Plenary Keynote Lecture

Connecting Providers, Payers and Patients

Dr. John Halamka
Harvard Medical School, U.S.A.

11:30 – 12:30
Thursday, 4th July
Large Hall (5th Floor)

Abstract

In 2009, the Obama Administration began its effort to accelerate electronic health record adoption in clinician offices and hospitals, expand health information exchange, and engage patients/families. As of 2013, 10 billion dollars has been spent, substantial progress has been made and many lessons learned. In this presentation, the speaker will provide an overview of the 2011, 2013, and 2015 stages of the Obama program, reflecting on the implications for other countries which may want to implement similar programs. The US program will also be compared to healthcare IT efforts in Asia, Europe, and Canada.

Major trends in healthcare IT will also be explored including cloud hosting of healthcare applications, big data analytics, personal health records, mobile devices, and security/privacy improvements.

Biographical Sketch

Dr. John Halamka is a Professor of Medicine at Harvard Medical School, Chief Information Officer of Beth Israel Deaconess Medical Center, Chairman of the New England Healthcare Exchange Network (NEHEN), co-Chair of the national HIT Standards Committee, co-Chair of the Massachusetts HIT Advisory Committee and a practicing Emergency Physician.

As Chief Information Officer of Beth Israel Deaconess Medical Center, he is responsible for all clinical, financial, administrative and academic information technology serving 3000 doctors, 14000 employees and two million patients. As Chairman of NEHEN he oversees clinical and administrative data exchange in Eastern Massachusetts. As co-Chair of the HIT Standards Committee he facilitates the process of electronic standards harmonization among stakeholders nationwide. As co-Chair of the Massachusetts HIT Advisory Committee, he engages the stakeholders of the Commonwealth to guide the development of a statewide health information exchange.

Plenary Keynote Lecture

Recent Progress in iPS Cell Research Towards Regenerative Medicine

Shinya Yamanaka
Center for iPS Cell Research and Application,
Kyoto University, Japan

11:00 – 12:00
Friday, 5th July
Large Hall (5th Floor)

Abstract

Induced pluripotent stem cells (iPSCs) were originally generated from mouse and human skin fibroblasts by introducing 4 transcription factor genes. iPSCs are similar to embryonic stem cells (ESCs), having a potential to produce cells for all the tissue types in the body such as neuron, blood , eyes and heart. Compared to ESCs, iPSCs have less ethical controversy since it can be generated without destroying fertilized eggs.

The iPSC technology has a substantial impact not only on basic science. As it is expected as innovative technology, there are great hopes for medical and pharmaceutical applications. iPSCs can be generated from various genetically identified individuals including patients. These iPSCs and subsequently differentiated target cells/ tissues would provide unprecedented opportunities in regenerative medicine, disease modelling, drug screening, and proof-of-concept studies in drug development.

Biographical Sketch

He received M.D. from Kobe University in 1987. After obtaining Ph.D. from Osaka City University in 1993, he worked as a postdoctoral fellow at the Gladstone Institute of Cardiovascular Disease in San Francisco. Returning to Japan in 1996, he served as Assistant Professor at Osaka City University and then Professor at the Nara Institute of Science and Technology. Moving to Kyoto University in 2004, he has served as the director of CiRA since 2008.

Plenary Keynote Lecture

IT Convergence & Healthcare

Dr. Yoonchae Cheong
Senior Vice President, Samsung Electronics Co. Ltd., Korea

11:15 – 12:15
Saturday, 6th July
Large Hall (5th Floor)

Abstract

Smart devices have been rapidly penetrating into the everyday life with various applications. With the advancement of communication and computing technologies, the smart devices are evolving toward the convergence with other industry sectors. Healthcare is one of such beneficiaries by the IT convergence. For example, the smart phone is to be with us almost every hour and minute, it is in the perfect position to take care of the owner's health and life. Many ambient devices would be necessary to implement the vision, such as sensors, actuators and controllers to bring the physical world into the digital world. Those ambient devices used to be with their own gateways and networks, but are converging into the architecture based on the smart phone. This will lead to the paradigm shift in many areas of the traditional healthcare and medical ecosystems.

Biographical Sketch

Dr. Yoonchae Cheong is the senior vice president and the head of the Future IT Research Center of Samsung Advanced Institute of Technology (SAIT).

He graduated from Seoul National University for his B.S. and M.S. in Electronics Engineering and from Texas A&M University for his Ph.D. in Electrical Engineering. He has been working for many years in the area of telecommunication system design, cellular systems and wireless technology, and is now interested in making the IT technology, such as communications and computing technology, available to the non-IT area such as health and medical to create a new paradigm shift.

