

Tuesday, August 30, 2011

General Program

Opening Luncheon Keynote

The Impact of Information Technology on Health Care Delivery

12:15 - 13:45

Marriott 4th floor, Salon E

Registration Required

Speaker: John Glaser, PhD - Siemens Healthcare

Health care providers are facing unprecedented pressures to reduce the cost of care and improve the quality and safety of care. These pressures are expected to lead to significant changes in the structure of the industry and the means used to reimburse care providers. Information technology (IT) is seen as a critical contributor to efforts to transform health care delivery. Leveraging a foundation of broadly adopted electronic health records, IT will have four core impacts:

- Enabling and improving health care processes
- Delivering knowledge to care providers
- Engaging patients
- Enabling sophisticated analyses of treatment effectiveness and efficiency

For IT to achieve its potential, research and innovation will be required in several areas.

John Glaser, PhD, is Chief Executive Officer, Health Services Business Unit, Siemens Healthcare. Previously he was Vice-President and Chief Information Officer, Partners HealthCare. Dr. Glaser was the founding Chairman of College of Healthcare Information Management Executives (CHIME) and is past President of the Healthcare Information and Management Systems Society (HIMSS). He was a Senior Advisor to the Federal Office of the National Coordinator for Health Information Technology. He is a fellow of HIMSS, CHIME and the American College of Medical Informatics. CHIME has established a scholarship in Dr. Glaser's name. He was elected to CIO Magazine's CIO Hall of Fame. He holds a Ph.D. in Healthcare Information Systems from the University of Minnesota.

Opening Remarks and IEEE EMBS Award Ceremony

14:00 - 14:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Join us for the conference opening ceremony.

Keynote Lecture

From Reading to Writing the Genetic Code

14:30 - 15:15

Marriott 4th floor, Salon F

Open to all registered conference attendees

Speaker: J. Craig Venter, PhD - J. Craig Venter Institute and Synthetic Genomics, Inc.

Dr. Venter tells of the unparalleled drama of the quest for the human genome, a tale that involves as much politics (personal and political) as science. He also reveals how he went on to be the first to read and interpret his own genome and what it will mean for all of us to do the same. He describes his sailing expedition, the Sorcerer II Global Ocean Sampling Expedition, to sequence microbial life in the ocean, as well as his groundbreaking success in creating synthetic life. Here is one of the key scientific chronicles of our lifetime, as told by the man who beat the odds to make it happen.

J. Craig Venter, Ph.D., is regarded as one of the leading scientists of the 21st century for his numerous invaluable contributions to genomic research. He is Founder, Chairman, and President of the J. Craig Venter Institute (JCVI), a not-for-profit, research organization with approximately 400 scientists and staff dedicated to human, microbial, plant, synthetic and environmental genomic research, and the exploration of social and ethical issues in genomics. Dr. Venter is also Founder and CEO of Synthetic Genomics Inc., a privately held company dedicated to commercializing genomic-driven solutions to address global needs such as new sources of energy and

next generation vaccines. Dr. Venter began his formal education after a tour of duty as a Navy Corpsman in Vietnam from 1967 to 1968. After earning both a Bachelor's degree in Biochemistry and a Ph.D. in Physiology and Pharmacology from the University of California at San Diego, he was appointed professor at the State University of New York at Buffalo and the Roswell Park Cancer Institute. In 1984, he moved to the National Institutes of Health campus where he developed Expressed Sequence Tags or ESTs, a revolutionary new strategy for rapid gene discovery. In 1992 Dr. Venter founded The Institute for Genomic Research (TIGR, now part of JCVI), a not-for-profit research institute, where in 1995 he and his team decoded the genome of the first free-living organism, the bacterium *Haemophilus influenzae*, using his new whole genome shotgun technique. In 1998, Dr. Venter founded Celera Genomics to sequence the human genome using new tools and techniques he and his team developed. This research culminated with the February 2001 publication of the human genome in the journal, *Science*. He and his team at Celera also sequenced the fruit fly, mouse and rat genomes. Dr. Venter and his team at the Venter Institute continue to blaze new trails in genomics. He and his team have sequenced and analyzed hundreds of genomes, and have published numerous important papers covering such areas as environmental genomics, the first complete diploid human genome, and the groundbreaking advance in creating the first self replicating bacterial cell constructed entirely with synthetic DNA. Dr. Venter, one of the most frequently cited scientists, is the author of more than 250 research articles. He is also the recipient of numerous honorary degrees, public honors, and scientific awards, including the 2008 United States National Medal of Science, the 2002 Gairdner Foundation International Award and the 2001 Paul Ehrlich and Ludwig Darmstaedter Prize. Dr. Venter is a member of numerous prestigious scientific organizations including the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Society for Microbiology.

Wyss Institute Presentation

15:15 - 16:45

Marriott 4th floor, Salon F

Open to all registered conference attendees

Organizer: Jim Niemi - Wyss Institute
Speakers: Ayis Antoniou, PhD, MBA - Wyss Institute
Donald E. Ingber, MD, PhD - Wyss Institute
Jim Niemi - Wyss Institute
David Paydarfar, MD - UMass Medical School
Michael Super, PhD; Wyss Institute
Mary Tolikas, PhD, MBA - Wyss Institute
Diana Young, PhD; Wyss Institute

This session will present and discuss the Wyss Institute, a new and exciting model for technology translation. The Wyss Institute for Biologically Inspired Engineering uses Nature's design principles to develop bioinspired materials and devices that will transform medicine and create a more sustainable world. Working as an alliance among Harvard's Schools of Medicine, Engineering, and Arts & Sciences, and in partnership with Beth Israel Deaconess Medical Center, Brigham and Women's Hospital, Children's Hospital Boston, Dana Farber Cancer Institute, Massachusetts General Hospital, Spaulding Rehabilitation Hospital, the University of Massachusetts Medical School, and Boston University, the Institute crosses disciplinary and institutional barriers to engage in high-risk research that leads to transformative technological breakthroughs. By emulating Nature's principles for self-organizing and self-regulating, Wyss researchers are developing innovative new engineering solutions for healthcare, energy, architecture, robotics, and manufacturing. These technologies are translated into commercial products and therapies through collaborations with clinical investigators, corporate alliances, and new start-ups.

Poster Session and Coffee Break

Westin 4th Floor, America Ballroom

15:15 - 16:45

Open to all registered conference attendees

Student Paper Competition Session

Marriott 3rd floor, Berkeley

17:00 - 18:30

Open to all registered conference attendees

Finalists of the Student Paper Competition present their papers in three special sessions. First, second and third place winners will be selected and receive monetary awards. The award ceremony will take place during the session starting at 1:00 pm on Friday.

Panel Discussion

The Future of Rehabilitation Robotics

Marriott 3rd floor, Salon E

17:00 - 18:30

Open to all registered conference attendees

Join us for a session in which clinicians and leaders from the private sector discuss their vision on how robotics is about to change rehabilitation medicine. Panel members will discuss a series of questions such as the following. Is robotics going to generate new paradigms in orthotics and prosthetics? Is the work of therapists going to be augmented or replaced by robots? Is robotics the way to deliver rehabilitation interventions in the home setting?

Oral Sessions

Marriott 3rd and 4th floors

17:00 - 18:30

Open to all registered conference attendees

Award Recognition Reception

19:30 - 21:30

Westin 3rd floor, Staffordshire

Registration required

This is an opportunity to network with the IEEE EMBS Award Recipients.

Tuesday, August 30, 2011

Courses, Tutorials, and Workshops

Half-Day Clinical Course

Virtual Reality and Robotics in Neurorehabilitation

8:15 - 12:40

Marriott 1st floor, Boylston

Registration Required

Organizer: Emily Keshner, PT, EdD - Temple University
Speakers: Sergei Adamovich, PhD - New Jersey Institute of Technology
Judith Deutsch, PT, PhD - University of Medicine and Dentistry of New Jersey
Susan Fasoli, ScD, OTR/L - Partners Healthcare
Gerard Fluet, DPT - University of Medicine and Dentistry of New Jersey
Emily Keshner, PT, EdD - Temple University
Hermano Igo Krebs, PhD - Massachusetts Institute of Technology
Barbara Ladenheim, PhD - Blythedale Children's Hospital
Joelle Mast, PhD, MD - Blythedale Children's Hospital
Alma Merians, PT, PhD - University of Medicine and Dentistry of New Jersey
William Zev Rymer, MD, PhD - Northwestern University
Steven L. Wolf, PT, FAPTA, FAHA, PhD - Emory University School of Medicine

This course aims to introduce participants to the use and mechanisms of action of virtual reality and robotics within the field of neurorehabilitation. The workshop will introduce participants to a range of robotic systems that utilize virtual reality from the clinical and engineering perspectives. The aim of this workshop is to engage the clinician and therapist in clinical reasoning regarding the best use of rehabilitation systems currently available for treatment of neurological disorders and to engage the engineer in the process of understanding the health care workers' perspective on the use of these systems in an attempt to bridge the gap between research and clinical application. Finally, we will look towards potential future applications of rehabilitation systems.

Full-Day Workshop

1st IEEE-EMBS Unconference on Wearable and Ubiquitous Technology for Health & Wellness

08:30 - 18:00

Westin 3rd Floor

Registration required

Organizers: Emil Jovanov, PhD - The University of Alabama in Huntsville
Misha Pavel, PhD - National Science Foundation
Mary Rodgers, PT, PhD - University of Maryland
Kaliya Hamlin (meeting designer) - Unconferemce.net
Shyamal Patel (demo competition coordinator) - Northeastern University

The purpose of the meeting is to bring together all those who care about addressing key challenges in the translation of technology from the lab to the field around wearable and ubiquitous technology for health and wellness. The unconference format allows attendees to create the agenda/schedule for the day live the day of the event. The format facilitates a focus on discussing emerging developments and new ideas. The event includes a session in which attendees will demonstrate prototypes of wearable technology leading to a competition that will acknowledge the most innovative and highest potential impact demonstrations. The organizers will compile contributions collected during the meeting in a white paper that will be published after the meeting.

Half-Day Tutorial

Brain Computer Interfaces

09:00 - 12:00

Marriott 3rd floor, Simmons

Registration Required

Organizer: Christoph Hintermüller, Ph.D - Guger Technologies OG
Speakers: Deniz Erdogmus, PhD - Northeastern University
Christoph Hintermüller, PhD - Guger Technologies OG
Robert Prückl, Dipl Ing - Guger Technologies OG
Gerwin Shalk, PhD - Wadsworth Center, NYS Dept of Health

The direct connection between the human brain and a computer, a so-called Brain-Computer Interface (BCI) is what research groups all over the world are working on feverishly and successfully. A brain-computer interface translates brain waves into control signals. BCIs have been developed during the last years for people with severe disabilities to improve their quality of life. Applications of BCI systems comprise the restoration of movements, communication and environmental control. In this tutorial, we will demonstrate some of the major concepts for BCI control like P300 and steady state evoked potentials (SSVEP) for spelling and robot control. This will allow attendees to become familiar with all required hardware and software, the typical training and classifier setup and the achievable accuracies. We will invite attendees to participate in live demonstrations.

Half-Day Tutorial

Clinical Image Analysis: Challenges, Techniques and Opportunities

09:00 - 12:00

Marriott 3rd floor, Regis

Registration Required

Organizer: Metin N. Gurcan, PhD -The Ohio State University

Clinical image processing and analysis requires coordinated efforts of medical professionals, algorithmic and software engineers, and statisticians. Basic image processing techniques are frequently used in every aspect of the development from initial pre-processing techniques for noise reduction, segmentation of lesions, and registration of lesions. Recent advances in hardware and software have made it possible to create digital scans of whole slides. These images are relatively large (100k x 100k) and in color, hence processing them presents new challenges. Similarly, radiological imaging scanners produce thousands of slices of images. The processing needs for these images are enormous. Although clinical image analysis research is getting increasingly popular, it does not receive sufficient coverage in most curricula. This tutorial will introduce the current challenges, recent advances and innovations in clinical image analysis while reviewing several frequently used image-processing techniques in this context. It will be taught from the perspective of a researcher, who carried out clinical image analysis and processing research for over 15 years both in academy and industry.

