journal for Biomedical Informatics and were visible on-line before the day of CTC (www.jbi.org).

This volume starts with an obituary for Jana Zvárová. George Mihalas, Vice-Chair of the History Working Group of the International Medical Informatics Association (IMIA) acknowledges and honors her professional life and achievements. Further contributions in this volume specifically address in more or less detail cooperation with Jana Zvárová in the context of electronic healthcare documentation, EHR systems, interoperability, knowledge management and decision support, educational challenges, but also the role of women in the domain of health informatics. Bernd Blobel discusses requirements, standards and solutions for interoperable EHR systems with some focus on user perspectives, thereby also referring to earlier papers with a more technical focus. Elske Ammenwerth addresses the transformation of the patient into a responsible care manager by assessing the role of patient portals for empowering them. The analysis emphasizes the situation in Austria, but also considers the aspects in general. Jan Kalina discusses the challenges of Big Data analysis in medicine. He illustrates the complexity reduction of highdimensional data with practical research problems such as face recognition and gene analysis. František Och presents the project "Comprehensive assessment of the clinical effect of specifically selected natural remedies on the treatment of knee osteoarthritis" Jana Zvárová was strongly involved in. In that context he presents the interdisciplinary challenge of evidence-based medicine in balneology as initiated by Jana. Lenka Lhotska discusses the evolution of decision support systems in healthcare, specifically highlighting the role of distributed systems and the Internet of Things (IoT). Izet Masic focuses on the field Jana Zvárová was especially engaged in: education in medical informatics, biostatistics and related domains and applications. He specifically highlights the situation in his home country

Bosnia-Herzegovina under the perspective of the Bologna Process. Pirkko Nykänen summarizes the investigations on the specific role and achievements of women in health informatics. Diane Whitehouse finally reports about conversations with Prof. Jana Zvárová on contemporary developments in digital health In the addendum of this Jana Zvárová Special Issue of the European Journal for Biomedical Informatics, we republish the official obituary of IMIA and EFMI concerning Jana Zvárová, which appeared first in the IMIA Newsletter 82 from July 2017.

Programme of the JZMC 2018

Friday, May 4th 2018

Registration: 8:30 - 9:00

Session I (9:00 - 10:25)

- Keynotes
  - George Mihalas (45 minutes)
  - Štěpán Svačina (15 minutes)
  - Vladimír Bencko (10 minutes)
  - EMA Board (15 minutes)

Coffee break

Session II (10:45 - 12:00)

- Former Ph.D. student of Jana Zvárová: Martin Hynek (10 minutes)
- Inspired by Jana Zvárová: Jiří Kofránek (10 minutes)
- Women in Health Informatics
  - Pirkko Nykänen (introduction, 5 minutes)
  - Elske Ammenwerth (25 minutes)
  - Diane Whitehouse (25 minutes)

Lunch (in place)

Session III (12:40 - 14:20)

- Bernd Blobel: Interoperable EHR Systems – Challenges, Standards and Solutions (40 minutes)
- Lenka Lhotská: Decision Support Systems: Present and Future (30 minutes)
- Miroslav Zvolský: Guidelines and Decision Support (30 minutes)

Coffee break

Session IV (14:40 - 16:20)

- Izet Masic: Medical Informatics Education - Past, Today and Future (30 minutes)
- Jan Kalina: Big Data, Biostatistics and Complexity Reduction (30 minutes)
- František Och: Looking back on one unapproved project (20 minutes)
- Discussion (15 minutes)
- Karel Zvára: Closing the Conference (5 minutes)

It was very nice to see some of very close friends of Jana Zvarova in Prague, at the University were Jana started long time ago as young mathematician and statistician, after graduating in 1965, later founding Medical Informatics Section of the Czech Society of Biomedical Engineering and Medical Informatics (in 1978) and become full professor of Charles university (in 1999) and Doctor of Sciences at the Academy of Sciences of the Czech Republic (in 1999).

This organized Memorial Conference in Prague, dedicated to acknowledging and honoring to Jana Zvarova was possibility express some stories about Jana's personality as teacher, academic, expert, woman, wife, mother – having "raised very successful children and being a role model for women in the field of Health informatics internationaly", as Jan H. van Bemmel, Marion Ball and Arie Hasman mentioned in their Obituary which published in IMIA newsletter from July 2017.

REFERENCES

1. Masic I. Prof Jana Zvarova, PhD (1943-2017). Acta Inform Med. 2017; 25(2): 147-148. doi: 10.5455/aim.2017.25.147-48.

2. Mihalas G, Zvarova J, Kulikowski K, Ball M, Bemmel van JH, Hasman A, Masic I, Witehouse D, Barber B. History of Medical Informatics in Europe - a Short Review by Different Approach. Acta Inform Med. 2014 Feb; 22(1): 6-10. doi: 10.5455/aim.2014.22.6-10.

3. Blobel B, Hasman A. Jana Zvarova Memorial Conference 2018 in Prague. European Journal for Biomedical Informatics. 2018; 14(2): (1-2).