Plenary Keynote Lecture

Systems Biology and Systems Biomedicine:
Integrating Systems Sciences and Biomedical Sciences

Hiroaki Kitano

Okinawa Institute of Science & Technology Graduate University, Japan

09:45 – 10:45
Sunday, 7th July
Large Hall (5th Floor)

Abstract

System-oriented approach is the fundamental to understand complex systems such as biological systems. There is increasing interest in systems biology approach to drug discovery and medical decision making. Already there are cases systems drug design delivered drugs that are in final stages of clinical trials and effective biomarkers have been identified. This talk provides perspectives on how systems biology contributes to future of biomedical research and what kind of theories and technologies are available today.

Biographical Sketch

Hiroaki Kitano is Professor of Okinawa Institute of Science and Technology, President of The Systems Biology Institute, President and Chief Executive Officer of Sony Computer Science Laboratories, Inc.

He received B.A. in physics from International Christian University, Tokyo, and Ph.D. in computer science from Kyoto University. From 1988 to 1994, he was a visiting researcher at Center for Machine Translation at Carnegie Mellon University. His research career includes Project Director of Kitano Symbiotic Systems Project, ERATO, Japan Science and Technology Corporation (1998-2003) followed by Project Director of Kitano Symbiotic Systems Project, ERATO-SORST, Japan Science and Technology Agency (2003-2008). He is also a Special Professor of University of Amsterdam, Sir Louis Matheson Distinguished Professor, Australian Regenerative Medicine Institute, Monash University, Australia, and a Founding President of The RoboCup Federation. He received The Computers and Thought Award from the International Joint Conferences on Artificial Intelligence in 1993, Prix Ars Electronica 2000, Design Award 2001 from Japan Inter-Design Forum, Good Design Award 2001 and Nature's 2009 Japan Mid-career Award for Creative Mentoring in Science, as well as being an invited artist for Biennale di Venezia 2000 and Museum of Modern Art (MoMA) New York in 2001. His research interests include AI, Robotics, and Systems Biology.

Theme Keynote Lectures

Theme 1: Signal Processing Guided by Physiology: Making the Most of Cardio-Respiratory Signals

Pablo Laguna
University of Zaragoza, Spain

16:30-18:00
Saturday, 6th July
Large Hall (5th Floor)

Abstract
Biomedical signals convey information about biological systems, and can emanate from sources of as varied origins as electrical, mechanical or chemical. In particular, biomedical signals can provide relevant information on the function of the human body. This information, however, may not be apparent in the signal due to measurement noise, presence of signals coming from other interacting subsystems, or simply because it is not visible to the human eye. Signal processing is usually required to extract the relevant information from biomedical signals and convert it into meaningful data that physicians can interpret. In this respect, knowledge of the physiology behind the biomedical measurements under analysis is fundamental. Not considering the underlying physiology may lead, in the best case, to processing methods that do not fully exploit the biomedical signals being analyzed and thus extract only partially their meaningful information and, in the worst case, to processing methods that distort or even remove the information of interest in those signals.

Biomedical signal processing (BSP) tools are typically applied on just one particular signal recorded at a unique level of the functional system under investigation and with limited knowledge of the interrelationships with other components of that system. In most instances though, BSP can benefit from an analysis in which more than one signal is evaluated at a time (multi-modal processing), different levels of function are considered (multi-scale processing) and scientific input from different disciplines is incorporated (multi-disciplinary processing). For each problem at hand, the BSP researcher should decide up to which extent information from a number of signals, functional levels or disciplines needs to be incorporated to solve the problem.

As an example, a multi-scale model may be necessary in cases where, for instance, a deeper knowledge of the cell and tissue mechanisms underpinning alterations in a body surface signal is required, whereas a simplified single-scale model may be sufficient in other cases, as when investigating the relationship between two signals measured on the whole human body. At present, there are many biomedical signals that can be acquired and processed using relatively low-cost systems, which makes their use in the clinics very extensive. In particular, non-invasive signals readily accessible to physicians are increasingly being used to improve the diagnosis, treatment and monitoring of a variety of diseases. The presentation aims to illustrate the role played by BSP in the analysis of cardiovascular signals. A set of applications will be presented where BSP contributes to improve our knowledge on atrial and ventricular arrhythmias, the modulation of cardiac activity by the autonomic nervous system (ANS) and the interactions between cardiac and respiratory signals.