Full-Day Workshop

Dynamic Nonlinear Modeling of Neural Ensemble Activity

09:00 - 18:30

Marriott 1st floor, Tremont

Registration Required

Organizer: Vasilis Marmarelis, PhD - University of Southern California
Speakers: Theodore W. Berger, PhD - University of Southern California
Emery N. Brown, MD, PhD - Harvard Medical School
Sam Deadwyler, PhD - Wake Forest University
Apostolos Georgopoulos, PhD - University of Minnesota
Nicholas Hatsopoulos, PhD - The University of Chicago
Vasilis Z. Marmarelis, PhD - University of Southern California
Christopher Pack, PhD - McGill University
Christoph E. Schreiner, PhD - University of California in San Francisco

This Workshop will bring together experts on the emerging subject of modeling the interrelationships among neuronal ensembles using multi-channel (i.e. multi-neuron) recordings. This subject is attracting increasing attention because of its fundamental importance in understanding brain function and the recent availability of multi-channel recordings from multi-electrode arrays. The latter are now chronically implanted in various parts of

the brain by several research groups and provide a wealth of electrophysiological data previously unavailable. This creates an exciting opportunity and a new urgency for the development of effective methodologies for the analysis of the collected vast databases in a manner that leads to increased scientific understanding of brain function without simplifying the inherent complexity of the problem. Fundamental in this regard is the issue of nonlinear dynamic modeling of the activity of multiple interconnected neurons, because of the intrinsic nonlinearities of neuronal dynamics and the nonlinear interconnections among neurons within the ensemble.

Half-Day Workshop

Nanobiomaterials

9:00 - 12:00

Marriott 3rd floor, Wellesley

Registration Required

Organizers: Ali Khademhosseini, PhD - Harvard-MIT Division of Health Sciences and Technology
Esmail Jabbari, PhD - University of South Carolina

Speakers: Karen Christman, PhD - University of California San Diego
Esmail Jabbari, PhD - University of South Carolina
Ehsan Jabbarzadeh, PhD - University of South Carolina
Ali Khademhosseini, PhD - Harvard-MIT Division of Health Sciences and Technology
Helen Lu, PhD - Columbia University
Michael McShane, PhD - Texas A&M University
Kit Parker, PhD - Harvard University
Milica Radisic, PhD - University of Toronto

The extracellular matrix of biological tissues exhibits hierarchical levels of organization from macroscopic to microscopic and nanoscale. This workshop will focus on how to apply material synthesis and processing technologies to the fabrication of biomaterials with well-defined nanoscale structure and chemistry, and to study biological processes at the molecular and cellular scales including cell migration, differentiation, development and maturation. The workshop will begin with a series of invited lectures on natural and synthetic nanomaterials and applications in regenerative medicine, drug delivery, and biosensing. Participants will learn specific details about the practical aspects of fabricating nanofibers, patterning, layered composites, self-assembled or directed assembly of nanostructures and their use for specific applications. The workshop includes a number of nationally renowned speakers, and is geared toward graduate students, research scientists, faculty and industrial participants who are interested in gaining experience in the exciting field of bionanomaterials.

Half-Day Tutorial

Bioacoustical Signal Processing: with Applications to Body Sounds Analysis

14:30 - 18:30

Marriott 1st floor, Boylston

Registration Required

Organizer: Sridhar Krishnan, PhD - Ryerson University

Speakers: Feng Jin, PhD - Ryerson University
Sridhar Krishnan, PhD - Ryerson University

Bioacoustical signal processing aims to establish a relationship between mechanical events within living organisms and the sounds these events give rise to. Since clinical evidences reveal the possible links between sounds produced within the human body and various pathological processes, the medical use of bioacoustics consists in extracting and analyzing the valuable information hidden in these symptom-related audio signals under the guidance of clinical values. Extraction of low-level representative and discriminative features from audio signal provides the basis for signal classification for diagnosis and therefore is the most important step in bioacoustical signal processing. Feature extraction methods utilize one of the following signal representation domains: temporal domain, spectral or joint time-frequency (TF) domain. The tutorial will cover the main techniques that are associated with each of the three domains with applications in the analysis of various body sounds including respiratory sounds, heart sounds, knee sounds, and sleeping sounds.

Half-Day Workshop Nanotechnology for Therapeutic and Diagnostic Systems

14:30 - 18:30

Marriott 3rd floor, Suffolk

Registration Required

Organizer: Carmelina Ruggiero, PhD - University of Genoa

Speakers: Fumihito Arai, PhD - Tohoku University

Mike McShane, PhD - Texas A&M University

Jay Nadeau, PhD - McGill University

Carmelina Ruggiero, PhD - University of Genoa

Nanobiodevices are based on molecular recognition, by which they can interact with complex molecular systems which are the basis of life processes. Early diagnosis and treatment of diseases is achieving significant advances by techniques based on recognition at the molecular level and on nano-materials for nano-sensor and drug delivery systems. Nanobiosensors and nanobiodevices utilize the properties of biological and physical nano-materials to recognize target molecules and transduce this information into electronic signals or into other actions such as the opening of a nano-structured drug delivery system. This workshop addresses several examples of such devices. Specifically, it focuses on quantum dots, nano-biosensors, drug delivery systems and biomedical nano-robotics. Quantum dots are crystals which have specific photochemical and photophysical properties that are not available from either isolated molecules or bulk solids and can be covalently linked with biological molecules such as peptides, antibodies and small-molecule ligands. They can therefore be used as biological labels. Application examples will be given in neuroscience, the study of ion channels and the environment.

Half-Day Workshop

Guaranteeing a Future for Blind Source Separation in Biomedical Signal Processing

14:30 - 18:30

Marriott 3rd floor, Simmons

Registration Required

Organizers: Christopher James, PhD - University of Warwick

Phlypo Ronald, PhD - GIPSA Lab

Speakers: Christopher James, PhD - University of Warwick

Phlypo Ronald, PhD - GIPSA Lab

The first part of the workshop will give a review of the Blind Source Separation literature, comprising a general historical overview and a more specific overview of (recent) applications in Biomedical Signal Processing. Special attention will be paid to the family of instantaneous linear mixture models, with a justification of the model on bio-electrical and -magnetic grounds. Attention will also be given to the benefits and drawbacks from different models and the conditions under which they are valid. The talk will continue with more recent advances in Blind Source Separation, including multi-modality and multi-dimensional signal processing (tensors). When coming to these current research efforts the gap with future research directions can be bridged quite comfortably, yielding an opportunity to start up a round table debate involving the attendees.

Half-Day Workshop Trends in Neural Probing

14:30 - 18:30

Marriott 3rd floor, Wellesley

Registration Required

Organizer: Herc Neves, PhD - IMEC
Speakers: Gyorgy Buzsaki, PhD - Rutgers University
Tim Harris, PhD - HHMI
Jack Judy, PhD - UCLA
Herc Neves, PhD - IMEC
Patrick Ruther, PhD - IMTEK
William Shain, PhD - Wadsworth Center
Patrick Tresco, PhD - University of Utah
Istvan Ulbert, PhD - Hungarian Academy of Sciences

Despite the considerable progress in neural probe technology made in the past few decades, stable interfacing with neurons using a large number of electrodes over long periods of time remains a challenge. Much is known today about the response of brain tissue to probes and innovative solutions have been introduced to reduce the impact of their presence: flexible materials, elution of anti-inflammatory drugs, reduced shank volume, to name a few. Microfabricated probes – including silicon-based implementations – are now mainstream. Probes with a very high electrode count and local electronics for signal processing and telemetry now greatly facilitate the study of freely moving, behaving subjects. Yet there is hardly a departure from the spike-shaped penetrating probes and the consequent damage to tissue. Probing systems still display a considerable mechanical mismatch with respect to the surrounding brain tissue and their sheer size is frequently too obtrusive to probe function. This workshop aims to bring together the developers and the users of this technology. Technologists will present the state of the art and discuss the most promising solutions. Neuroscientists will present their views on existing tools and discuss their wish-lists. Beyond that, the event should also serve as a forum to think outside the box, to suggest radically different approaches to probe the brain.

Wednesday, August 31, 2011

General Program

Student Paper Competition Session

Marriott 3rd floor, Berkeley

08:00 - 9:30

Open to all registered conference attendees

Finalists of the Student Paper Competition present their papers in three special sessions. First, second and third place winners will be selected and receive monetary awards. The award ceremony will take place during the session starting at 1:00 pm on Friday.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

08:00 - 9:30

Open to all registered conference attendees

Exhibits

09:00 - 17:00

Visit the exhibits located on the 4th floor of the Marriott hotel.

Visit the exhibits located on the 3rd floor of the Westin hotel.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

09:30 - 11:00

Open to all registered conference attendees

Student Paper Competition Session

Marriott 3rd floor, Berkeley

11:15 - 12:45

Open to all registered conference attendees

Finalists of the Student Paper Competition present their papers in three special sessions. First, second and third place winners will be selected and receive monetary awards. The award ceremony will take place during the session starting at 1:00 pm on Friday.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

11:15 - 12:45

Open to all registered conference attendees

Cash Concession at the Marriott (food and beverages)

12:30 - 14:00

We are pleased to offer a cash concession menu that will be located on the 4th floor (atrium) at the Marriott to include sandwiches, salads, cookies and beverages. Please note that this is cash only (no credit cards accepted).

Wyss Award

13:00 - 14:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Organizers: Jim Niemi - Wyss Institute
Mary Tolikas, PhD, MBA - Wyss Institute

The session will include presentations by the six finalists of the IEEE EMBS - Wyss Institute Award for Translational Research. A panel of experts will judge the presentations and choose three of them for awards to recognize the top three finalists. The finalists (individuals or teams) will receive \$3,000, \$2,000 and \$1,000 respectively and recognition of their achievement. The award will recognize translational engineering projects with the potential for making a transformative impact on healthcare safety, quality, effectiveness, accessibility and affordability.

Symposium on BME Education

13:00- 14:30

Marriott 3rd floor, Suffolk

Open to all registered conference attendees

Organizers: Richard Baird, PhD - National Institutes of Health
Bin He, PhD - University of Minnesota
Melur Ramasubramanian, PhD - National Science Foundation

Biomedical engineering (or bioengineering) is an emerging field to encompass intersection between engineering and biomedicine. It has been anticipated that we will witness a 72% increase in the workforce by 2018 in the U.S. alone. Many biomedical engineering departments and programs have been established in the past decade, reflecting the increased demand in the scientific field and job market. How to optimally educate and train the next generation of leaders in this important field represents a grand challenge to biomedical engineering and the bioengineering community. This symposium is aimed at bringing together all stakeholders, including academic, government and industrial sectors, for public discussions. Senior academic leaders including department chairs, NSF/NIH training program directors, and industrial representatives will be invited to discuss challenges and best practices on biomedical engineering education and training. Topics to be discussed include: biomedical engineering as a discipline or interdisciplinary field, core courses for biomedical engineering, broad based training vs. focused track based training, international biomedical engineering curriculum, etc. Interactive communications between invited speakers and audience are also anticipated.

Lunch with Leaders SOLD OUT

13:00 - 14:30

Westin 3rd floor, Staffordshire

Registration required

Organizer: Iris Yan - The Pennsylvania State University

All EMBS students are invited to a free lunch where they choose to sit with one of many leaders in biomedical engineering. Approximately ten students per table and a leader engage in informal conversation over a delicious lunch. This a rare and invaluable opportunity for you as a student to talk to a leader in biomedical engineering, get some advice and network in your field.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

13:00- 14:30

Open to all registered conference attendees

Keynote Lecture

Engineering Drug Dosing in Dynamic Biological Systems

14:45 - 15:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Speaker: David J. Balaban, PhD - Amgen Inc.