4. Masic I, Pandza H. Medical Informatics Edication - Past, Today and Future. European Journal for Biomedical Informatics. 2018; 14(2): (40-45.

5. Bemmel van JH, Ball M, Hasma A. Remembering Jana Zvarova (1943-2017). European Journal for Biomedical Informatics. 2018; 14(2): (53-54.

6. Mihalas G. Jana Zvarova - a Distinguished Personality of Medical Informatics. European Journal for Biomedical Informatics. 2018; 14(2): (3-9).

24

Izet Masic

17TH INTERNATIONAL CONFERENCE ON INFORMATICS, MANAGEMENT AND TECHNOLOGY IN HEALTH CARE, ATHENS, GREECE, 5-7 JULY, 2019

During the period from 5th to 7th July of the 2019 17th International Conference on Informatics, Management in Technology and Healthcare (ICIMTH 2019) was held in Athens, Greece.

The title of the 17th ICIMTH Conference was: "Health Informatics Vision: From Data via Information to Knowledge" (1). At the Conference were presented: 4 keynotes, 89 papers, 18 poster presentations, 4 Invited workshop and 2 Special Panel Sessions by presenters from over 30 countries in the world. Special Session has organized as EFMI Honorary Session during which Anne Moen, former President of EFMI and and Ragnar Nordberg, former Treasurer of EFMI, received certificates as new elected Honorary Fellows of EFMI at EFMI Council meeting held in Zagreb, Croatia in 2018.

The conference represents one of the largest European gathering in the field of Medical informatics: Medical/Health/Biomedical Informatics, Biomedical Engineering, Information Science, Health Informatics, Clinical Informatics, Public Health Informatics, Healthcare IT, Decision Support and Intelligent Systems, Diagnostic Technologies for Medical Decision Support, Formalization of Knowledge, Ontologies, Clinical Guidelines and Standards of Healthcare, Telemedicine, Interoperability in Healthcare Systems, Imaging, Health Information Management, Knowledge Management, Health

*This text is republished from the journal Acta Inform Med. 2019; 27(3): 214-216. doi: 10.5455/aim. 2019.214-216. with permission of Publisher: © Avicena d.o.o. Sarajevo, Mis Irbina 11, 71000 Sarajevo, B&H. Some parts are corrected and edited by Editor of this book.

Figure 1. Participants of the ICIMTH Conference in Athens, Greece, July, 2019

Technology Assessment, E-learning and Education, Robotics and Virtual Reality, Socio-Economic Issues, Standards, Social and Legal Issues.

ICIMTH 2019 Conference has opened by President of EFMI, professor Lacramioara Stoicu-Tivadar with interesting lecture: "Medical Education in a Digital Society: IT is a Support or a Chalange?"

Over three days, 4 invited lectures were presented: Reinhold Haux ("Some Thoughts on Extended Collaboration of Entities with Natural and with Artificial Intelligence in Health Care and Beyond"); Theodoros N. Arvanitis ("Quantitative Magnetic Resonance Imaging Radiomics Informatics Approaches Toward Personalized Medicine"); Catherine Chronaki ("International Patient Summary and Open Standard APs for Value-Based Care"); Patrick Weber ("Standards and Nursing").

Panayota Sourtzi chaired panel "Applications of Information Technology in Health" (panelists were: Marianna Diomidous, Stelios Zimeras and Costas Chardalias), and Panel chaired by George Mihalas with title: "Medical Informatics: the Crossroads Between Information Technologies and Medical Specialties" (panelists were: George Mihalas, Arie Hasman, Lacramioara Stoicu-Tivadar and John Mantas).

During ICIMTH 2019 Conference were organized two interesting workshops: John Mantas moderated workshop "CrowdHEALTH EU Project" and Reinhold Haux moderated workshop: "On Writing for Publication and on Good Research in Biomedical and Health Informatics".

All keynote lectures and paper and poster presentations were followed by interesting discussions. Participants were able to participate with presentations of full papers and

