The History of Medical Informatics Development - an Overview

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Background: 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. It means Medical informatics history can be stated connected with the beginnings of computer usage in medicine. **Objective:** The aim of this reviewe was to describe most important facts about historical backgrounds of development of Health/Medical/Biomedical informatics based on facts searched through systematic scientific literature. **Methods:** Author used descriptive method for explanation history of medical informatics based on published facts in the scientific literature deposited in online databases. **Results and discussion:** 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 informatics that is now part of all medical disciplines 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. 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. **Conclusion:** During last 70 years Biomedical informatics became one of the most prominent biomedical disciplines included in almost all other academic and scientific medical disciplines.

Keywords: Medical informatics, Biomedical informatics, IMIA, EFMI.

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1. WORLDWIDE MEDICAL INFORMATICS DEVELOPMENT

1.1. 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, 2, 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, 4, 5, 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).

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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 anal-

ysis, 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 patient 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 (ICT), 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 Phillippe Louis-Dreyfus in Paris, France (1). He established the term Informatics (information + otomatic). 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).

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 and John Anderson, In France Francois Gremy, in USA Morris Collen, in former Yugoslavia Gjuro Dezelic, 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

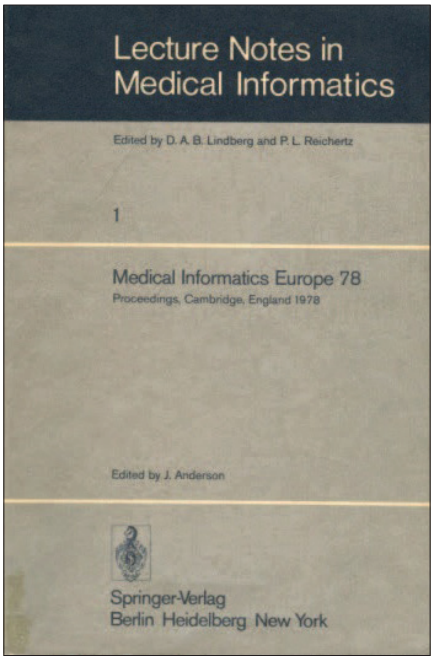


Figure 1. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

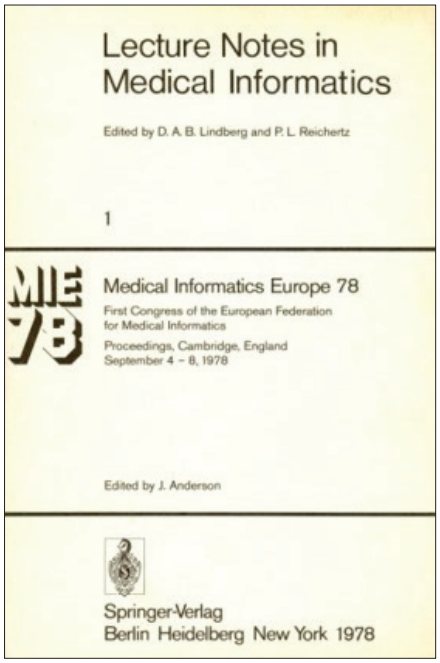


Figure 2. Cover page of Proceedings of MIE '78, Cambridge, UK, 1978

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.

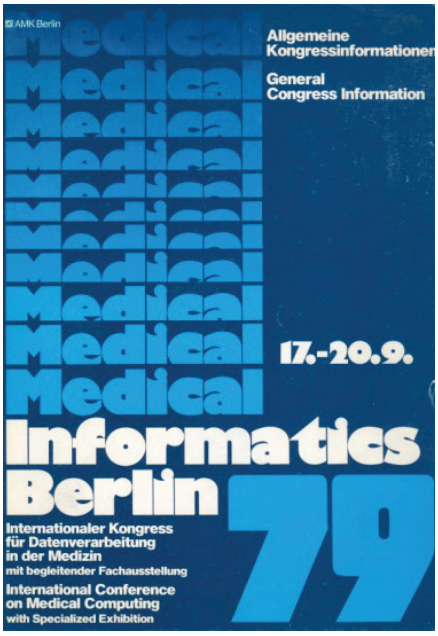


Figure 3. Cover page of Proceeding of MIE '79, Berlin, FR Germany 1979

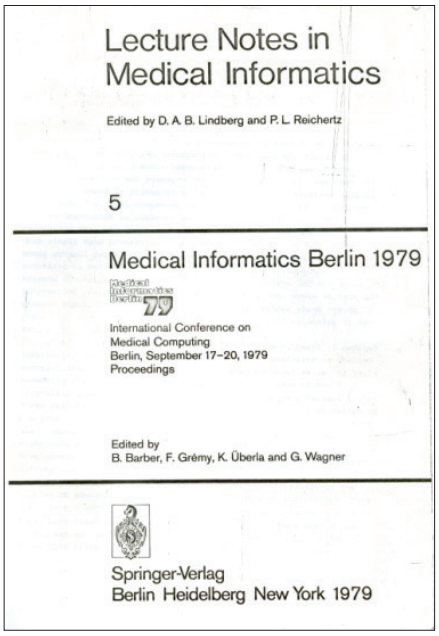


Figure 4. Cover page of Proceeding of MIE '79, Berlin, FR Germany, 1979

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 (1-3). 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 care (1968) emerge (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, 18).