Many human biophysical systems have complex physiological responses when regulated by pharmaceutical agents. Predicting such responses is difficult if there are long delay times between receiving a dose of a drug and seeing an effect, if the system exhibits nonlinear responses, or if subsystems respond at very different time scales. We show how computer-based, nonlinear model predictive control can be used to specify an adaptive dosing protocol to produce a desired response. The controller uses repeated measurements of the patient's physiological state, together with statistical parameter estimation methods, to adapt to changes in the patient's condition. In addition to helping predict appropriate doses, these estimated parameters may be of interest to physicians, as they reflect important aspects of the patient's condition that are normally difficult to measure directly. We use human erythropoiesis as an example biophysical system. It is a dynamic, complex, multi-step process where hemoglobin levels (Hb) are regulated with erythropoiesis stimulating agents (ESAs). Fourier analysis reveals that for some patients, the time series of their Hb levels is wildly variable and even oscillatory. Much of this variability can be explained by changes in patient condition and physicians' best-effort actions to counteract these changes with next-dose recommendations based on an observational history shorter than one red blood cell (RBC) lifetime. Via computer simulation, using a partial differential equation-based model describing time-dependent RBC aging as well as feedback effects for ESAs, we explore the possibility of using computer-generated dosing protocols to create a smoother response that more effectively maintains Hb levels. Medical, engineering, commercial, and psychological challenges must be overcome before such controllers can be widely used, but we believe that such techniques promise better regulation of many human biophysical systems. The creation of an adequate, but still mathematically and computationally tractable, model of the biological system can be difficult and time consuming, but often yields its own biological insights. Physicians are naturally and justifiably apprehensive about trusting computers to recommend pharmaceutical doses. However, when the biological system is sufficiently complex, computer-based control systems may offer significant improvements in control as compared to the unaided practitioner.

As Amgen's Vice President of Research & Development Informatics, Dave works closely with the head of R&D and the CIO to provide operational and strategic leadership in support of Amgen's worldwide initiatives in drug discovery and development. Dave leads teams of scientific and technical professionals in Translational Sciences, Discovery Sciences, Systems Informatics, Strategy & Operations, Knowledge Management, and Development. The Research & Development Informatics staff numbers over 250 and serves Amgen and its patients from four global sites. Dave's responsibilities include managing a large client-funded budget, collaborating with clients to identify and improve processes, developing and implementing enterprise architecture standards, making recommendations on new systems, and managing the implementation of business plans. Prior to joining Amgen Inc., Dave was CIO and Vice President of Informatics and Information Technology at Signature Bioscience in San Francisco, CA. He developed and led teams to enhance corporate and scientific computing facilities, built a drug discovery infrastructure, developed corporate strategy, and began software development for cellular instruments. Dave holds a Ph.D. in Applied Mathematics from the University of California Berkeley. Throughout his more than twenty-five year career, Dave has been awarded over 15 patents in the field of database design and data visualizing techniques and has a similar number of patent applications pending. His technical interests include functional programming and the application of mathematical systems theory to biology and drug discovery. Dave is a member of the Board of Trustees of the Institute for Pure and Applied Mathematics at the University of California Los Angeles, a member of the Computer Aids for Chemical Engineering Task Force of the Foundations of Systems Biology in Engineering group, a founding member of the Industrial Haskell Group, and a graduate of the CIO Institute.

Keynote Lecture

From Nature and Back Again ... Giving New Life to Materials for Energy, Electronics, Medicine and the Environment

14:45 - 15:30

Westin 3rd floor, Essex Ballroom

Open to all registered conference attendees

Speaker: Angela Belcher, PhD - Massachusetts Institute of Technology

Organisms have been making exquisite inorganic materials for over 500 million years. Although these materials have many desired physical properties such as strength, regularity, and environmental benign processing, the types of materials that organisms have evolved to work with are limited. However, there are many properties of living systems that could be potentially harnessed by researchers to make advanced technologies that are smarter, more adaptable, and that are synthesized to be compatible with the environment. One approach to designing future technologies which have some of the properties that living organisms use so well, is to evolve organisms to work with a more diverse set of building blocks. These materials could be designed to address many scientific and technological problems in electronics, military, medicine, and energy applications. Examples include a virus enabled lithium ion rechargeable battery we recently built that has many improved properties over conventional batteries, as well as materials for solar and display technologies. This talk will address conditions under which organisms first evolved to make materials and scientific approaches to move beyond naturally evolved materials to genetically imprint advanced technologies.

Angela Belcher is a Materials Chemist with expertise in the fields of biomaterials, biomolecular materials, organic-inorganic interfaces and solid state chemistry. Her primary research focus is evolving new materials for energy, electronics and the environment. She received her B.S. in Creative Studies with an emphasis in biology from The University of California, Santa Barbara (UCSB). She continued her education at UCSB and earned a Ph.D. in Inorganic Chemistry (1997). Following a year of postdoctoral research in electrical engineering at UCSB, Dr. Belcher joined the faculty at The University of Texas at Austin in the Department of Chemistry in 1999. She joined the faculty at MIT in 2002. In 2006, she was appointed Germeshausen Professor of Materials Science and Engineering and Biological Engineering. In 2002, she founded the company Cambrios Technologies, Inc., and in 2007 she founded Siluria Technologies, Inc. At MIT she services as the MIT campus director of the Army UARC -The Institute for Collaborative Biotechnologies. In 2010, Dr. Belcher received the Eni Prize for Renewable and Non-conventional Energy. In 2005, she was named as one of 10 to watch by Fortune magazine for "How The World Will Work In The Next 75 Years." The next year she was named Research Leader of the Year by Scientific American and was awarded a Popular Mechanics Breakthrough Award. In 2007, Time Magazine named her a "Hero" for her research related to Climate Change. In 2009, Rolling Stone Magazine named her one of the "100 People Who are Changing The World." Other awards include the MacArthur Foundation Fellowship; a Four Star General Recognition Award (US Army), Presidential Early Career Award for Science and Engineering (PECASE), Top 10 Innovators Under 40 (Fortune Magazine), 2002 World Technology Award (Materials), 2002 Popular Science Brilliant Ten, 2002 Technology Review Top 100 Inventors (TR100). She is a 2001 Packard Fellow, won the 2001 Wilson Prize in Chemistry at Harvard University, 2001 Alfred P. Sloan Research Fellow, received the 2000 Beckman Young Investigator Award, received the 1999 DuPont and IBM Young Investigator Awards, and the 1999 Army Research Office Young Investigators Award. Her work has been published in many prestigious scientific journals including Science and Nature, and has been reported in the popular press including Time, Fortune, Forbes, Discover, Scientific American, Rolling Stone, The New York Times, Washington Post and The Wall Street Journal.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

15:30 - 17:00

Open to all registered conference attendees

Panel Discussion

Innovation & Entrepreneurship in BME

Marriott 3rd floor, Berkeley

17:15 - 18:45

Open to all registered conference attendees

Organizers: Ming Jack Po - Columbia University
Colin Brenan - Center for the Integration of Medicine & Innovative Technology

This expert panel discussion will provide insight into the process of technology development and funding, from a nascent idea to the next hot biomedical company. Perspectives will be offered from the various stages in the process from the academic grant office to the pursuit of venture capital. Come hear from our panelists about their experiences, their motivations, and most importantly, what they think are the key components to success in biomedical technology. Our speakers will include an early-stage venture capitalist, a university technology licensing officer, a startup lawyer and two entrepreneurs who transformed their research into successful businesses.

Oral Sessions

Marriott 3rd floor

17:15 - 18:45

Open to all registered conference attendees

Student Welcome Reception

19:30 - 21:30

Westin 3rd floor, Essex Ballroom

Registration required - Guests of students may purchase tickets.

This year's EMBS conference will host two receptions. The Student Welcome Reception will be held at the Westin and the General Conference Attendee reception will be held at the Marriott.

Students, make sure you attend this exciting networking opportunity. Complimentary appetizers and beverages will be served.

Welcome Reception for General Conference Attendees

19:30 - 21:30

Marriott 4th floor, Grand Ballroom

Registration required - Guests of conference attendees may purchase tickets.

This year's EMBS conference will host two receptions. The Student Welcome Reception will be held at the Westin and the General Conference Attendee reception will be held at the Marriott.

Make sure you attend the appropriate welcome reception. Complimentary appetizers and beverages will be served.

Wednesday, August 31, 2011

Courses, Tutorials, and Workshops

Half-Day Clinical Course

Neurotechnology

08:00 - 12:45

Marriott 3rd floor, Suffolk

Registration required

Organizer: Seward Rutkove, MD - Harvard Medical School
Speakers: Peter Bergethon, MD - Boston University
Leigh Hochberg, MD, PhD - Harvard Medical School
Seward Rutkove, MD - Harvard Medical School
Ted Teng MD, PhD - Harvard Medical School

Neurotechnology represents a broad field spanning both diagnostics and therapeutics as applied to the entire nervous system, from brain and spinal cord to peripheral nerve and muscle. Over the past decade major advances in technologies have led to improved health of individuals with a variety of neurological disorders, including stroke, Parkinson's disease, and spinal cord injury. Rather than providing an overview of those past successes, this workshop will survey the many areas of neurological care still in need of innovation, while highlighting a few ongoing neurotechnological efforts. Each talk will discuss unmet needs, major limitations to current technologies, and then specifically use their work as an example of addressing unmet needs.

Full-Day Workshop

Rehabilitation and Therapeutic Robotics for Upper and Lower Extremity

08:00 - 18:45

Marriott 3rd floor, Simmons

Organizer: Hermano Igo Krebs, PhD - Massachusetts Institute of Technology
Speakers: Sunil Agrawal, PhD - Delaware University
Grigore Burdea, PhD - Rutgers University
Glauco Caurin, PhD - Universidade de Sao Paulo
Lorenzo Chiari, PhD - University of Bologna
Eugenio Guglielmelli, PhD - Università Campus Bio-Medico
Neville Hogan, PhD - Massachusetts Institute of Technology
Hermano Igo Krebs, PhD - Massachusetts Institute of Technology
Olivier Lambercy, PhD - ETH
Marcie O'Malley, PhD - Rice University
Anindo Roy, PhD - University of Maryland

The field of rehabilitation and therapeutic robotics has grown steadily over the past decade, with significant clinical contributions. Studies have demonstrated both the efficacy and advantages of robotics for assessing and treating motor impairment. Robotics and information technologies enable an overdue transformation of rehabilitation clinics from pre-industrial manual operations to technology-rich activities and there is significant opportunity for engineers in this area. The purpose of this full-day workshop is to provide a concise yet broad-based introduction to key topics in the field of rehabilitation and therapeutic robotics, such as basic neuroscience and rehabilitation, impairment based approaches, design and control of devices from a mechatronics perspective, and clinical implications. The 1-day workshop will include a series of speakers with expertise in upper and lower extremity rehabilitation robotics representing both engineering and clinical research labs.

Full-Day Workshop

Software tools for Image Based Modeling, Simulation, and Visualization

08:00 - 18:45

Marriott 1st floor, Tremont

Organizers: Dana Brooks, PhD - Northeastern University
Robert MacLeod, PhD - University of Utah

Brett Burton, BS - University of Utah
Burak Erem, MS - Northeastern University
Tom Fogal, MS - University of Utah
Ayla Khan, BS - University of Utah
Josh Levine, PhD - University of Utah
Robert MacLeod, PhD - University of Utah
Darrell Swenson, BS - University of Utah
Jess Tate, BS - University of Utah

The goal of this tutorial is to introduce participants to a suite of software tools for image-based modeling, simulation, and visualization developed by the NIH/NICHD Center for Integrative Biomedical Computing (CIBC). This portable and flexible collection of interactive tools was designed in particular to support the development of subject specific, image based geometric models for simulation of bioelectric fields. The tools, individually or as a suite, have much broader utility and have supported research and clinical projects all over the world. The tools in the suite include: Seg3D, for general purpose user-guided image segmentation; ImageVis3D, for visualization of large scale data; map3d, for visualization of surface based maps from multichannel time signals; BioMesh3D, a set of utilities for creating surface and volume meshes from segmented image data; and SCIRun, a comprehensive problem solving environment that integrates many of the capabilities of an entire image based modeling pipeline. The tutorial will be a mix of didactic presentations on the components of image based modeling, simulation, and visualization; hands on practice with the software; and cases studies of real world applications. We will provide participants with the software and test data sets and encourage participants to bring their laptop computers, and, if relevant, their own data. CIBC staff and developers will be on hand to help participants learn the programs, port their data, and generate useful results. We especially encourage participation by students, post docs, and technical users and software developers. All the tools are compatible with Apple OSX and Windows operating systems.