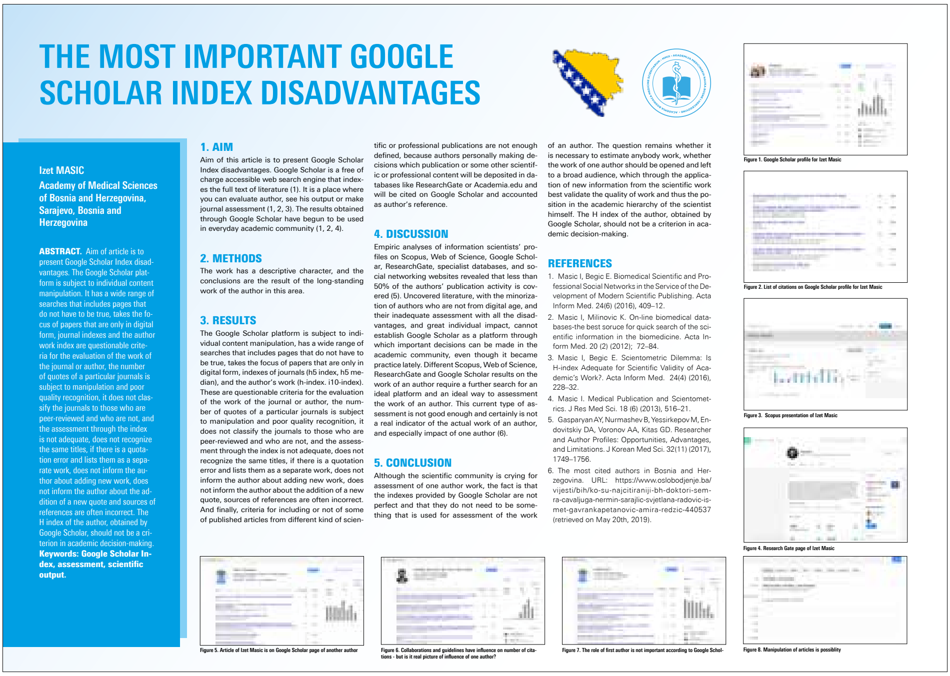


Figure 2. Poster presentation of Professor Izet Masic at ICIMTH 2019 Conference about Google Scolar Index disadvantages

posters and all gathered had the opportunity to learn about the latest developments of health informatics achievemnts in all segments of biomedicine and to see many presentations about the use of information technologies (IT) in different fields of healthcare systems in the world.

During Closing Ceremony John Mantas, Chair of the Organizing Committee promoted a new book “Biografico Leksiko”, written by Professor Izet Masic, translated from English language to Greek language by Professor Marianna Diomidous (original title of the book is “Biographical Lexicon of Public Health”) - Masic I. Biografico Lexico. Broken Hill Publisher LTD, Nicosia, Cyprus. 2019: 623. pp. ISBN: 978-9925-563-26-5).

As usual, like in previous years, great job of reviewed and selected papers which were presented at ICIMTH 2019 have done by Professor Arie Hasman (2-4). The Organizing Committee, led by Professor John Mantas and his tream, chaired by Paris Galos, have done also a really great job.

We hope that “ICIMTH 2020” Conference which is now traditional scientific event in the field of Biomedical Informatics in Europe and larger, next year will attract larger number of participants, because event like this certainly deserves it.

All papers are published in the Proceedings of ICIMTH 2019, by IOS Press publisher, Amsterdam, and papers are indexed in MEDLINE. Presented papers show that Information technologies certainly have growing use in all segments of medicine and its use certainly represents the future of all disciplines and subdisciplines of medicine and healthcare protection.

Author of this report at ICIMTH 2019 Conference presented very two interesting presentations: first one, about most frequent mistakes of statistical analysis of PhD students thesis, and second one about disadvantages of Google Scholar Index, as one of most frequent index used currently in the praxis, but with a lot of mistakes (5, 6).

Figure 3. Promotion of the book “Biografico Lexico” in Greak language during ICITHM 2019 Conference in Athens, Greece, July 2019

It was discussed during ICITHM 2019 Conference with many participants as very important topic, who agreed with my opinion. But, very few academics and scientists openly written about it. We shall see feed-back of the critics for my comments, conclusions and recommendations what to do in the future and who, how, and what need to do for improving Google Scholar Index.

Webometrics use this index as very important platform for assessment of academic institutions and universities and professional academic staffs, but very few people make evaluation of that. Somebody need to do it, definitely.

REFERENCES

1. https://www.icimth.com/. Retrieved on August 5th, 2019.
2. Masic I. 14th ICIMTH Conference, Athens, Greece, 1-3 July 2016. Acta Inform Med. 2016 Aug; 24(4): 300-301. doi: 10.5455/aim Med.24.300-301.
3. Masic I. 15th International Conference on Informatics Management and Technology in Health Care (ICITHM 2017). Acta Inform Med. 2017 Sep; 25(3): 208-209. doi; 10.5455/aim.2017.25.208-209.
4. Masic I. 16th International Conference on Informatics Management and Technology in Health Care (ICITHM 2018). Acta Inform Med. 2018 Sep; 26(3): 210-212. doi; 10.5455/aim.2017.26.210-212.
5. https://www.oslobodjenje.ba/vijesti/bih/ko-su-najcitiraniji-bh-doktori-semra-cavaljuga-nermin-sarajlic-svjetlana-radovic-ismet-gavrankapetanovic-amira-redzic-440537.Retreived on August 05th, 2019.
6. 6https://nap.ba/news/56828. Retreived on August 05th, 2019.