Biographical Sketch
Pablo Laguna is Full Professor of Signal Processing and Communications in the Department of Electrical Engineering at the Engineering School, where he has being vice-dean for international relation (1999-2002), and a researcher at the Aragón Institute for Engineering Research (I3A), both at University of Zaragoza, Spain, where he has being responsible of the Biomedical Engineering division of the I3A (2000-2011) and of the master in Biomedical Engineering (2003-2010). His professional research interests are in Signal Processing, in particular applied to biomedical applications. He has co-authored more than 85 research papers on this topic, over 250 international conference papers, and has advise 10 Ph.D Thesis. He has lead a broad number of projects on biomedical signal interpretation specially in the cardiovascular domain, most of them with international collaborations at clinical and engineering sites. He is having some international scientific responsibilities, as serving at the board of Computing in Cardiology conference, editor of the digital signal processing journal (Eurasip), and of the journal of electrocardiology, organizer of different scientific conferences, etc. He is also member, and currently director, of the Spanish Center for Biomedical Engineering, Biomaterial and Nano-medicine Research CIBER-BBN, and responsible of the Ph.D. program in Biomedical Engineering at Zaragoza University. He is, together with L. Sörnmo, the author of Bioelectrical Signal Processing in Cardiac and Neurological Applications, book (Elsevir, 2005)

Theme 2: Therapeutic and Diagnostic Decision Support from 3D Medical Data Based on Computational Anatomy

Yoshinobu Sato, PhD
Image Analysis Group, Department of Radiology
Graduate School of Medicine, Osaka University

08:00 – 09:30
Sunday, 7th July
Large Hall (5th Floor)

Abstract
In this talk, we describe fully automated systems for therapeutic and diagnostic decision support from 3D medical data. The systems firstly reconstruct patient anatomy from 3D data, and then provide therapeutic and diagnostic decision support based on simulations and statistical optimizations on the reconstructed patient anatomy. The systems fully utilize computational anatomy models representing inter-patient anatomical variability specific to diseases and therapy, which are derived from the training datasets consisting of segmented 3D datasets of the anatomical structures, diagnostic proof datasets, and therapeutic plan datasets. We demonstrate a couple of automated decision support systems for the abdominal and musculoskeletal diagnosis and therapy.

Biographical Sketch
Yoshinobu Sato received his B.S., M.S. and Ph.D degrees in Information and Computer Sciences from Osaka University, Japan in 1982, 1984, 1988 respectively. From 1988 to 1992, he was a Research Engineer at the NTT Human Interface Laboratories. In 1992, he joined the Division of Functional Diagnostic Imaging of Osaka University Medical School as a faculty member. From 1996 to 1997, he was a Research Fellow in the Surgical Planning Laboratory, Harvard Medical School and Brigham and Women's Hospital. He is currently an Associate Professor at Osaka University Graduate School of Medicine and an Adjunct Associate Professor of MEI Center and Graduate School of Information Science and Technology, Osaka University. His research fields include medical image analysis, computer assisted surgery, and computational anatomy. Dr. Sato is a member of IEEE, MICCAI, and CAOS-International, and an editorial board member of Medical Image Analysis journal and the International Journal of Computer Assisted Radiology and Surgery.

Theme 3: Integrated Bio-Nano-CMOS-Sensors for Remote Monitoring of Human Metabolism toward Applications in Personalized Medicine

Sandro Carrara
EPFL - École Polytechnique Fédérale de Lausanne

08:00 – 09:30
Saturday, 6th July
Large Hall (5th Floor)

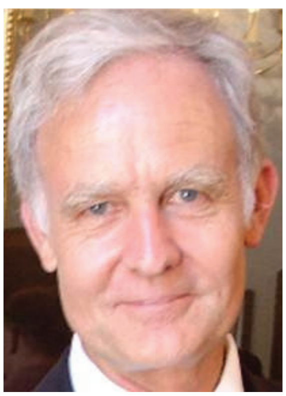
Abstract
Integrated Nano-Bio-Sensing [1] for diagnosis and/or treatment of patients with specific physiological conditions (e.g., heart, cardiovascular, cancer diseases) or convalescents is a key factor to provide better, more rationale, effective and ultimately low-cost health care also at home. The ultimate goal of improved health care on those subjects is the extension of the patients' autonomy, the possibility for auto-monitoring, the improvement of their comfort levels and their integration into everyday life. On-line monitoring is also required in professionals and recreational sportsmen training, as well as in elderly and/or disabled citizen care and/or people involved in public utilities (e.g. the public-transportation drivers). For those, it is a key aspect the maintenance of their safety by through embedded systems to alert emergency services in the event of a potentially dangerous situation. Some systems for on-line monitoring are available in the market. They use wearable devices (accelerometers, heartbeat monitoring system, etc). However, all these systems do not measure the human metabolism at molecular level (metabolites). The only available real-time, implantable/wearable systems for metabolic control are limited to glucose monitoring and used only for diabetic patients. However, many other molecules present crucial relevance in human metabolism in chronic patients. So far, there are no available integrated nano-bio-systems for multi-metabolites, real-time, remote monitoring of the human metabolism. Thus, the aim of this keynote talk is to present an innovative concept for multi-panel, highly integrated, fully implantable, remotely powered and real-time monitoring systems for human metabolism at molecular level. The considered metabolic molecules will be glucose, lactate, glutamate, ATP [2],