Half-Day Clinical Course

Global Health

08:30 - 12:00

Marriot 1st floor, Boylston

Registration required

Organizer: Anna Young, MD, PhD - Innovations in International Health @ MIT
Speakers: Jose Gomez-Marquez - Innovations in International Health @ MIT
Kristian Olson, MD, MPH, DTM&H - Center for Integration of Medicine & Innovative Technology
Anna Young, MD, PhD - Innovations in International Health @ MIT

Innovations in International Health (IIH) at Massachusetts Institute of Technology (MIT) and the Global Health Initiative (GHI) at Massachusetts General Hospital (MGH) will share their approach, Global Health Technology 2.0, to developing medical technologies for low and middle income countries (LMIC). We define Global Health Technology 2.0 as technology standing as an independent determinant of global health rather than an aspect of policy that gets folded in as systems mature. In our work towards this new model of technologies in health, we outline a new way of doing research and development. As global health development assistance has tripled in the last decade, policymakers are recognizing the need for accessible health technologies aimed at low and middle income countries (LMICs). Developing these technologies is not simple. It requires a delicate departure from top-down, sophisticated engineering towards user-enabled designs that are elegant, simple, and field trialed and tailored. However, the stakes are higher--- technologies must succeed with a unique set of design challenges and address a higher burden of global illness. These technologies must be aligned with end-user needs which requires co-development with innovators in LMICs. Multiple iterations with end-user feedback are needed for ultimate translation to practical use. This course will explore Global Health Technology 2.0 through an opening presentation outlining the approach, followed by an interactive demo and prototyping activity, and closing remarks on how to integrate this approach in the participants' respective institutions.

Half-Day Clinical Course

New Developments in EMG-Based Assessment of Motor Function and Activity: Implications for Research and Clinical Practice

14:45 – 18:45

Marriott 1st floor, Boylston

Registration required

Organizer: Gerold Ebenbichler, MD - Vienna Medical University

Speakers: Jules Dewald, PT, PhD - Northwestern University
Gerold Ebenbichler, MD - Vienna Medical University
Roberto Merletti, PhD - Politecnico di Torino

Objective classification of impaired neuromuscular function and reliably monitoring the outcome through therapeutic interventions are of utmost importance in medicine. The science of electromyography has been evolving rapidly in recent years. Focused research and the advent of new technology have made objective examination of motor performance possible on an electrophysiological basis. In addition to the traditional diagnostic needle EMG technique, acquisition of EMG with surface electrodes has reached a point where monitoring the motor control and performance aspects of patients in a clinical environment or examining ergonomics in the workplace has become both feasible and simple to perform.

Half-Day Tutorial

X-ray Computed Tomography: Principles, Applications, and Future Directions

14:45 – 18:45

Marriott 3rd floor, Wellesley

Registration required

Organizer: Rajiv Gupta, PhD, MD - Harvard Medical School

This tutorial will cover the following topics.

1. Fundamental principles of computed tomography: The entire imaging chain and all major components and reconstruction algorithms will be described.
2. Applications of CT as a problem solving tool.
3. Future direction:
 - Dual Source and Dual Energy CT
 - Cardiac CT
 - Flat-panel and Cone-beam CT
 - CT-guided Interventions

Half-Day Workshop

How Smart Homes and AAL Can be Used to Improve Quality of Life

14:45 – 18:45

Marriott 3rd floor, Arlington

Registration required

Organizer: Vicente Traver, PhD - Universidad Politécnic de Valencia

Speakers: Marco Aiello, PhD - University of Groningen
Oliver Amft, PhD - TU Eindhoven
Michael S. Belshaw, PhD - Toronto Rehabilitation Institute
Enrique Dorrnzoro, PhD - Sevilla University
Sergio Guillén, PhD - TSB, Valencia
Norbert Noury, PhD - University Claude Bernard Lyon

The invited session will bring together specialist from different perspectives regarding Ambient Assisted Living (AAL). Therefore, they will be focused on the new AAL paradigms in a pragmatic way, showing how AAL and Smart Homes can improve quality of life. Special attention will be paid to how all the elements are integrated within the citizen ecosystem and how the citizen interacts. This a great chance to realize about how can all these possible home care services are defined, analyze and simulated if needed, allowing context awareness in real time conditions.

Half-Day Workshop

Electrical Fields at the Cell and Protein Scale

14:45 – 18:45

Marriott 3rd floor, Regis

Registration required

Organizers: Milica Radisic, PhD - University of Toronto
Gordana Vunjak-Novakovic, PhD - Columbia University

Speakers: Lauren Black, PhD - Tufts University
Michael Levin, PhD - Tufts University
Vivian Mushahwar, PhD - University of Alberta
Milos Popovic, PhD - University of Toronto
Milica Radisic, PhD - University of Toronto
Sarah Sundelacruz, PhD - Tufts University

Endogenous electrical fields are powerful regulators of cellular function. Traditionally, the study of electrical potentials and their effects on cellular function have been limited to excitable cells such as neurons and muscle cells. However, recent emerging evidence suggests that these potentials, produced by ion channel and pump proteins control functions such as proliferation, differentiation, migration, apoptosis, and cell shape in many other cell types and tissues. Recent work by our speakers demonstrates that bioelectrical signals are used as a medium in which living systems store information about tissue and organ shape within bioelectrical networks that are invisible to proteomics and genomic analysis. When applied to tissue culture in vitro, the electrical fields influence assembly of excitable tissues such as cardiac and nerve tissue. This workshop will provide forward-looking strategies to restore standing and walking functions as well as voluntary grasping after spinal cord injury in human subjects via electrical stimulation. Examples of the use of electrical stimulation to improve impulse propagation and functional properties of engineered cardiac tissues as well as to direct the fate of stem and progenitor cells will be featured. The workshop will feature recent evidence demonstrating that transmembrane potential gradients are powerful controls of eye development, craniofacial patterning, spinal cord and limb regeneration, tumorigenesis and stem cell growth. Consequently, the control of bioelectrical fields enables control of excitable tissue assembly in vitro, detection and suppression of cancer and altering the positioning of body organs during development.

Wednesday, August 31, 2011

Corporate Program

For the first time at EMBC, we offer access to sessions organized by some of the companies that exhibit at EMBC. The content of these sessions is not endorsed by IEEE EMBS neither it undergoes a peer-review process before being presented at the conference. However, we believe that gaining exposure to what companies are working on will be of great use to conference attendees.

Session Hosted by Shimmer Research An Open and Extensible Wearable Research Platform

13:00 - 14:30

Marriott 3rd floor, Berkeley

Open to all registered conference attendees

Speakers: Kieran Daly Shimmer Research
Benjamin Kuris Shimmer Research
Steve Ayer Shimmer Research
Bor-rong Chen, PhD - Biosensics

This workshop will be of interest to biomedical researchers and students interested in wearable sensors, biomechanics, and activity classification. Shimmer is a research platform used to support clinical and academic understanding in over 50 countries. Designed explicitly as a wearable technology, Shimmer is a small wireless sensor platform that can record (micro SD) and transmit (Bluetooth/802.15.4) physiological, kinematic and ambient data in real-time. The platform is extremely extensible and enables researchers as well as industry to be at the leading edge of sensing technology. The workshop will introduce the platform and its capabilities as well as some typical applications. We will discuss the various ways to work with the platform as well as the tools available from a developer standpoint. A live demonstration of building and customizing an application will be given. A Shimmer partner - Biosensics LLC - will also present and discuss their transition from research into commercialization based on a unique activity classification solution (PAMSys) developed on the shimmer platform. PAMSys (Physical Activity Monitoring System) provides a complete and comprehensive map of individuals' physical activity including detailed posture classification (sitting, standing, walking, lying).

Contact us: info@shimmer-research.com

Session Hosted by Delsys Inc.

Wearable Technologies: Simplified Collection and Analysis of sEMG and Physiological Signals

13:00 - 14:30

Marriott 3rd floor, Dartmouth

Open to all registered conference attendees

Speakers: Nick Kundu, MS - Delsys Inc.
Gianluca Deluca, MS - Delsys Inc.
Paola Contessa, PhD - Boston University

This workshop will be of interest to biomedical researchers and students interested in wearable sensors, signal processing, biosignals, biomechanics, and activity monitoring. Newly developed wireless data acquisition systems for EMG and other physiological signals will be used to unobtrusively capture information about the human body, in real time, and in real world situations. Portable, wireless systems allow unencumbered monitoring of natural motion and activities. Through an integrated system of data collection, data viewing, and scriptable processing routines, this corpus of information may be analyzed to interpret the relationships among these data. We will demonstrate recently-developed tools that bring these insights to the forefront, while facilitating experiment set-up, data management, and processing. A live demonstration of data collection tools will be given, showing how real-time data display and processing can be used to optimize the quality of sEMG data collection. Novel technology for suppressing the movement artifact and reducing cross-talk detected during dynamic activities will be demonstrated. Concurrent signals, such as EKG, inertial (movement), GPS (location), all collected through an integrated and synchronized data collection system, will be analyzed and related to the muscle activity monitored by the sEMG signals. Flexible data analysis tools will be used to view and process physiological data, demonstrating the ease with which research questions can be explored, and trends and nuances related to physiological states can be evaluated.

For additional information, please contact us at Delsys@delsys.com

Wednesday, August 31, 2011

Program in Systems and Synthetic Biology

Systems in Synthetic Biology (Part I)

9:30 - 11:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Ron Weiss - Synthetic Biology: From Parts to Modules to Therapeutic Systems
Pamela A. Silver - Designing Biological Systems for Therapeutics and Sustainability
Bruce Tidor - Synthetic Design of Molecular Therapeutics with Multifactorial Systems Goals

Systems in Synthetic Biology (Part II)

11:15 - 12:15

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Reshma Shetty - Making Biology Easier to Engineer
Jacob Beal - Toward Breaking the Complexity Barrier for Synthetic Biology Therapeutics

Systems in Synthetic Biology (Part III)

13:00 - 14:30

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: David McMillen - Integral Feedback Control in a Synthetic Gene Network
Michael T. Laub - Using Evolution to Guide the Rewiring of Two-Component Signal Transduction Systems
Kristala Jones Prather - Rational Design of Microbial Chemical Factories

Systems in Synthetic Biology (Part IV)

15:30 - 17:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Peter Carr - Engineering Microbial Genomes with MAGE: New Genetic Codes
George Church - Integration of Instrumental, Computational, Molecular, Organismal & Ecological Engineering
Jared Toettcher - A Light-Based Feedback Controller for Generating User-Defined Intracellular Signaling Dynamics

Systems Models in Biology (Part I)

15:15 - 18:45

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Mark Transtrum - Sloppy Models, Information Geometry, and Data Fitting
David Hagen - Optimal Experimental Design for Model Identification in Systems Biology
Bree Aldridge - Multi-Factorial Analysis of Receptor-Mediated Apoptosis

Thursday, September 1, 2011

General Program

Special Session for Students and Mentors

Winning Projects in a National Competition for Innovation in Primary-Care Technology

08:00 - 09:30

Marriott 3rd floor, Berkeley

Open to all registered conference attendees

Organizer: Ron Newbower, PhD - Center for the Integration of Medicine & Innovative Technology

Each year \$400,000 in prizes are awarded by CIMIT for innovations in technology for potential benefit in transforming primary care. This unique competition is open to graduate and undergraduate engineering students nationwide. This session will feature presentations from winners from the past three years, each representing a collaborative team which attacked a significant clinical need in a novel and potentially transformative fashion, reaching for better outcomes and lower cost at the frontlines of healthcare -- the domain of primary care clinicians. The top prize in this annual process is \$150,000 -- not only to recognize the students' achievement, but to foster further progress towards implementation and even commercialization. The presenters will tell their stories of success, both to illustrate the process of multi-disciplinary collaborative innovation, and to tell their stories of how they were attracted by this prize to devote efforts to this field.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

08:00 - 09:30

Exhibits

09:00 - 17:00

Visit the exhibits located on the 4th floor of the Marriott hotel.