THE LIST OF AUTHORS

- Marion Ball, senior advisor, Health Care Informatics, IBM Research, John Hopkins University, Baltimore, USA.
- Barry Barber, retired at from NHS, former managing director at Health data protection Ltd., London, UK.
- Jan H. van Bemmel, professor of Medical informatics, Erasmus University Rotterdam, The Netherlands.
- Patrice Degoulet, professor of Medical informatics. EFMI, Paris, France.
- Gjuro Dezelic, professor emerrita of Medical informatics, "Andrija Stampar School of Public Health", University of Zagreb, Croatia.
- Rolf Engelbrecht, associate professor of Medical informatics. USMF, Chisinau.
- Francis Roger France, professor of Medical informatics, Louvain University, Louvain, Belgium.
- Arie Hasman, Department of Medical informatics. Academic medical center, University of Amsterdam, The Netherlands.
- Reinhold Haux, Department of Medical Informatics at Heidelberg University, Germany.
- Mira Hercigonja-Szekeres, assistant professor of Medical informatics. Hrvatsko zagorje Polytechnic, Krapina, Croatia.
- Jacob Hofdijk, PhD. partner in Casemix, Oegstgeest, The Netherlands.
- Ilias Iakovidis, PhD. Acting Head of Unit - Digital Social Platforms. DG for Communication Networks, Content and Technologies. European Commission.
- Vesna Ilakovac, professor of Medical informatics. Department of Biophysics, Medical statistics and Medical informatics, School of medicine, University of Osijek, Croatia.

- Josipa Kern, professor of Medical informatics, “Andrija Stampar School of Public Health, University of Zagreb, Croatia.
- Casimir Kulikowski, professor of Medical informatics, Department of Computer science. The State University of New Jersey, Piscataway, NJ, USA.
- Donald Lindberg, director of National Library of medicine, Bethesda, Maryland, USA.
- Kwok Chan (KC) Lun, professor of Medical informatics. IMIA, Singapore.
- John Mantas, professor of Medical informatics. Health Informatics Laboratory, University of Athens, Greece.
- Izet Masic, Professor Emeritus of Medical informatics and Family medicine. Faculty of medicine, University of Sarajevo, Bosnia and Herzegovina.
- George Mihalas, professor of Medical informatics, Victor Babes University of medicine and Pharmacy, Timisoara, Romania.
- Hans E. Peterson, former director of the Department of Medical informatics at the Greater Stockholm Health Care Administration, Stockholm, Sweden.
- Mladen Petrovecki, professor of Medical informatics. Department of Medical informatics, School of medicine, University of Rijeka, Croatia.
- Assa Reichert. HealSis Ltd. Healthcare Systems Planning & Technology Management. P.O.B. 1512 Ramat Hasharon 47114, Israel.
- Maureen Scholes. European Federation of Medical Informatics.
- Gustaw A. Wagner. professor of Medical informatics, University of Vienna, Austria.
- Patrick Weber, Nice Computing SA. Ch de Maillefer 37, CH-1052, Le Mont-sur-Lausanne, Switzerland.
- Diane Whitehouse, The Castlegate Consultancy, London, UK.
- Tatyana Zarubina. Department of Medical Cybernetics and Informatics. Pirogov Russian National Research Medical University, Moscow, Russia.
- Jana Zvarova, professor of Medical informatics, Charles University of Prague, Prague, The Czech Republic.

REFERENCES

1. Masic I, Mihalas G. (Eds.) et al.. Contributions to the History of Medical informatics. Avicena, Sarajevo, 2014: 439 pp. ISBN: 978-9958-720-56-7.
2. Masic I. The History of Medical Informatics Development - an Overview. Int J Biomed Healthc. 2020; 8(1): 37-52, doi: 10.5455/ijbh.2020.8.37-52.
3. Masic I. Historical Background of EFMI in Development of Medical Informatics. Acta Inform Med. 2021; 29(2): 141-147. doi: 10.5455/aim.2021.29.141-147
4. Masic I. European Federation for Medical Informatics – the Most Influential Promoter of Medical Informatics Development for the Past 45 Years. Acta Inform Med. 2021; 29(2): 80-93. doi: 10.5455/aim.2021.29.80-93.
5. Masic I. Biographical Lexicon of Medical Informatics. Avicena. Sarajevo, 2017: 546 pp. ISBN: 978-9958-720-62-8.
6. Masic I. Honorary Fellows of the European Federation for Medical Informatics. Avicena. Sarajevo, 2019: 50: pp. ISBN: 978-9958-720-64-2.
7. Masic I. Honorary Fellows of the International Association of Medical Informatics. Avicena. Sarajevo, 2018: 49: pp. ISBN: 978-9958-720-70-3.
8. Masic I. Historical Backgrounf of EFMI in Development of Medical Informatics. EFMI Inside. 2020; 1(1): 3-9.
9. Dezelic G. After three decades of Medical Informatics Europe congresses. Stud Health Technol Inform. 2009; 150: 3-7.
10. Mihalas G, Zvarova J, Kulikowski K, Ball M, van Bemmel J, Hasman A, Masic I, Whitehouse D, Barber B. History of Medical Informatics in Europe - a Short Review by Different Approach. Acta Inform Med. 2014 Feb; 2014; 22(1): 6-10. doi. 10.5455 aim/2014.22.6.10.
11. Masic I. Thirty Years Anniversary of the Biomedical Informatics Journal "Acta Informatica Medica" - 1993-2022. Acta Inform Med. 2022; 30(1): 4-10. doi: 10.5455/aim.2022.30.4-10.
12. Zvarova J, Masic I. Medical informatics - an interdisciplinary approach. Med Arh. 1996; 50(3-4): 107-109.
13. Adlassnig KP, Blobel B, Mantas J, Masic I. (Eds). Medical Informatics in a United and Healthy Europe. Proceedings of MIE 2009. IOS Press. Amsterdam, 2009: pp. 1064.
14. Masic I. The History and New Trends of Medical Informatics. Donald School Journal of Ultrasound in Obstretics and Gynecology,2013;; 7(3): 313-322.
15. Masic I, Five Periods in Development of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 44-48. doi: 10.5455/aim.2014.21.44-48..