and injected drugs [3]. The proposed nanotechnology will be based on carbon nanotubes to improve the sensors performance [3, 4]. To pursue their detection, innovative VLSI solutions [5] are discussed including the system remote powering [6]. The new approach is obtained by integrating nano/bio/micro/CMOS/SW/RF systems in three devices: (i) a fully implantable sensors array for data acquisition; (ii) a on-skin intelligent-patch for remote powering and signal processing; (iii) a wearable station (a mobile phone) for data collection, elaboration and storage. The major presented breakthroughs are in the areas of: (i) nano-sensors; (ii) signal analysis; (iii) HW/Bio co-design; (iv) multi-panel metabolites detection; (v) fully implantable sensors; (vi) remote powering; (vi) minimally-invasive biomedical implants.

Biographical Sketch

Sandro Carrara is a lecturer and scientist at the EPFL in Lausanne (Switzerland). He also was a professor of optical and electrical biosensors at the Department of Electrical Engineering and Biophysics (DIBE) of the University of Genoa (Italy) and a professor of nanobiotechnology at the University of Bologna (Italy). Sandro Carrara graduated in Electronics in Technical school of Albenga, got a Master in Physics from University of Genoa and received his Ph.D. in Biochemistry and Biophysics from University of Padoa. He is founder and Editor-in-Chief of the journal BioNanoScience by Springer, Topical Editor of the IEEE Sensors Journal, and Associate Editor of IEEE Transactions on Biomedical Circuits and Systems. He is an IEEE member for the Circuit and System Society (CASS) and member of the Board of Governors of the IEEE Sensors Council. He also has been recently appointed as CASS Distinguished Lecturers for the years 2013-2014. His scientific interests are on electrical phenomena of nano-bio-structured films, and include CMOS design of biochips based on proteins and DNA. He has more then 130 scientific publications and 10 patents. He has Top-25 Hottest-Articles (2004, 2005, 2008, 2009, and 2012) published in highly ranked International-Journals such as Biosensors and Bioelectronics, Sensors and Actuators B, and Thin Solid Films. His work received a NATO Advanced Research Award in 1996 for the original contribution to the physics of single-electron conductivity in nano-particles, two Best Paper Awards at the IEEE PRIME Conference in 2010 (Berlin), and in 2009 (Cork), a Best Poster Award at the Nanotera workshop in 2011 (Bern), and a Best Poster Award at the NanoEurope Symposium in 2009 (Rapperswil). He also received the Best Referees Award from the journal Biosensor and Bioelectronics in 2006. From 1997 to 2000, he was a member of an international committee at the ELETTRA Synchrotron in Trieste. From 2000 to 2003, he was scientific leader of a National Research Program (PNR) in the filed of Nanobiotechnology. He is now an internationally esteemed expert of the evaluation panel of the Academy of Finland in a research program for the years 2010-2013. He was Chair in boards of several International Conferences such as NanoNets/Luzern-2009, IEEE-IWASI/Bari-2011, ISMICT/Montreux-2011, and of several editions of IEEE BioCAS Conference. He will be the General Chairman of the Conference BioCAS, edition 2014

Theme 4: An Overview of VPH/Physiome Activities: A (bio)Engineering Opportunity



Peter Hunter
Bioengineering Institute, University of Auckland, New Zealand

13:30-15:00
Saturday, 6th July
Large Hall (5th Floor)

Abstract

Multi-scale models of organs and organ systems, based on model encoding standards, are being developed under the umbrella of the Physiome Project of the International Union of Physiological Sciences (IUPS) and the Virtual Physiological Human (VPH) project funded by the European Commission. These computational physiology models deal with multiple physical processes (coupled tissue mechanics, electrical activity, fluid flow, etc) and multiple spatial and temporal scales. They are intended both to help understand physiological function and to provide a basis for diagnosing and treating pathologies in a clinical setting. A long term goal of the project is to use computational modeling to analyze integrative biological function in terms of underlying structure and molecular mechanisms. Web-accessible databases, based on the standards, have been established for models and model-related data at the cell, tissue, organ and organ system levels. This talk will discuss recent developments in the VPH/Physiome Project.