Visit the exhibits located on the 3rd floor of the Westin hotel.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

09:30 - 11:00

Open to all registered conference attendees

Careers in Biomedical Engineering and Health Informatics (Women in Engineering Program)

11:15 - 12:45

Marriott 3rd floor, Regis

Registration required

Organizers: Semahat Demir, PhD - National Science Foundation
Zeynep Erim, PhD - National Institutes of Health

A valuable session for anyone interested in learning more about Biomedical Engineering and Health Informatics as a career choice for women. Prominent women within the domains of Biomedical Engineering and Health Informatics will present on issues such as career/family balance, experiences with and strategies to eliminate glass ceilings together with working in a profession perceived to be male dominated. Latest information will be provided on the representation of women within these professions. Utilize the fantastic networking opportunity that will conclude this session to build and establish new professional networks with other women interested in your fields of expertise. Bring your contact details and be ready to make new contacts that are relevant for you!

Special Session for Students Technical Writing and Manuscript Preparation

11:15 - 12:45

Marriott 3rd floor, Berkeley

Open to all students registered for the conference

Organizers: Cristian A. Linte, PhD - Mayo Clinic College of Medicine
Matthias Reumann, PhD - IBM
Iris Yan - The Pennsylvania State University

This session's audience targets student and GOLD members primarily. The whole writing process from starting to write to publication will be covered in this session. The talks will give brief overviews of the structure and important points that make an excellent scientific article, writing methods to improve writing skills will be addressed and the final talk will cover the review and editorial process. At the end of the talk there will be enough time for a longer discussion and direct questions.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

11:15 - 12:45

Open to all registered conference attendees

Cash Concession at the Marriott (food and beverages)

12:30 - 14:00

We are pleased to offer a cash concession menu that will be located on the 4th floor (atrium) at the Marriott to include sandwiches, salads, cookies and beverages. Please note that this is cash only (no credit cards accepted).

Keynote (Women in Engineering Program)

Re-engineering the War on Cancer: A Call to Action for Personalized Medicine

13:00 - 13:45

Marriott 3rd floor, Salon F

Open to all registered conference attendees

Speaker: Mara G. Aspinall, MBA - On-Q-ity, Inc.

Cancer research, treatment and care has come a long way in the last 50 years, dominating the science in industry and academia. Yet, current cancer treatments are effective only 22 percent of the time and almost half of all patients do not survive five years. Personalized medicine through the use of diagnostic tools can make the difference, but needs to be implemented in the forefront of medicine. There have been many discussions, meetings and plans to make this happen, but the questions remain: Is the science ready? Are the diagnostic tools reliable and reproducible? Do the regulatory agencies have the necessary framework to move personalized medicine products forward? And, will physicians incorporate these new advances into their clinical practice? Personalized medicine can save lives. Through the human genome project and advances in diagnostic and imaging technology, we now know more about disease than ever before. Every disease area can now be divided into more and more precise sub-types. The challenge now is making those sub-types clinically meaningful. First – we need to instill confidence in physicians and payors to support the diagnostic tools available today. Second – we need to embrace new technology to understand not just what disease sub-type a patient has but how it progresses and recedes. Third – we need to create new tools that will not only improve diagnosis for an individual patient but monitor that patient throughout the course of their disease to ensure that their treatment is at maximal efficacy. Through advanced diagnostics, we can move the treatment paradigm from one that is organ-based (how to treat breast cancer) to one that is mechanism-based (how to treat Her-2 based cancers). The Call to Action is clear – we must embrace diagnostics to move the needle in personalized medicine from “concept” to reality in disease management, most notably in cancer. We must replace the “trial and error” and “watch and wait” with “target and succeed”. In this talk, I will discuss the successes and failures of personalized medicine to date and how we must make some structural changes in our health care system to ensure its success.

Mara Aspinall is the Chief Executive Officer of On-Q-ity, an innovative personalized medicine company focused on transforming cancer lifecycle management through diagnostics. On-Q-ity is developing diagnostics that will identify the unique characteristics of an individual's cancer, predict the response to therapy and monitor the efficacy of treatment in multiple cancer types. On-Q-ity leverages two core technologies: Microfluidic

chip technology to capture, enumerate, and characterize circulating tumor cells (CTC) from a patient's blood and protein biomarkers to predict treatment response. Before being recruited to On-Q-ity, Mara was previously president of Genzyme Genetics, a leading provider of testing in the oncology and reproductive markets. Under Mara's leadership, Genzyme Genetics set the standard for quality genetics testing in the industry, while profitably growing at an unprecedented pace. She transformed the business, expanding its scope and reach to become one of the nation's largest diagnostic laboratories. Before that, Mara served as president of Genzyme Pharmaceuticals. An active participant in the healthcare policy community, Mara is a Director of the Personalized Medicine Coalition (PMC), a founding Director of the European Personalized Medicine organization (EPEMED), as well as an active member of the Federal Secretary of Health and Human Services' Advisory Committee on Genetics, Health and Society. Mara currently holds an appointment as lecturer in health care policy at Harvard Medical School and is a Director of Blue Cross Blue Shield of Massachusetts. Mara co-authored, "Realizing the Promise of Personalized Medicine" in the Harvard Business Review and, most recently, was named one of the 2010 "100 Most Inspiring People in Life Sciences" by PharmaVOICE Magazine. Mara started her business career at Bain & Company, an international strategic consulting firm. She earned her MBA from Harvard Business School and her Bachelors in International Relations from Tufts University.

Panel Discussion

Let the Great World Spin - The Delicate Art of Balance

13:00 - 14:30

Marriott 1st floor, Tremont

Open to all registered conference attendees

Organizer: Diane Damiano, PT, PhD - National Institutes of Health
Deborah Gaebler-Spira, MD - Northwestern University

Panelists: Lorenzo Chiari, PhD - University of Bologna
Diane Damiano, PT, PhD - National Institutes of Health
Deborah Gaebler-Spira, MD - Northwestern University
Emily Keshner, PT, EdD - Temple University

Balance Rehabilitation is necessary in diverse clinical populations to prevent falls and increase patient participation in activities of daily living. Understanding the mechanisms of postural control and balance is necessary in providing an optimal rehabilitation program however; ensuring the therapy program is carried out is the next greatest challenge. Monitored therapy time in the clinic is limited, therefore therapists are looking towards community classes and home based therapies such as the Wii to motivate and continue balance training outside therapy sessions. The limitations of these options include little or no outcomes feedback and decreased control of the direction of therapy. Novel solutions such as integration of open source games with inexpensive off the shelf balance platforms or use of body worn sensors with virtual reality gaming will allow the therapist to focus therapy while receiving clinical data on home therapy outcomes. Monitoring technology may allow the therapist a greater understanding of their patients balance within the home environment while also serving as fall detectors. This Panel Discussion will be led by a group of leading clinicians and engineers who are focused on understanding and developing innovative solutions towards assessing and directing therapy for balance rehabilitation.

Panel Discussion

Frontiers and Future Trends in Brain-Machine Interface

13:00 - 14:30

Marriott 4th floor, Salon H

Open to all attendees registered for the conference

Organizer: Bin He, PhD - University of Minnesota

Panelists: Tim Denison, PhD - Medtronic Inc.

Shangkai Gao, PhD - Tsinghua University

Bin He, PhD - University of Minnesota

José del R. Millán, PhD - Swiss Federal Institute of Technology Lausanne

Grace Peng, PhD - National Institutes of Health

Jose Principe, PhD - University of Florida

Nitish Thakor, PhD - Johns Hopkins University

Brain-Machine Interface (BMI) research has shown great promises in the past several years to enable subjects to interface the brain with machines. Such hybrid systems interfacing the brain and machines represent an excited emerging field of research in neuroengineering. Recent progresses have shown that trained monkeys can control an artificial limb from invasive recordings in motor cortex, or trained humans can control flight of a virtual helicopter in real-time in 3-dimensional sky from noninvasive scalp-recorded electroencephalograms. In this Panel Discussion, leading experts from academia, government and industry in BMI and brain-computer interface (BCI) will discuss the latest developments in BMI/BCI, the challenges and future trends of the field of BMI/BCI.

Panel Discussion

The Recent Earthquake in Japan: Experience of, and responses to, Earthquake, Tsunami, and Nuclear Power Plant Disaster

13:00 - 14:30

Marriott 3rd floor, Regis

Open to all registered conference attendees

Organizer: Toshiyo Tamura, PhD - Japanese Society of Biological and Medical Engineering

Panelists: Atsunori Nakagawa, PhD - Tohoku University

Yuichi Kimura, PhD - National Institute of Radiological Sciences

Masatsugu Fujie, PhD - Waseda University

Tetsuji Watanabe, PhD - Teijin Home Health Care

On March 11, 2011, an 8.9-magnitude earthquake devastated north-east Japan. The people of Japan have received an outpouring of sympathy and offers of assistance from all over the world. A few months after this disaster, they have started to resume their normal daily activities. In this panel discussion, some of the key players in responding to such emergency situation will review the disaster and describe how their tragic experience has changed the way they intend to plan for potential future responses to natural disasters as the one they recently experienced.

Lunch with Leaders SOLD OUT

13:00 - 14:30

Westin 3rd floor, Staffordshire

Registration required

Organizer: Iris Yan - The Pennsylvania State University

All EMBS students are invited to a free lunch where they choose to sit with one of many leaders in biomedical engineering. Approximately ten students per table and a leader engage in informal conversation over a delicious lunch. This a rare and invaluable opportunity for you as a student to talk to a leader in biomedical engineering, get some advice and network in your field.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

13:00 - 14:30

Open to all registered conference attendees

Keynote Lecture

Health, Innovation and Seduction

14:45 - 15:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Speaker: Roni Zeiger, MD - Google Inc.

Innovation in health typically focuses on scientific and technological breakthroughs. While these are and will continue to be critical, we are leaving a tremendous amount of health on the table. This is a result of “the last mile problem in health” — we often know the right therapeutic or preventive intervention, but we don’t know how to make it compelling enough for most of us to take it or do it. Part of the answer lies in making health more engaging; we need to make health seductive much in the same way the market does so for nearly every other product. The next generation of health innovation, from robotics to digital medicines, will be engineered to seduce you.

Dr. Roni Zeiger is Chief Health Strategist at Google where he helps lead efforts in health search, Google Health, and health projects at google.org including Google Flu Trends and Google Crisis Response. He has worked as a primary care physician and has served as a Clinical Instructor of Medicine at Stanford University School of Medicine. He continues to practice urgent care medicine on occasional weekends. Dr. Zeiger received his MD from Stanford and completed an internal medicine residency at the University of California, San Francisco. He was a fellow in medical informatics at Veterans Affairs in Palo Alto, California, and received a masters degree in biomedical informatics from Stanford University. He currently serves on the board of directors of the Society for Participatory Medicine.