16. Collen MF. Origins of Medical Informatics. The Western Journal of Medicine. 1986 December: 778-785.

17. Detmer DE. BSMCUL. Clinical Informatics Board Certification: History, Current Status, and Predicted Impact on the Clinical Informatics Workforce. Applied Clinical Informatics. 2010.

18. Park S, Parwani AV, Aller RD, et al. The history of pathology informatics: A global perspective. Journal of Pathology Informatics. 2013.

19. Detmer D, Munger B, Lehmann C. Medical Informatics Board Certification: History, Current Status, and Predicted Impact on the Medical Informatics Workforce. Applied Clinical Informatics. 2010; 1(1): 11-18.

20. Masic I, Novo A. History of Medical Informatics in Bosnia and Herzegovina. Acta Inform Med. 2007; 15(1): 49-61.

21. Masic I, Ridjanovic Z, Pandza H, Masic I. Medical Informatics (second edition). Avicena. Sarajevo, 2010: 13-36. ISBN: 978-9958-720-39-0.

22. Masic I. History of Medical Informatics. an Overview. Avicena. Sarajevo, 2014: 29-63. ISBN 978-9958-720-56-7.

23. Masic I. A History of Medical informatics in Bosnia and Herzegovina. Avicena, 2007: 3-26.

24. Masic I. A Review of Informatics and Medical informatics History. Acta Inform Med. 2007; 15(3): 178-188.

25. Masic I. The History and New Trends of Medical Informatics. Donald School J Ultrasound Obstet Gynecol. 2013; 7(3). 301-312.

26. Kern J, Petrovecki M. i sur. Medicinska informatika. Medicinska naklada, Zagreb, 2009: 269-292.

27. Shortlife EH, Pereault LE, Wiederhold G, Fagan LM. Medical Informatics. Computer Applicationsin Health Care and Biomedicine. Springerrlag, New York, 2000: 3-40.

28. Masic I, Ridjanovic Z. Medicinska informatika. Avicena. Sarajevo, 1994: 269-292.

29. Masic I, Ridjanovic Z. Medicinska informatika. Knjiga 1. Osnove Medicinske informatike. Avicena. Sarajevo, 1999; 195-220. ISBN 9958-720-16-7.

30. Dezelic Gj. Zdravstvena informatika. Medicinski fakultet Sveucilista u Zagrebu. Zagreb, 1991: 53-6.

31. Bemmel van J, Musen AM. Handbook of Medical Informatics, Springer-Verlag, 1997: 37-51.

32. Ball M, Lindberg D, Masic I. Special Tribute on Morris F. Collen: Charismatics Leader of Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 4-5. doi: 10.5455 aim/2014.22.4-5.

33. Masic I, Pandza H. Praktikum iz medicinske informatike. Avicena. Sarajevo, 1999: 5-22.

34. Milinkic S, Masic I. Information technologies in the new millenium. Med Arh. 1999; 53(4, sup.3): 100.

35. Dezelic G, Kern J, Petrovecki M, Ilakovac V, Hercigonja-Szekeres M. Medical Informatics in Croatia - a Historical Survey. Acta Inform Med. 2014 Feb; 22(1): 49-59. doi: 10.5455/aim.2014.22.49-59.

36. Dezelic Gj. Short review of Medical informatics history. Acta Inform Med. 2007; 15(1): 49-61.

37. Hofdijk J, Weber P, Mantas J, Mihalas G, Masic I. A Short Factography About International Medical Informatics Association and European Federation for Medical Informatics. Acta Inform Med. 2014 Feb; 22(1): 71-78. doi: 10.5455/aim.2014.22.71-78.

38. Ball MJ, van Bemmel JH, Kaihara S. IMIA Presidential Retrospectives on Medical Informatics. IMIA Yearbook of Medical Informatics. 2007: 165-75.

39. Masic I. The Most Influential Scientists in the Development of Medical Informatics (1): Francois Gremy. Acta Inform Med. 2014 Aug; 22(4): 287. doi: 10.5455/aim.2014.2.287-287.