Biographical Sketch

Professor Hunter holds degrees from Auckland University and a PhD in Physiology from Oxford University. He is Professor of Engineering Science and Director of the Bioengineering Institute at the University of Auckland, and co-Director of Computational Physiology at Oxford University. As a recent Chair of the Physiome Committee of the International Union of Physiological Sciences he has been helping to lead the international Physiome Project, which aims to use computational methods for understanding the integrated physiological function of the body in terms of the structure and function of tissues, cells and proteins, and has been developing the standards to facilitate reproducible multi-scale modeling.

Theme 5: Modeling Heart Function and Dysfunction

Natalia Trayanova
Johns Hopkins University

08:00 – 09:30
Friday, 5th July
Large Hall (6th Floor)

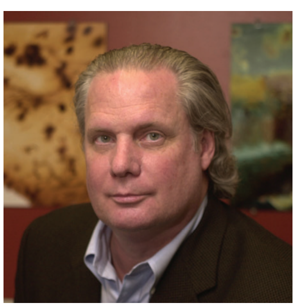
Abstract

Simulating cardiac electrophysiological or electromechanical function is one of the most striking examples of a successful integrative multi-scale modeling approach applied to a living system directly relevant to human disease. Today, after nearly fifty years of research in the field and the rapid progress of high-performance computing, we stand at the threshold of a new era: anatomically-detailed tomographically-reconstructed models that integrate from the ion channel or sarcomere to the electromechanical interactions in the intact heart are being developed. Such models hold high promise for interpretation of clinical and physiological measurements in terms of cellular mechanisms; for improving the basic understanding of the mechanisms of dysfunction in disease conditions, such as reentrant arrhythmias, myocardial ischemia, and heart failure; and for the development and performance optimization of medical devices. Attempt is made to extend these models beyond electromechanics and include regulatory processes such as energy metabolism. Here we provides specific examples of the state-of-the-art in cardiac integrative modeling, including 1) improving ventricular and atrial ablation procedures by using MRI reconstructed ventricular and atrial geometry and structure (including fibrotic scar) to investigate the reentrant circuits formed in the presence of an infarct scar; 2) employing an electromechanical model of the heart to determine the mechanisms for electromechanical delay in heart failure; 3) understanding the contributions of non-myocytes to cardiac function and dysfunction; and 4) understanding arrhythmogenesis in heart failure.

Biographical Sketch

Dr. Natalia Trayanova is a Professor of Biomedical Engineering and Medicine and a member of the Institute for Computational Medicine at Johns Hopkins University. She is the inaugural Murray B. Sachs Endowed Chair. She is Fellow of Heart Rhythm Society, American Heart Association, and American Institute for Medical and Biological Engineering. Dr. Trayanova has published over 200 papers. She is Associate Editor of Frontiers in Computational Physiology and Medicine, served as Associate Editor of IEEE T-BME (1998-2005), is on the Editorial Boards of Heart Rhythm and American Journal of Physiology, and is Area Editor of IEEE Reviews in BME.

Theme 6: Engineering Memories: A Cognitive Neural Prosthesis for Restoring and Enhancing Memory Function



Theodore W. Berger
University of Southern California

13:30-15:00
Friday, 5th July
Large Hall (5th Floor)

Abstract

Dr. Berger leads a multi-disciplinary collaboration with Drs. Marmarelis, Song, Granacki, Heck, and Liu at the University of Southern California, Dr. Cheung at City University of Hong Kong, Drs. Hampson and Deadwyler at Wake Forest University, and Dr. Gerhardt at the University of Kentucky, that is developing a microchip-based neural prosthesis for the hippocampus, a region of the brain responsible for long-term memory formation. Damage to the hippocampus is associated with epilepsy, stroke, and dementia, and underlies the memory deficits characteristic of these neurological conditions. The goals of Dr. Berger's multi-laboratory effort include: (1) experimental study of neuron and neural network function during memory formation -- how does the hippocampus encode information?, (2) formulation of biologically realistic models of neural system dynamics -- can that encoding process be described mathematically to realize a predictive model of how the hippocampus responds to events?, (3) microchip implementation of neural system models -- can the mathematical model be realized as a set of electronic circuits?, and (4) creation of conformal neuron-electrode interfaces -- can cytoarchitectonic-appropriate multi-electrode arrays be created to optimize bi-directional communication with the brain? By integrating solutions to these problems, the team is realizing a biomimetic model of hippocampal nonlinear dynamics that can serve as a neural prosthesis. A proof-of-concept is presented using rats chronically implanted with stimulation/recording micro-electrodes throughout the hippocampus, and that have been trained in a delayed, non-match-to-sample task. Memory-behavioral function of the hippocampus is blocked pharmacologically, and then in the presence of that

blockade, *hippocampal memory/behavioral function is restored by a multi-input, multi-output model of hippocampal nonlinear dynamics that interacts bi-directionally with the in vivo hippocampus*. These results show for the first time that it is possible to create "hybrid electronic-biological" systems that mimic physiological properties, and thus, may be used as neural prostheses to restore damaged brain regions.