Keynote Lecture

Frontiers in Neuroimaging: from Cortical Columns to Whole Brain Function, Connectivity and Morphology

14:45 - 15:30

Westin 3rd floor, Essex Ballroom

Open to all registered conference attendees

Speaker: Kamil Ugurbil, Ph.D., University of Minnesota

In the last decade and a half, imaging of cellular processes in vivo has been identified as an indispensable capability for biomedical research. Today, numerous different technologies are employed in pursuit of imaging processes such as organ function, intracellular chemistry, tissue perfusion, oxygen utilization, gene expression, and enzyme activity in intact animals and humans. In this effort, magnetic resonance imaging (MRI) has proven to be rich in information content but inherently poor detection sensitivity, which impose a fundamental limitation on this methodology. In the last two decades, we have pursued ever increasing magnetic fields for use in MRI to alleviate this limitation and also for extracting unique physiological information in humans, going first to 4 Tesla, and subsequently to 7 and 9.4T. A plethora of early experiments, particularly at 7T, demonstrated superior sensitivity and accuracy of functional brain imaging (fMRI) signals, and improvements in several contrast mechanisms for anatomical imaging. In fMRI, these gains have ultimately resulted in unique applications such as robust functional mapping of elementary computational units in the human brain, functional connectivity through resting state fMRI, and neuronal tractography. These applications had to deal with complexities arising from damped traveling wave behavior of 300 MHz RF, the 7T proton frequency, in the human body. These were managed through multichannel transmit capability on the transmit side while, on the receive side, they lead to significant gains in spatial encoding using parallel imaging.

Professor Kamil Ugurbil holds a Ph.D. in physics and chemical physics from Columbia University. After receiving his Ph.D., he joined AT&T Bell Laboratories, subsequently returning to Columbia University in 1979 as a faculty member. In 1982, he moved to the University of Minnesota where his research effort in magnetic resonance (MR) led to the evolution of his laboratory into an interdepartmental and interdisciplinary research center, the Center for Magnetic Resonance Research (CMRR). Dr. Ugurbil currently holds the McKnight Presidential Endowed Chair Professorship in Radiology, Neurosciences, and Medicine and is the Director of CMRR at the University of Minnesota. His research focus has been the development of biological magnetic resonance imaging and spectroscopy using very high magnetic fields, with particular emphasis on brain function, anatomy, and chemistry. One of the two studies that introduced functional imaging in the brain using magnetic resonance techniques (fMRI) were conducted in CMRR at the University of Minnesota under his leadership. Since then, his work has primarily revolved around understanding the origins of the MR detected functional signals and developing strategies to improve the spatial accuracy, and spatial resolution of the functional maps obtained by magnetic resonance. The use of ultrahigh magnetic fields (7 Tesla and above) for human studies was pioneered by CMRR as part of this neuroimaging effort.

Professor Ugurbil's contributions to biomedical magnetic resonance was recognized with the Gold Medal from the International Society of Magnetic Resonance in Medicine (ISMRM) in 1996, the highest award given by this society. He was subsequently elected as a Fellow of ISMRM in 1997 and of the International Society of Magnetic Resonance (ISMAR) in 2009. Dr. Ugurbil was inducted into the American Academy of Arts and Sciences and the National Academy of Sciences (USA) – Institute of Medicine in 2005 and 2007, respectively. In 2005 he received an Honorary Doctorate (Doctorate Honoris Causa) from the University of Utrecht, Netherlands.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

15:30 - 17:00

Open to all registered conference attendees

Short Workshop

Imaging and Computation in Clinical Electrocardiology

17:15 - 18:45

Marriott 3rd floor, Berkeley

Open to all registered conference attendees

Organizers: Dana Brooks, PhD - Northeastern University

Robert MacLeod, PhD - University of Utah

Speakers: Ravi Ranjan, MD PhD - University of Utah

Petr Stovicek, MD PhD - Charles University Hospital

John Triedman, MD - Harvard Medical School

Investigators have been conducting research on the use of imaging and computation in electrocardiology for many years. However until fairly recently the impact of advances in this area on clinical practice has been minimal except in a few specialized areas. In contrast, recent research progress, combined with improvements in imaging and computational technology itself, have begun to result in many exciting possibilities for clinical application of research results. In particular the combination of imaging and computation is enabling dramatic expansion of the concept of “personalized medicine” beyond the world of genomics by enabling patient-specific modeling and simulation. This short workshop will focus on both progress and challenges in three distinct clinical applications of imaging and computational research, from the points of view of three presenters who are each clinicians who are active in both clinical practice and research.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

17:15 - 18:45

Open to all registered conference attendees

Thursday, September 1, 2011

Courses, Tutorials, and Workshops

Full-Day Clinical Course

Cerebral Palsy Neurorehabilitation: From Impairment to Participation

8:00 - 12:00 (morning session)

14:30 - 18:00 (afternoon session)

Marriott 1st floor, Tremont

Registration Required

Organizer: Deborah Gaebler-Spira, MD - Northwestern University
Speakers: Sergei Adamovich, PhD - New Jersey Institute of Technology
Alycia Berg, MS, CCC-SLP - Children's Hospital Boston
Diane Damiano, PhD, PT - National Institutes of Health
Deborah Gaebler-Spira, MD - Northwestern University
Eugene Goldfield, PhD - Harvard Medical School
Brian Snyder, MD, PhD - Harvard Medical School
Leia Stirling, PhD - Wyss Institute
Rebecca Therriault, M.S., CCC-SLP - Children's Hospital Boston
Li-Qun Zhang, PhD - Northwestern University

Participants will be introduced to robotic rehabilitation methods for cerebral palsy (CP), both as a treatment and as an outcome evaluation tool. The workshop will first provide a basic understanding of Cerebral Palsy (CP) impairment and engineering terminology, followed by a presentation of technologies that are currently being developed, as well as those available in the market. For devices to have a greater opportunity of success for the patient, it is important for clinicians, researchers, and engineers to be involved in the development of new technologies. The course aims to demystify the boundary between engineers and clinicians in order to encourage collaboration for the mutual benefit of children and families.

Half-Day Workshop

Disruptive Innovation in Patient Self-Management and Empowerment

14:45 - 18:45

Marriott 3rd floor, Regis

Registration Required

Organizers: Maria Teresa Arredondo, PhD - Technical University of Madrid
Speakers: Maria Teresa Arredondo, PhD - Technical University of Madrid
Joe Gorman, PhD
Viveca Jiménez-Mixco, PhD
Juan Carlos Naranjo, PhD
Enzo Pasquale Scilingo, PhD
Javier Colás Fustero, PhD

The role of self-care in the management of long term conditions is crucial for effective high quality health care of patients. More and more, patients with chronic diseases and elderly people that need continuous health surveillance are able to live in their own home and surroundings with help from relatives and health professionals. In order to enable the patient to receive a preventative home based self empowered care, a complete system must be provided; it must help them to manage and monitor their daily health status, and needs to be connected to the professional medical system at the hospital and medical professionals. This concept that involves the actions taken towards the possibility of not being continuously attached to the hospital environment is often called "patient empowerment". It implies a re-distribution of power between patients and physicians and therefore an increase of the individual patients' autonomy to make informed decisions and personally handle their disease for their own health and well being. Different levels of empowerment can be defined, depending on the patient's expectations, ranging from simply providing information, to giving full control over all medical decision-making. In any case, empirical evidence suggests that active patient participation in health care is related to better patient outcomes.

Half-Day Workshop

Social Impact and Sustainable Research for Biosignals and Biorobotics

14:45 - 18:45

Marriott 3rd floor, Simmons

Registration Required

Organizers: Dinesh Kant Kumar, PhD - RMIT University
Martha Zequera Díaz, PhD - Pontificia Universidad Javeriana

Speakers: S Arjunan, PhD - RMIT University
Rezaul Begg, PhD - RMIT University
Dinesh Kant Kumar, PhD - RMIT University
E Piragova, PhD - RMIT University
E Saunders, PhD - RMIT University

Medical devices and research has headed to become the exclusive domain of the healthy societies, and leading to an unequal distribution of the health outcomes. The devices are designed for being located where the infrastructure such as electricity, buildings and telecommunication is robust and clean. However, the majority of the world does not live in these conditions, and there is an urgent need to think beyond the 10% of the global population. This requires urgent research, where the devices are reliable and robust, even in the most challenging situations, and are adaptable for new demographics. This workshop will open this topic for discussions and seek people with ideas to join in.

Thursday, September 1, 2011

Program in Systems and Synthetic Biology

Systems Models in Biology (Part II)

9:30 - 11:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Debasis Barik - Stochastic Model of Cell Cycle Regulation in Budding Yeast
Tina Toni - Computational Design for Synthetic Biology
Bo Kim - Robust Protocol Design for Cancer Immunotherapy

Systems Models in Biology (Part III)

11:15 - 12:15

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Elebeoba May - Investigating the Metabolic Dynamics of Pathogenic Organisms Using BioXyce
David Amsallem - An Open, Flexible Device Model Specification Framework with Applications to Neuron Modeling

Systems Biology Data Modeling (Part I)

13:00 - 14:30

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: David de Graaf - Patient Stratification for Efficacy and Safety As Building Blocks for Personalized Medicine
Ernest Fraenkel - Using Network Algorithms to Integrate 'Omic' Data and Reveal Disease Mechanisms
Marc Vidal - Interactome Networks and Human Disease

Systems Biology Data Modeling (Part II)

15:30 - 17:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Douglas Lauffenburger - Cue-Signal-Response Analysis in Vivo
Michael Yaffe - Integration of Growth Factor, MAP Kinase, and DNA Damage Signaling Networks
Forest White - Biological Insight from Quantitative Analysis of Cellular Signaling Networks

Friday, September 2, 2011

General Program

Special Session for Students

Effective Presentation Design and Delivery

08:00 - 09:30

Marriott 3rd floor, Berkeley

Open to all students registered for the conference

Organizer: Cristian A. Linte, PhD - Mayo Clinic College of Medicine

For many of us oral presentations can be the prime means for communicating our ideas and our research, not only to our peers, but also to our employers and to potential customers. As students, you are no exception – the prospect of an oral presentation can be daunting, the pressure is on to make a good impression with your research. That we are scientists presenting sometimes very complicated scientific ideas and results need not necessarily be a recipe for a sleep inducing “death by PowerPoint” presentation, rather there are simple ways in which we can all try and make our presentations effective and captivating. This session aims to give you some all-round pointers on the “dos” and “don’ts” of preparing and delivering an effective presentation that best conveys your ideas smoothly, understandably and, most important, succinctly.

Short Workshop

Neuromodulation

08:00 - 12:45

Marriott 3rd floor, Fairfield

Open to all registered conference attendees

Organizer: Felipe Fregni, MD, PhD, MPH - Harvard Medical School

Speakers: Felipe Fregni, MD, PhD, MPH - Harvard Medical School
Jennifer Thomson, PhD - Harvard Graduate School of Education
Frederick Ulam, PhD - University of Missouri

In the field of neurorehabilitation, there has been a rapid development of electroencephalography (EEG)-based techniques, including the use of neurofeedback in rehabilitation and the measurement of event related potentials (ERP). Neurofeedback techniques are based on the notion that subjects can voluntarily modulate their brain activity as indexed by EEG, and also that neuropsychological disorders have EEG signatures. ERP measurement is a technique that quantifies transient neural electrophysiological responses arising as a result of external stimuli; changes in ERP patterns can index response to neurorehabilitation at a micro-level. In this short course we will cover the basics of ERP measurement and neurofeedback techniques. We will review both their independent and combined uses in neurorehabilitation, as well as discussing how they intersect with other neuromodulation techniques.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

08:00 - 9:30

Open to all registered conference attendees

Exhibits

09:00 - 17:00

Visit the exhibits located on the 4th floor of the Marriott hotel.