40. Masic I. The Most Influential Scientists in the Development of the Medical Informatics (2): Morris F. Collen. Acta Inform Med. 2014 Oct; 22(5): 350. doi: 10.5455/aim.2014.22.350-350.

41. Masic I. The Most Influential Scientists in the Development of Medical Informatics (3): Peter Leo Reichertz. Acta Inform Med. 2014 Dec; 22(6): 415. doi: 10.5455/aim.2014.22.415-415.

42. Masic I. The Most Influential Scientists in the Development of Medical Informatics (4): Allan Cormack. Acta Inform Med. 2015 Feb; 23(1). 65. doi: 10.5455/aim.2015.23.65-65.

43. Masic I. The Most Influential Scientists in the Development of Medical Informatics (5): Charles Edwin Molnar. Acta Inform Med. 2015 Apr; 23(2): 121. doi: 10.5455/aim.2015.23.121-121.

44. Masic I. The Most Influential Scientists in the Development of Medical Informatics (6): Heinz Zemanek. Acta Inform Med. 2015 Jun; 23(3): 184. doi: 10.5455/aim.2015.23.184-184.

45. Masic I. In Memoriam on Assa Reichert (1943-2015). Acta Inform Med. 2015 Jun; 23(3): 185-186. doi: 10.5455/aim.2015.23.185-186.

46. Masic I. The Most Influential Scientists in the Development of Medical Informatics (7): Shigekoto Kaihara. Acta Inform Med. 2015 Aug; 23(4): 250-251. doi: 10.5455/aim.2015.23.250-250-251.

47. Masic I. The Most Influential Scientists in the Development of Medical Informatics (8): Jean Raoul Schrrer. Acta Inform Med. 2015 Oct; 23(5): 326-327.. doi: 10.5455/aim.2015.23.326-326-327.

48. Masic I. The Most Influential Scientists in the Development of Medical Informatics (9): William Abbott. Acta Inform Med. 2015 Dec; 23(6): 398. doi: 10.5455/aim.2015.23.398-398.

49. Masic I. The Most Influential Scientists in the Development of Medical Informatics (10): Marsfen Scott Blois. Acta Inform Med. 2016 Feb; 24(1): 70-71.. doi: 10.5455/aim.2016.24.70-71.

50. Masic I. The Most Influential Scientists in the Development of Medical Informatics (11): David B. Shires. Acta Inform Med. 2016 Apr; 24(2): 149. doi: 10.5455/aim.2016.24.149-149.

51. Masic I. The Most Influential Scientists in the Development of Medical Informatics (12): Joshua Lederberg. Acta Inform Med. 2016 Jun; 24(3): 220-1- doi: 10.5455/aim.2016.24.220-221.

52. Masic I. The Most Influential Scientists in the Development of Medical Informatics (13): Margaret Belle Dayhoff. Acta Inform Med. 2016 Aug; 24(4): 299. doi: 10.5455/aim.2016.24.299-299.

53. Masic I. The Most Influential Scientists in the Development of Medical Informatics (14): Branko Cesnik. Acta Inform Med. 2016 Oct; 24(5): 375. doi: 10.5455/aim.2016.24.375-375.

54. Masic I. The Most Influential Scientists in the Development of Medical Informatics (15): Homer R. Warner. Acta Inform Med. 2016 Dec; 24(6): 422-3. doi: 10.5455/aim.2016.24.422-423-423.

55. Masic I. The Most Influential Scientists in the Development of Medical Informatics (16): John Anderson. Acta Inform Med. 2017 Mar; 25(1): 58-59. doi: 10.5455/aim,2017.25.58-59.

56. Masic I. The Most Influential Scientists in the Development of Medical Informatics (17): Eugene Garfield. Acta Inform Med. 2017 Jun; 25(2): 145. doi: 10.5455/aim..2017.25.145-145.

57. Masic I. In Memoriam: Prof Jana Zvarova, PhD. (1943-2017). Acta Inform Med. 2017 Jun; 25(2): 147-148. doi: 10.5455/aim.2017.25.147-148.

58. Masic I. The Most Influential Scientists in the Development of Medical Informatics (18): Ishaack Sedick. Acta Inform Med. 2017 Sep; 25(3): 206-207. doi: 10.5455/aim.2017.25.206-207.

59. Masic I. The Most Influential Scientists in the Development of Medical Informatics (19): John Bryden. Acta Inform Med. 2017 Dec; 25(4): 280. doi: 10.5455/aim.2017.25.280-280.

60. Masic I. The Most Influential Scientists in the Development of Medical Informatics (20): Robert S. Ledley (1926-2012). Acta Inform Med. 2018 Mar; 26(1): 71-72. doi: 10.5455/aim.2018.26.71-72.

61. Masic I. The Most Influential Scientists in the Development of Medical Informatics (21): Antoine Remond (1917-1998). Acta Inform Med. 2018 Jun; 26(2): 144-145. doi: 10.5455/aim.2018.26.144-145.