In 1959, 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. 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.

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 and Internist-I. In 1965, the National Library of Medicine started to use MEDLINE and MEDLARS. Around this time, Neil Pappalardo, Curtis Marble, and Robert Greenes developed MUMPS (Massachusetts General Hospital Utility Multi-Programming System) (1, 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, cofounded 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). 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 R. Warner, one of the fathers of medical informatics, who founded the Department of Medical Informatics at theUniversity of Utah in 1968 (2), on application of informatics to medicine..

1.2. 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 publi-

cations 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.

1.3. 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).

2. THE ROLE OF IMIA IN THE DEVELOPMENT OF MEDICAL INFORMATICS

2.1. 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 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 biobank-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).

2.2. 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 bound-

aries; 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.

2.3. 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 BioMedicine – 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.

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

2.4. 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.

2.5. 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 ver-

sion 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.

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) .

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

2.6. 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).

2.7. 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

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

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)

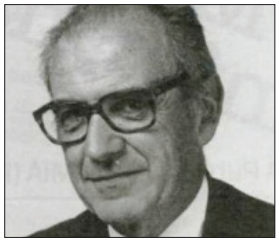
1989 – 1992: Jos L. Willems (Sweden)

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).

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
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

2.8. 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)..

3. THE ROLE OF EFMI IN THE DEVELOPMENT OF MEDICAL INFORMATICS

3.1. Establishment of EFMI

The first World Congress of Medical Informatics/ MEDINFO was organized by IFIP-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).

3.2. 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 (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.

3.3. 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), Brus-


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)

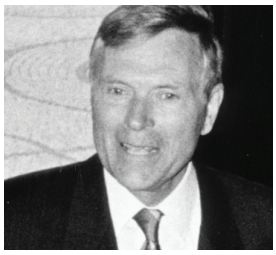

2002 – 2003: Assa Reichert (Israel)


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)

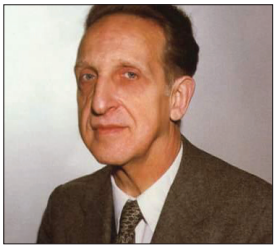

1976 – 1977: Antoine Remond (France)

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).

sels (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.

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).

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

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.

3.4. 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 ex-

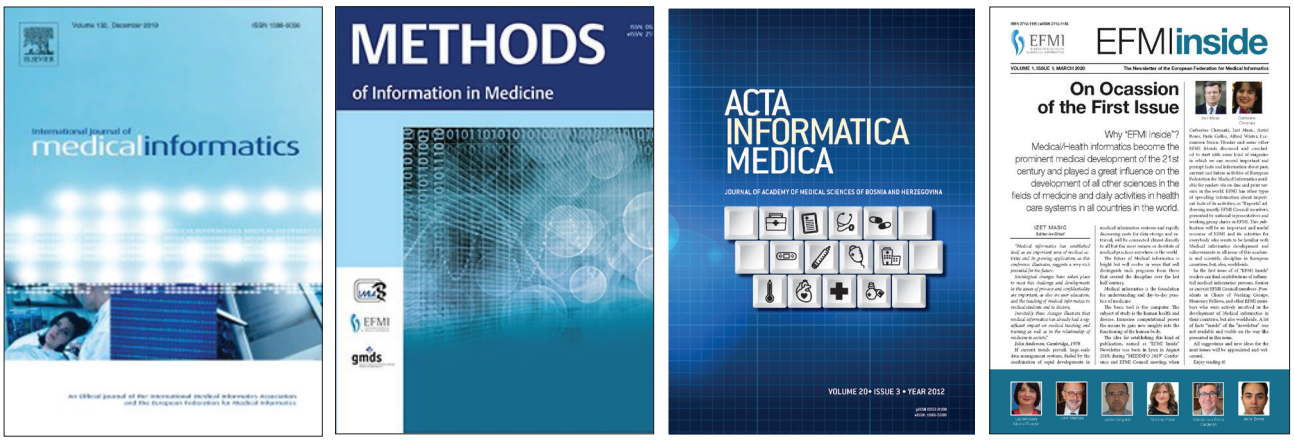


Figure 10. Official journals of the European Federation for Medical Informatics (EFMI)

pertise 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.

3.5. 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).

3.6. 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).

4. 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.

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