Visit the exhibits located on the 3rd floor of the Westin hotel.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

09:30 - 11:00

Open to all registered conference attendees

Short Workshop

Planning your Future: Putting Together a Short and Long Term Career Plan

11:15 - 12:45

Marriott 3rd floor, Berkeley

Organizer: Cristian A. Linte, PhD - Mayo Clinic College of Medicine

This session is focused on getting the EMBS trainees up to speed on the ins and outs of both an academic and industry career in biomedical engineering. Depending on what you intend to pursue, you must know what you are getting yourself into and become familiar with the “currency” you need to trade with. Our speakers will include senior academics and industry-based career development professionals who will provide coaching in terms of what is expected of you for each professional career, what you need to do to achieve your aims and how to keep your career plan up to date to get you closer to your end goals.

Short Workshop

Computing Brain Networks

11:15 - 12:45

Marriott 4th floor, Salon J

Open to all registered conference attendees

Organizer: Lucia Vaina, MD, PhD - Boston University

Speakers: Alexandre Gramfort, Ph.D. - Harvard Medical School

Susan Whitfield-Gabrieli, PhD - Massachusetts Institute of Technology

Lucia Vaina, MD, PhD - Boston University

Anastasia Yendiki, PhD - Harvard Medical School

During this short workshop we will provide an overview on recently developed methods to derive brain connectivity information and their potential clinical applications. We will discuss methods to study resting state functional connectivity (rs-fcMRI). rs-fcMRI can reveal intrinsic, spontaneous networks which elucidate the basic functional organization of the human brain. A common approach to investigating rs-fcMRI is the “seed-based” approach where it is critical to appropriately address noise in order to avoid possible confounds from spurious correlations based on non-neuronal sources. We will present a functional connectivity toolbox that implements the CompCor strategy for noise source reduction, which provides increased protection against such confounds. We will then discuss some recent developments in neuroimaging toward the study of spontaneous brain activity and observation of large-scale structures aimed at identifying brain architecture and markers of brain pathologies. To date, there has been no demonstration that the limited and noisy data available in spontaneous activity observations could be used to learn full-brain probabilistic models that generalize to new data. We will present a technique that attempts to describe subject-level brain functional connectivity structure as a multivariate Gaussian process and to estimate it from group data, by imposing a common structure on the graphical model in the population. We will show that individual models learned from functional Magnetic Resonance Imaging (fMRI) data using this population prior generalize better to unseen data than models based on alternative regularization schemes. To our knowledge, this is the first report of a cross-validated model of spontaneous brain activity. Finally, we will discuss the reconstruction of white-matter pathways from diffusion-weighted MR images. This is a challenging problem due to imaging noise and distortions in the data, uncertainty in the presence of crossing pathways, and a large solution space. We will discuss a fully automated method for reconstructing a set of major white-matter pathways using prior information on their surrounding anatomy

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

11:15 - 12:45

Open to all registered conference attendees

Lunch with Leaders SOLD OUT

13:00 - 14:30

Westin 3rd floor, Staffordshire

Registration required

Organizer: Iris Yan - The Pennsylvania State University

All EMBS students are invited to a free lunch where they choose to sit with one of many leaders in biomedical engineering. Approximately ten students per table and a leader engage in informal conversation over a delicious lunch. This a rare and invaluable opportunity for you as a student to talk to a leader in biomedical engineering, get some advice and network in your field.

Cash Concession at the Marriott (food and beverages)

12:30 - 14:00

We are pleased to offer a cash concession menu that will be located on the 4th floor (atrium) at the Marriott to include sandwiches, salads, cookies and beverages. Please note that this is cash only (no credit cards accepted).

Keynote (followed by Student Paper Award Ceremony)

Applications and Opportunities for Wearable Technology in Physiological Monitoring

13:00 - 13:45

Marriott 4th floor, Salon F

Open to all registered conference attendees

Speaker: Dale Wiggins, PhD - Philips

It is estimated that patients on general care floors of the hospital are increasingly sicker than ever before, yet the clinician-to-patient ratio has remained low. Serious consequences can arise when patients develop 'hidden' complications in between clinician visits. Patient physiologic monitoring can help to identify subtle degradations in patient condition and alert clinicians when attention is needed. Conventional physiological monitoring systems have several limitations when applied to patients on the general care floors. The patients have to be 'wired' to the bed, resulting in immobilization and slower physical and emotional healing. In addition, with traditional monitoring systems, clinician workflow may be complicated by cumbersome equipment management and overwhelming information overload. Wearable monitoring devices have attracted increasing interest in recent years, both in research and Industry. New technologies and evolving solutions are being developed that can address the constraints of conventional monitoring systems and significantly improve patient outcomes. These solutions must enhance the patient healing process by adapting to the patient condition. They must be robust enough to deal with the environmental constraints of the hospital environment. They must eliminate redundant steps in the clinical workflow. And lastly, they must provide accurate, actionable information to the appropriate caregivers. In this talk, early experiences with these technologies and solutions will be shared and insights into future development opportunities and accompanying benefits will be offered.

Dale Wiggins is Vice President of Technology for Philips Healthcare Patient Care and Clinical Informatics. In this role, he leads the team that is focused on driving strategic technology plans across the businesses and oversees activities related to several principal healthcare industry themes including systems integration within the hospital enterprise architecture, clinical decision support, interoperability standards, and outcomes improvement studies and other clinical research. Previously, Dale was Chief Architect for the global Patient Monitoring business. He joined Philips from Hewlett-Packard/Agilent Technologies where he held various management, architecture, and engineering positions in research and development. Dale holds BS and MS degrees in Computer and Systems Engineering.

Student Paper Award Ceremony

13:45 - 14:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Please join us in acknowledging the winners of all our student competitions. This year, we will have winners for three competitions. In addition to our traditional IEEE EMBS competition sponsored by the National Science Foundation, we will have awards for a competition sponsored by Philips and a competition sponsored by IBM.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

13:00 - 14:30

Open to all registered conference attendees

Keynote Lecture

The Process of Innovation

14:45 -15:30

Marriott 4th floor, Salon F

Open to all registered conference attendees

Speaker: Dean Kamen - DEKA Research and Development Corporation

Dean Kamen is an inventor, an entrepreneur, and a tireless advocate for science and technology. His roles as inventor and advocate are intertwined—his own passion for technology and its practical uses has driven his personal determination to spread the word about technology's virtues and by so doing to change the culture of the United States. As an inventor, he holds more than 440 U.S. and foreign patents, many of them for innovative medical devices that have expanded the frontiers of health care worldwide. Recently, Dean and DEKA have been working with DARPA and the Department of Defense on a robotic arm for our veterans. The story of the arm, dubbed "Luke," illustrates the motivation for and the process of innovation. Behind every invention there is a story as complex and interesting as the device itself. Dean will also discuss FIRST (For Inspiration and Recognition of Science and Technology), a nonprofit that encourages students to seek careers in science and engineering through robotics competitions. It is up to the current group of technology leaders to inspire the next generation of inventors and innovators; that is what FIRST is all about.

As an inventor and physicist, Dean Kamen has dedicated his life to developing technologies that help people lead better lives. As an inventor, he holds more than 440 U.S. and foreign patents, many of them for innovative medical devices that have expanded the frontiers of health care worldwide. While still a college undergraduate, he invented the automatic, self-contained ambulatory pump designed to deliver precise doses of medication to patients with a variety of medical conditions. In 1976 he founded AutoSyringe, Inc., to manufacture and market the pumps. At age 30, he sold that company to Baxter International Corporation. By then, he had developed a number of other infusion devices, including the first wearable insulin pump for diabetics. Following the sale of AutoSyringe, Inc., he founded DEKA Research & Development Corporation to develop internally generated inventions, as well as to provide R&D for major corporate clients. The array of products and technologies invented and developed by Dean and the engineering team at DEKA is extremely broad. Some examples of notable breakthrough medical devices invented and developed by DEKA are the HomeChoice™ portable dialysis machine, marketed by Baxter Healthcare and the iBOT™ Mobility System, a sophisticated mobility aid developed for Johnson & Johnson. DEKA's other projects include: a DARPA-funded robotic arm project intended to restore functionality for individuals with upper extremity amputations; a new and improved Stirling engine intended to convert almost any fuel into electrical power and clean heat as part of a system that is clean, quiet, easy to use and easy to maintain with a long operating life; new water purification technology intended to convert almost any source water into safe drinking water; and many others. Dean is also widely recognized as the inventor of the Segway™ Human Transporter, which was designed to provide a clean alternative for short distance travel and enhance people's productivity. Among Dean's proudest accomplishments is founding FIRST (For Inspiration and Recognition of Science and Technology), an organization dedicated to motivating the next generation to understand, use and enjoy science and technology. In 2010, its flagship program, the FIRST Robotics Competition, will reach more than 45,000 high-school students on more than 1,800 teams in 43 regional competitions, seven district competitions, and one national championship. The FIRST Robotics Competition teams professionals and young people to solve an engineering design problem in an intense and competitive way. In 1998, the FIRST LEGO League was created for children ages 9-14. Similar to the FIRST Robotics Competition, these young participants build a robot and compete in an event designed for their age group. In the 2009/10 season, over 147,000 children participated in 56 countries. FIRST also offers the Junior FIRST LEGO League for 6 to 9 year-olds and the FIRST Tech Challenge, which provides high-school-aged students with a hands-on learning experience to develop and hone their skills and abilities in science and technology. Dean has received numerous awards and accolades including the Heinz Award in Technology, the Economy and Employment in 1998, the National Medal of Technology from President Clinton in 2000, the Lemelson-MIT Prize in 2002 for Invention and Innovation, the United Nations Association of the USA Global Humanitarian Action Award in 2006, the American Society of Manufacturing Engineers Medal in 2007, the 2008 LEGO Prize, the 2009 Committee for Economic Development Public Policy Award and honorary degrees from more than 25 colleges and universities. Dean was inducted into The National Inventors Hall of Fame in May 2005.

Keynote Lecture

Modularity for Motor Coordination

14:45 - 15:30

Westin 3rd floor, Essex Ballroom

Open to all conference registered attendees

Speaker: Emilio Bizzi, MD, PhD - Massachusetts Institute of Technology

Selecting the appropriate muscle pattern to achieve a given goal is an extremely complex task because of the dimensionality of the search space and because of the non-linear and dynamical nature of the transformation between muscle activity and movement. The complex task of mapping a goal into a muscle pattern might be simplified by organizing a modular and hierarchical control architecture. In a modular system the control task is decomposed in a series of simple control processes that can be carried out in parallel. Furthermore, a hierarchical organization allows for an efficient use of the same modules for different tasks and facilitates learning new tasks. To investigate whether the central nervous system uses a modular and hierarchical architecture to control movement we took a reverse engineering approach. We recorded electro-myographical activity from the hind limb muscles of intact and freely moving frogs during jumping, swimming, and walking in naturalistic conditions with the aim of identifying the invariant characteristics of the motor output as clues of the functional organization of the controller. We used multidimensional factorization techniques to extract specific relationships among the amplitude and timing of the muscle activations observed during a variety of different movements. We found that a small number of synergies could explain a large fraction of the variation in the muscle patterns and that sets of synergies with different number of elements captured different levels of detail, providing a hierarchical characterization of the structure in the patterns. Most synergies appeared to be preserved across different behaviors and animals, supporting the inference that the structure captured by the synergies reflects a modular and hierarchical organization of the controller. We have also examined muscle activity in stroke patients as they performed different reaching movements. The patients had stroke damage in one cortical hemisphere only, so one arm was impaired while the other was unaffected. By comparing the activity patterns in the two arms, we showed that the same modules were present in both arms, but their activation and combination was disrupted specifically on the affected side; a finding indicating that the supra-spinal motor control areas generate movements specifying the combination of synergies and by setting up the right coefficient of activation for each spinal synergy.