Biographical Sketch

Dr. Theodore W. Berger is the David Packard Professor of Engineering, Professor of Biomedical Engineering and Neuroscience, and Director of the Center for Neural Engineering at the University of Southern California. Dr. Berger's research uses an integrated experimental and theoretical approach to developing biologically realistic nonlinear dynamic models of the hippocampus and its function in forming new memories. The resulting models have been used to understand the role of neural nonlinear dynamics in multi-input, multi-output signal processing, the dynamics of large-scale multi-neuron systems, and multi-scale, hierarchical neural organization. Preclinical applications of Dr. Berger's research include the development of cognitive neural prostheses for restoring lost memory function; clinical applications extend to the development of medical devices and procedures for controlling seizures; industrial applications include biologically-based models underlying spatio-temporal pattern recognition. Dr. Berger received his Ph.D. from Harvard University, and has been elected a Fellow of the AAAS, the AIMBE, and the IEEE. Among other awards, he has recently received the Academic Career Achievement Award from the EMBS.

Dr. Theodore W. Berger is the David Packard Professor of Engineering, and Professor of Biomedical Engineering and Neuroscience at the University of Southern California. Dr. Berger's research uses an integrated experimental and theoretical approach to developing biologically realistic nonlinear dynamic models of the hippocampus and its function in forming new memories. Preclinical applications include the development of cognitive neural prostheses for restoring lost memory function; clinical applications extend to medical devices/procedures for controlling seizures. Dr. Berger received his Ph.D. from Harvard University, and is a Fellow of AAAS, AIMBE, and IEEE. Among other awards, he is the 2013 recipient of the Academic Career Achievement Award from the EMBS.

Theme 8: Reproducibility in Modeling: Technology for the Stepping Stones of Science

Mitsuo Kawato
ATR, Japan

13:30-15:00
Thursday, 4th July
Large Hall (5th Floor)

Abstract

Most studies of human learning/memory/cognition have concentrated on examining correlations between behavioral and neural activities rather than establishing cause-and-effect relationships. Even for animal studies, most frequently used technique is examining temporal correlation between neural activities and some hypothetical computational variables proposed by experimenters. The lack of experimental tools examining cause and effect relationships in the systems neuroscience severely constrains its progress and applicability to practical issues. I proposed the new field "manipulative neuroscience" to overcome this technical obstacle (Kawato, 2008, Phil Trans Roy Soc B). By applying a novel online-feedback method utilizing decoded functional magnetic resonance imaging (fMRI) signals, we developed a new technique to manipulate neural codes (Shibata, Watanabe, Sasaki, Kawato, 2011, Science).

Neurofeedback training based on real-time fMRI has attracted considerable attention for its potential advantages in therapeutic treatments. Most fMRI neurofeedback methods focus on up- or down-regulation of single-ROI activation, but these have recently been extended to control spatial activity patterns within a specific ROI as mentioned above. Furthermore, Fukuda, Kawato and Imamizu (2011, SFNM) demonstrated that fMRI neurofeedback can further modulate spatiotemporal activation patterns across multiple ROIs as well as intrinsic networks. This effect was preserved over a surprisingly long period. Disturbances in intrinsic networks have been reported for a number of neurological and psychiatric diseases. Consequently, the connectivity neurofeedback method could be applied not only as a causal tool for basic neuroscience to alter functional networks but also as revolutionary therapeutic method

Biographical Sketch

Mitsuo Kawato received a B.S. degree in physics from Tokyo University in 1976 and M.E. and Ph.D. degrees in biophysical engineering from Osaka University in 1978 and 1981, respectively. From 1981 to 1988, he was a faculty member and lecturer at Osaka University. From 1988, he was a senior researcher and then a supervisor in the ATR Auditory and Visual Perception Research Laboratories. Since 2003, he has been Director of ATR Computational Neuroscience Laboratories. Since 2004, he has been an ATR Fellow. In 2010, he became Director of ATR Brain Information Communication Research Laboratories. From 1996 to 2001, he served as director of the Kawato Dynamic Brain Project, ERATO, JST. From 2004 to 2009, he served as research Supervisor of the Computational Brain Project, ICORP, JST. In 2008, he was jointly appointed as a Research supervisor of PRESTO, JST.

Theme 9: Relevant Technology for the Future of Surgery – How Should We Pick our Winners?