62. Masic I. The Most Influential Scientists in the Development of Medical Informatics (22): Warner V. Slack (1933-2018). Acta Inform Med. 2018 Sep; 26(3): 208-209. doi: 10.5455/aim.2018.26.208-209.

63. Masic I. The Most Influential Scientists in the Development of Medical Informatics (23): Attila Naszlady (1931-2015). Acta Inform Med. 2019 Mar; 27(1): 64-64. doi: 10.5455/aim.2019.27.64-64.

64. Masic I. The Most Influential Scientists in the Development of Medical Informatics (24): Eugene Ackerman (1920-2014). Acta Inform Med. 2019 Jun; 27(2): 64-64. doi: 10.5455/aim.2019.27.64-64.

65. Masic I. The Most Influential Scientists in the Development of Medical Informatics (25): Rolf Hansen (1931-1993). Acta Inform Med. 2019 Sep; 27(3): 195-196. doi: 10.5455/aim.2019.27.195-196.

66. Masic I. The Most Influential Scientists in the Development of Medical Informatics (25): Dixon J. Wilfrid (1915-2008). Acta Inform Med. 2019 Dec; 27(4): 287-288. doi: 10.5455/aim.2019.27.287-288.

67. Masic I. The Most Influential Scientists in the Development of Medical Informatics (26): Barry Barber (1933-2019). Acta Inform Med. 2020 Jun; 28(2): 160-161. doi: 10.5455/aim.2020.28.160-161.

68. Masic I. The Most Influential Scientists in the Development of Medical Informatics (27): Hans Peterson (1928-2021). Acta Inform Med. 2021 Jun; 29(2): 134-135. doi: 10.5455/aim.2021.29.134-135.

69. Masic I. The Most Influential Scientists in the Development of Medical Informatics (28): Francis Roger France (1941-2021). Acta Inform Med. 2021; 29(4): 293-294. doi: 10.5455/aim.2021.29.4.293-294.

70. Masic I. Jana Zvarova Memorial Conference 2018, Prague, Czech Republic, May 4th, 2015. Acta Inform Med. 2018; 26(2): 146-148. doi: 10.5455/aim.2018.26.146-148.

71. Masic I. 17th International Conference on Informatics, Management and Technology in Health Care, Athens, Greece, 5-7 July, 2019. Acta Inform Med. 2019; 27(3): 214-216. doi: 10.5455/aim.2019.214-216.

INSTEAD OF THE REVIEWS

...The modern society at the transition from the second into the third millennium, frequently labeled as "information society", is asking for a new way of information thinking and working in all fields of human activity, and consequently in medicine and healthcare. Among new information and communication technologies (ICT), like mobile phones, fax, TV teletext, etc., the Internet plays the most important role. This ICT, using net resources all over the world, the World Wide Web (WWW or Web), expanded the transfer of information in all spheres of human activity, provoking a state described often as "Web-pandemic".

But technological changes are only a part of the progress and change. We should always have in mind that technology should be man´s servant and not a master.

Izet Mašić, in explaining the congress motto "Medical Informatics in a United and Healthy Europe", clearly states that the motto:

- incorporates the role of medical informatics as a scientific, technological, philosophical, and medical discipline, and

Figure 1. Participants of the MIE 2009 Conference, held in Sarajevo in August 2009

- raises the question as to whether and to what extent medical informatics is contributing to a new scientific, cultural, social and political community in Europe.

Mašić also calls attention that "the expansion of technological power raises the need for ethical responsibility and for the preservation and promotion of human health". Let us hope that the result of MIE 2009 will really be a contribution to the advance of human health in Europe streaming to unity. The mandate to organize the MIE 2009 Congress in Sarajevo is the crown of all efforts of Prof. Mašić, struggling for it for a long time, supported by the Society for Medical Informatics of Bosnia and Herzegovina he is leading for years so successfully. Credit should also be given to EFMI, by deciding for Sarajevo, supporting building of "new medical, biomedical, and health informatics bridges between the western and eastern parts of the European world".

From the keynote speech of Gjuro Dezelic at MIE Sarajevo '09 „After Three Decades of Medical Informatics Europe Congresses"

...Professor Izet Masic has made such incredible contributions to the field of Medical Informatics throughout his life, and he still does not consider stopping. He still has so much energy and so much more to contribute. As always, he keeps us informed of his activities and shares with us all. His incredible energy is visible through publications, books and papers that he has contributed throughout his life. He is a remarkable individual and I will never forget how Izet came to IMIA General Assembly meeting in Dresden in September of 1994, when I was president of IMIA, driving through war zones to support the International Medical Informatics Association (IMIA) by including Bosnian-Herzegovinian Society of Medical Informatics to IMIA family. Izet Masic is a remarkable gentleman, and we are all better off for all that he has done and contributed to the field of Medical informatics. Let me take this opportunity again to congratulate Izet on his incredible new publication entitled "Historical Background of Medical Informatics Development" as a great and important collection of contributions by the most influential scientists and experts within Biomedical scientific and academic fields, who have written historical facts about development of Health/Medical/Biomedical Informatics during past 70 years. My respect and congratulations to Izet for this excellent work...