Catherine Mohr, MD MSME
Director of Medical Research, Intuitive Surgical

16:30 – 18:00
Thursday, 4th July
Large Hall (5th Floor)

Abstract
From orthopedics to cardiac and abdominal surgery, surgical robots in use today are designed to allow the surgeon to perform surgical operations both more precisely and through smaller incisions. Most of these procedures, however, are simply improved versions of surgeries that have been done for decades through open or laparoscopic access. In the age of biomarkers, novel therapeutics and advanced imaging, new medical technologies outside of surgery are poised to disrupt the field of surgery profoundly. The surgeries of the future may be very different from those of today as will the technologies needed to enable those surgeries. There will be huge opportunity for new emerging technologies as we adapt to this changing landscape.

Biographical Sketch
Dr. Catherine Mohr is the Director of Medical Research at Intuitive Surgical, a high technology surgical robotics company that makes the da Vinci Surgical System. In this role she evaluates new technologies for incorporation into the next generation of computer aided surgical platforms. In addition, she is a Consulting Assistant Professor in the department of Surgery at Stanford School of Medicine, and Faculty at Singularity University based at NASA Ames which studies the impact of exponentially changing technologies on our society.

Dr. Mohr received her BS and MS in mechanical engineering from MIT, and her MD from Stanford University School of Medicine. She has been involved with numerous startup companies in the areas of alternative energy transportation, and worked for many years developing high altitude aircraft and high efficiency fuel cell power systems, computer aided design software, and medical devices.

Dr Mohr has served as a scientific advisor for several startup companies in Silicon Valley, the NCI SBIR program, and government technology development programs in her native New Zealand. She is the author of numerous scientific publications, and the recipient of multiple design awards.

Theme 10-1: Grand Challenges in Cardiovascular Health Informatics

Yuan-Ting Zhang
Chinese University of Hong Kong, Hong Kong

16:30-18:00
Friday, 5th July
Large Hall (5th Floor)

Abstract
In essence, future healthcare systems should encourage the Participation of all nations for the Prevention of illnesses and the early Prediction of diseases such that Preemptive and Precise treatment is delivered to realize Pervasive, Personalized and Patient-centralized healthcare, i.e., the paradigm of the 8-Ps medicine or 8-Ps Healthcare [1]. Health informatics plays an important role in implementing the 8-Ps medicine and improving the human health. Advancing health informatics has been identified as one of 14 grand challenges in engineering in the 21st century [2].

Cardiovascular diseases (CVD) continue to be the leading cause of death worldwide. This talk will discuss technical grand challenges in cardiovascular health informatics, and cover specifically some aspects of wearable and unobtrusive CVD monitoring system together with its integration with cardiovascular imaging for personalized and preventive CVD care. This talk will also present the progress of a project on "Myocardial Infraction and Stroke Screening and Intervention among Nations (MISSIoN 2020)". The enabling technologies such as cardiovascular sensing, imaging, informatics and intervention (CS3I) will be discussed. Using the MISSIoN 2020 project as an example, we will illustrate that these approaches should allow the practice of 8-Ps medicine that is pervasive, predictive, preventive, precise, personalized, participatory, preemptive and patient-centralized [3,4].

Biographical Sketch

Yuan-Ting Zhang is currently the Director of Joint Research Center for Biomedical Engineering and Professor of Department of Electronic Engineering at the Chinese University of Hong Kong (CUHK), Hong Kong, China. He serves concurrently the Director of the Key Lab for Health Informatics of the Chinese Academy of Sciences (HICAS) at SIAT, Shenzhen, China. He is the first Head of the Division of Biomedical Engineering at CUHK and the founding Director of the CAS-SIAT Institute of Biomedical and Health Engineering. Dr. Zhang was elected to the AdCom of IEEE Engineering in Medicine and Biology Society (EMBS) in 1999 and became previously the Vice-President of the IEEE-EMBS in 2000. He served as the Technical Program Chair and the General Conference Chair of the 20th and 27th IEEE-EMBS Annual International Conferences in 1998 and 2005, respectively. He also served on IEEE Medal on Innovations in Healthcare Technology Award Committee and IEEE Fellow Elevation Committee. He severed on the editorial boards of several international journals in biomedical engineering such as the Editor-in-Chief of IEEE Transactions on Information Technology in Biomedicine (T-ITB). Dr. Zhang serves currently on the Fellow Membership Committee of the International Academy of Medical and Biological Engineering, IEEE-EMBS Technical Committee on Information Technology in Biomedicine, HK-ITC Projects Assessment Panel, , the IEEE-EMBS Summer School Steering Committee, the BSN Steering Committee, and the Editor-in-Chief of IEEE Journal of Biomedical and Health Informatics (J-BHI) which was retitled from T-ITB in Jan., 2013. Dr. Zhang's current research interests include wearable medical devices, body sensor networks, physiological modeling, neural engineering, cardiovascular health informatics, and m-u-p-Heath technologies. He has authored and co-authored over 400 scientific publications in BME and filed over 30 patents, some of which have been successfully licensed for commercialization. His research work has won him and his students/teams numerous honors/awards including the best journal paper awards from IEEE-EMBS, best conference paper awards from IFMBE, and the Grand Award in e-Health at the Asia-Pacific ICTAAC in Melbourne in 2009. He is the recipient of the IEEE-EMBS outstanding service award in 2006. Dr. Zhang holds the fellowships from the International Academy of Medical and Biological Engineering (IAMBE), the Institute of Electrical and Electronics Engineers (IEEE), and the American Institute of Medical and Biological Engineering (AIMBE) in recognition of his outstanding contributions to the development of wearable medical devices and mobile health technologies. Dr. Zhang completed his undergraduate and Master Degree studies in 1976 and 1981, respectively, in telecommunication from Department of Electronics of Shandong University and was conferred a Ph.D. in electrical engineering at the Institute of Bioengineering from the University of New Brunswick in 1990.