Professor Emeritus Marion J. Ball,
EdD, FACMI, FAAN, FIAHSI, FMLA, FAHIMA, FHIMSS, FCHIME
University of Texas at Arlington, USA

..A book entitled “HISTORICAL BACKGROUND OF MEDICAL INFORMATICS DEVELOPMENT” was recently published by the renowned publishing house “Avicena” from Sarajevo. This exceptional book is among the first in the world to deal with the history of the development of medical informatics. Through 25 chapters, a large number of eminent authors, led by the doyen of medical informatics, professor Izet Mašić, deal with the development of informatics in medicine from all aspects. First, the reader is introduced to this area by explaining the impact of the development of computer technology on medical informatics, and then by defining informatics in general and medical informatics in particular. Specific periods in the development of medical informatics are singled out (five of them), and then specific events that were key to the development of informatics in Europe and the world in general are described. The authors specifically mentioned the names of scientists who played key roles in the development of medical informatics, along with their key biographical data, so that reading the book provides a complete insight into the historical development of this discipline. Special chapters deal with the origin and history of international associations devoted to medical informatics (EFMI and IMIA), as well as with the development of education at all levels in the field of medical informatics. One of the chapters is devoted to the history of medical informatics in Bosnia and Herzegovina. All chapters are richly illustrated with photographs that marked key events or individuals. The quality of the text is uniform in all chapters, and at a high level, so the book is easy to read and understand. Concrete examples supplement all theoretical concepts, so the book arouses much greater interest of younger readers compared to other literature in the same field. All chapters are accompanied by recent references.

The main contribution of this remarkable book is to create a complete picture of medical informatics in the world, which is easily conveyed to the readers. Thus, one branch of human activity is placed in the logical context of other activities, and its importance and contribution to the overall intellectual development of humanity is underlined. This publication is also of great importance for the Balkans as a unique region of Europe, where ingenious ideas are often born, but remain unrecognized by large societies, or are taken over without mentioning the source. This book precisely exposes the productive minds of the Balkans and gives them the place they deserve in the history of the development of medical informatics. I highly recommend such a valuable and important book to every library of medical literature in the world, as well as to any interested reader.

Professor Slobodan M. Jankovic, MD, PhD
University of Kragujevac, Kragujevac, Serbia

"Congratulations. A wonderful contribution to Medical informatics."
Ed Hammond

"Great book! Thank you for keeping our history alive!"
Elizabeth Borycki

"Impressive. Bravo. My hearty congratulations."
Doncho. M. Donev

"Great! Congratulations!"
George Mihalas

"Congratulations on the publication."
George M. Hripcsak

This publication is an absolutely incredible issue, such a detailed history with magnificent pictures and descriptions .You are to be congratulated on this contribution you've made to our profession .With my warmest regards and appreciation.
Marion Ball

I am in total agreement with Marion's words. To produce a publication like this takes hard work.
Terry Hannan

Congratulations Izet. This is a great document.
Vimla Patel

ABOUT THE EDITOR

Izet Masic is Professor Emeritus of Medical Informatics and Family Medicine at the Medical Faculty of the University of Sarajevo and Professor of Social Medicine, Health Care Organization and Health Economics at the Faculty for Health Sciences at the University of Zenica in Bosnia and Herzegovina. He is also Professor of Health Management at Dubrovnik International University in Croatia. As author and co-author Professor Izet Masic has published over 1000 papers in domestic and international journals, plus over 85 books and monographs. He has been or current Editor-in-Chief of five biomedical journals: Medical Archives, Materia Socio-Medica, Acta Informatica Medica, International Journal on Biomedicine and Healthcare, European Journal for Biomedical Informatics, and also Editor-in-Chief of EFMI Inside, the official newsletter of EFMI.

In 2009, Izet Masic formed the Academy of Medical Sciences of Bosnia and Herzegovina (AMNuBiH) and became its first President. He established the Society for Medical Informatics in Bosnia and Herzegovina (BSMI) and is or has been a Council or General Assembly member of several international medical informatics associations (EFMI, IMIA, EUPHA). Professor Izet Masic is Vice President of International Academy of Sciences and Arts in Bosnia and Herzegovina (IANUBIH), Vice President of Bosnian Academy of Sciences and Arts (BANUK), member of World Academy of Arts and Sciences (WAAS) and European Academy of Sciences and Arts (EASA). He is Founding member of International Academy of Health Informatics Sciences (IAHSI), and Fellow of the European Federation for Medical Informatics (FEFMI) and Fellow of American College of Medical Informatics (FACMI).

Prof Masic has organized over 50 scientific and professional conferences, including 10 during the wartime in Sarajevo- 1992-1995. He has been actively involved as speaker and session chairman at various congresses in public health, medical informatics and family medicine throughout Europe. He was Chair of 22nd European Congress of Medical Informatics - MIE 2009, organized in Sarajevo in August 2009.