Theme 10-2: New Generation of Personal Health Systems Enabling Quality Health Data and Information Gathering and Use

Nicos Maglaveras
Aristotle University - Certh, Greece

08:00-09:30
Thursday, 4th July
Large Hall (5th Floor)

Abstract

Modern healthcare systems face important challenges, among which quality and effectiveness of the provided services, patient safety, continuity of care and rationalization of healthcare costs, to name a few. In order to meet these goals, the traditional paradigm for delivering healthcare services is changing drastically, conceiving the patient in the center of the consumption of healthcare services and as a more active and empowered participant, focusing on disease prevention, and on timely medical intervention in case of health threatening complications.

Personal health systems have evolved into a major endeavor for addressing the above challenges and achieve individualization of care, the effectiveness of which has been reported in several studies illustrating significant results, such as reduction in hospitalization rates for chronic patients, increased compliance in therapy plans, patient awareness and self-care, etc. As regards their application domain, personal health systems have evolved from simple open loop remote monitoring systems aiming to facilitate chronic disease management, to integrated solutions supporting as well wellness assessment, lifestyle management, and quite lately self-management, linked with IT systems hosted in the clinical environment, e.g. Electronic Health Records (EHRs), in a "closed loop" fashion. This evolution was in alignment with the development of new communication and computing technologies, enabling pervasive and ubiquitous healthcare, as well as with the need for developing integrated care models enabling the production of evidence based medicine. These advances resulted in large scale data and information gathering, triggering advanced and complex requirements for analysis, interpretation and archiving / access.

In this presentation we will refer to the evolution of personal health systems towards the provision of individualized tele-health services, highlighting important paradigms that took/take place during this evolution as well as the associated benefits for health delivery. Equally important, besides referring to the significant progress that has been achieved in the field, this presentation aims in presenting open issues and challenges that are key for leveraging the state-of-the-art of personal health systems and that have not been addressed sufficiently yet, e.g. embedding intelligence and medical knowledge in personal health systems, advancing multi-parametric models for clinical decision support, contextualization of healthcare services, interoperability issues across personal health systems and the clinical IT infrastructure (e.g. electronic health records), patient and healthcare professionals' acceptance, and evaluation aspects. Paradigms from state-of-the-art such as the HEARTCYCLE integrated project linked with the development of new generation closed-loop telehealth systems in cardiology and the impact in large-scale data and information gathering and communication with the integrated health care systems shall be highlighted.

Biographical Sketch

Nicos Maglaveras (S'80–M'87-SM'06) received the diploma in electrical engineering from the Aristotle University of Thessaloniki (A.U.Th.), Greece, in 1982, and the M.Sc. and Ph.D. degrees in electrical engineering with an emphasis in biomedical engineering from Northwestern University, Evanston, IL, in 1985 and 1988, respectively. He is currently a Professor and Director with the Lab of Medical Informatics, A.U.Th. His current research interests include nonlinear biological systems simulation, cardiac electrophysiology, biomedical informatics-ehealth, biosignal analysis, medical imaging, and neurosciences. He has published more than 250 papers in peer reviewed international journals, books and conference proceedings. He has developed graduate and undergraduate courses in the areas of biomedical informatics, biomedical signal processing, and biological systems simulation. He has served as a Reviewer in CEC AIM technical reviews and as reviewer, associate editor and editorial board member in a number of international journals, and participated as Coordinator or Core Partner in over 30 national and EU-funded competitive research projects. He has served as president of the EAMBES in 2008-2010. Dr. Maglaveras has been a member of the IEEE, AMIA, the Greek Technical Chamber, the New York Academy of Sciences, the CEN/TC251, and Eta Kappa Nu.