Born in Rome, Italy, Emilio Bizzi received his M.D. from the University of Rome in 1958, and his Docenza in 1968. He is currently an Institute Professor at Massachusetts Institute of Technology. He served as Chairman of the Department of Brain and Cognitive Sciences at MIT from 1986 to 1997 and Director of Whitaker College of Health Sciences, Technology, and Management at MIT from 1983 to 1989. Dr. Bizzi's primary research interest is the understanding of how the brain controls voluntary movements. To this end he has focused on two related questions: how does the brain handle the enormous complexity involved in making even the simplest movement and how does the brain learn a new motor task and then generalize that learning to each new variation of the task. During the last two years, he began investigations of applying his work on muscle modules to methods that could lead to enhanced rehabilitation. In addition, his lab also continues collaborations with neurosurgeons from Massachusetts General Hospital to develop the next generation of neural prosthetics. He is a member of the National Academy of Sciences (1986), and the American Academy of Arts and Sciences, (1980), where he recently completed service as President. In 1998 he was elected to the Accademia dei Lincei, Rome. In 2004 he was awarded a degree "honoris causa" in Biomedical Engineering, University of Genova, Italy. (2004), and in 2005 he was elected to the Institute of Medicine of the National Academies. He has won awards for his research and academic work including the W. Alden Spencer Award and the Hermann von Helmholtz Award for Excellence in Neuroscience, and in 2005 received the President of Italy Gold Medal for achievements in science and the Empedocles Prize. He has authored numerous publications over the years, including text books, journal articles, reviews, and abstracts.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

15:30 - 17:00

Open to all registered conference attendees

Oral Sessions

Marriott 3rd and 4th floors

17:15 - 18:45

Open to all registered conference attendees

Meet the Editors

17:15 - 18:45

Marriott 4th floor, Salon A

Open to all registered conference attendees

Organizers: Matthias Reumann, PhD - IBM
Cristian A. Linte, PhD - Mayo Clinic College of Medicine

This is an interactive session following the Workshop on technical Writing and Manuscript Preparation where the audience will have a chance to meet the editors of some of the IEEE EMBS journals in person and get their questions answered with regards to their journal of interest or journal publications in general. Each editor will be available to discuss specific to each journal and give you tips on do's and don'ts aimed at helping you improve your technical writing and getting your work published.

GOLD & Student Networking Reception

19:30 - 21:30

Westin 3rd floor, Essex Ballroom

Organizers: Matthias Reumann, PhD - IBM
Iris Yan - The Pennsylvania State University
Laura J. Wolf - IEEE EMBS

In its effort to increase the value of IEEE and EMBS membership for young engineers, the IEEE Engineering in Medicine and Biology Society hosts its sixth IEEE EMBS-GOLD & Student Networking Reception at its 33rd Annual International Conference in Boston, USA. The *Graduates Of the Last Decade (GOLD)* program is an IEEE entity working at providing benefits for young IEEE members after their 'Student Member' status has expired. If you are an IEEE Member who graduated with your first professional degree within the last ten years, including all graduate students, you are automatically part of IEEE GOLD! Around the world, there are over 47,000 GOLD members and 100 GOLD Affinity Groups. The continuing goal of GOLD is to find out what students need from their Society at this particular stage of their careers and how their Society can in turn offer additional value of membership. If you are indeed GOLD, you are cordially invited to network with your peers, some of whom are working in industry, at the Reception's informal and fun environment.

Friday, September 2, 2011

Courses, Tutorials, and Workshops

Full-Day Workshop

The Integrated Patient Care Environment: Device Connectivity, EMR Integrated Patient Data, Patient Centric Identification & Association and Embedded RTLS / RFID Technologies

08:00 - 18:45

Marriott 1st floor, Tremont

Organizers: Paul Frisch, PhD - Memorial Sloan-Kettering Cancer Center

Over the past decade the patient care environment has transitioned from a set of discrete and independent devices and applications to an integrated and dynamic environment. This integrated environment provides, device interconnectivity, data sharing and mining, patient centric identification and association and real time location. These technologies are dependent on complex wireless and network infrastructure, seamlessly enabling data to be shared by multiple systems and applications. In addition connectivity real time location information, such as RFID, establishes the dynamic relationships between patients, staff and equipment. The complexity of this environment has significantly impacted the roles of IT and engineering and clinical staff requiring new operational synergies to develop this highly interactive environment. Advanced clinical applications integrating medical devices and supporting technologies have significantly increased the quality and the quantity of patient diagnostic and monitoring information, and have further added complexity to the issues of data and alarm management and point of care information delivery. These advances have been coupled with increasing workloads and reduced staffing; have revealed difficulties in effectively prioritizing and handling this information resulting in increased equipment-related errors, patient dissatisfaction, the potential for patient injury, and an increasing overall concern for patient safety. Concerns about this trend have prompted the Joint Commission to establish patient safety initiatives geared to establishing methodologies and protocols to reduce the probability of errors, and providing an enhanced level of communications. The goals of this interdisciplinary workshop will focus on identifying and defining the issues around this dynamic environment and the technologies projected to provide resolution to the above workflows. Speakers will address specific methodologies, technologies and applications focusing on connectivity, data sharing, real time location and RFID, patient centric identification and association, wireless and network infrastructure, point of care information delivery and communications, and the electronic medical record and documentation issues.

Full-Day Tutorial

Implantable/Wearable Biomedical Circuits and Systems

08:00 - 18:45

Marriott 3rd floor, Simmons

Organizers: Maysam Ghovanloo, PhD - Georgia Institute of Technology
Pedram Mohseni, PhD - Case Western Reserve University
Sameer Sonkusale, PhD - Tufts University

This tutorial will address a growing area of integrated circuits in the context of emerging biomedical applications. Exciting new opportunities exist in the area of wearable sensors, biomedical implants and portable medical instrumentation for low-cost point-of-care healthcare. These applications often place unique requirements on constituent electronic circuits and systems in CMOS technology. Requirements range from ultralow-power operation, small form-factor, reliance on energy harvesting, and safe and secure wireless transmission. The proposed tutorial will be led by experts in the area of low-power analog front-end circuits, data converters, wireless power delivery, power management circuits and wireless transceivers to provide a comprehensive tutorial in the area of biomedical circuits and systems. The tutorial will begin with an introduction to fundamentals of low-power analog and mixed-mode circuit design, followed by a systematic step-by-step coverage of critical building blocks such as biopotential amplifier design and inductive coupling, followed by the latest architectures in emerging biomedical applications. Examples derived from practical applications such as neuroprostheses, ECG/EEG data acquisition, and transcutaneous power transmission will provide the attendees with complete circuits-to-systems-to-applications coverage.

Half-Day Clinical Course Non-Invasive Brain Stimulation

14:45 - 18:45

Marriott 1st floor, Boylston

Registration Required

Organizer: Felipe Fegni, MD, PhD - Harvard Medical School
Speakers: Mar Cortes, MD - Burke Medical Research Institute
Dylan Edwards, PhD - Burke Medical Research Institute
Felipe Fregni, MD, PhD, MPH - Harvard Medical School
Alvaro Pascual-Leone, MD, PhD - Harvard Medical School

This course is an introduction to **Non-Invasive Brain Stimulation** techniques. It will cover the history and basic mechanisms of TMS/tDCS/tACS, and how they relate to research directions and clinical practice. This course will also have a demonstration of the techniques and hands-on opportunities for the students. The course is relevant to those clinicians and/or researchers in need of acquiring basic information regarding Transcranial Magnetic Stimulation (TMS), Transcranial Direct Current Stimulation (tDCS) and Transcranial Alternating Current Stimulation (tACS) for their practice. The overall purpose of the course is to improve your understanding of the techniques of non-invasive brain stimulation, such as TMS, tDCS and tACS. Besides, we will provide information relating to the history and basic mechanisms of these techniques, as well as information about safety guidelines and clinical applications. Finally, we will perform hands-on demonstrations of these techniques.

Half-Day Workshop Biological Micro Electro Mechanical Systems (BioMEMS): Fundamentals and Applications

14:45 - 18:45

Marriott 3rd floor, Wellesley

Registration required

Organizers: Mehmet R. Dokmeci, PhD - Northeastern University
Michelle Khine, PhD - University of California Irvine
Speakers: Utkan Demirci, PhD - Harvard Medical School
Mehmet R. Dokmeci, PhD - Northeastern University
Ali Khademhosseini, PhD - Harvard Medical School
Michelle Khine, PhD - University of California Irvine

BioMicroElectroMechanical Systems (BioMEMS) have seen a surge in growth and has been continuously enabling novel discoveries in Biomedical Sciences. The development of technologies at the microscale has created enabling tools and technologies that are crucial for the advances in life sciences. Specifically polymer based BioMEMS technologies including Polydimethylsiloxane (PDMS) and parylene have seen unprecedented growth. This workshop will provide an overview on how to apply BioMEMS technologies to obtain new insights into biological processes that encompass processes at the molecular, cellular and tissue scales including chemotaxis and cellular forces; cell metabolism, electrophysiology and signaling; angiogenesis and metastasis; and differentiation and development. This workshop will begin with a series of lectures and invited talks outlining key aspects of the micro and nanofabrication technologies and applications of BioMEMS technologies to life sciences, and will learn specific details regarding the practical aspects of BioMEMS and sensor design, fabrication, and use for specific applications. Topics ranging from microchips for implantable devices, to biosensors and sensors for global health will also be included. The workshop will consist of a number of nationally renowned speakers, and is geared towards graduate students, research scientists, faculty and industrial participants who are interested in gaining experience in the exciting field of BioMEMS.

Half-Day Workshop

Motor Control Principles in Neurorobotics and Prosthetics

14:45 - 18:45

Marriott 3rd floor, Regis

Registration required

- Organizers:** Jose L. Pons, PhD - Spanish National Research Council
Silvestro Micera, PhD - Swiss Federal Institute of Technology Lausanne
Diego Torricelli, PhD - Spanish National Research Council
- Speakers:** Hartmut Geyer, PhD - Carnegie Mellon University
Karsten Berns, PhD - Kaiserslautern University
Thomas Mergner, MD - University of Freiburg,
Julio Gomez-Soriano, PhD - National Hospital for Paraplegics
Scott Delp, PhD - Stanford University

Actual efforts in rehabilitation research are integrating neuroscience knowledge into engineering to develop new effective means for neurorehabilitation, based on a deeper understanding of the human control system. In the field of robotics and prosthetics, a variety of systems based on neurophysiological and biomechanical principles have been proposed so far. At the same time, other emerging fields such as humanoid robotics or human body simulation, which are not specifically directed to rehabilitation, also have made use of bio-inspiration to mimic human behaviour. Promising improvements in rehabilitation can arise from the exchange of knowledge between these different technological areas. The workshop aims to bring together engineers and clinicians interested in sharing their ideas in biologically motivated approaches concerning the following main areas: 1) Neuro-musculo-skeletal modeling of human walking; 2) Control of human-like bipedal robots; 3) Neural control of wearable robots, e.g. exoskeletons and prosthesis; 4) Simulation tools for 3D human body modeling. Three main standpoints will structure the contributions from the invited speakers as well as the debate among the participants: 1) Methods & concepts. Techniques, prototypes and conceptual designs for innovative bio-inspired machines and models will be discussed. Particular interest will be devoted to the sensorimotor mechanisms of walking and standing; 2) Software platforms & analysis tools. Practical insights on programs and software environments adopted by each community will be presented, to share and compare different solutions to common problems. 3) Clinical & therapeutic applications. Contributions on new therapeutic applications and diagnostic measures which envision the use of bio-inspired machines will be debated.

Friday, September 2, 2011

Program in Systems and Synthetic Biology

Control in Synthetic Biology (Part I)

9:30 - 11:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Timothy Lu - Scalable and Tunable Platforms for Engineering Synthetic Gene Circuits
Harris Wang - Construction of Synthetic Organisms through Large-Scale Genome Engineering
Doug Densmore - EDA to BDA

Control in Synthetic Biology (Part II)

11:15 - 12:15

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Jeff Gore - Bacterial Cheating Limits Antibiotic Resistance
Domitila del Vecchio - A Control Theory Approach to Engineering Biomolecular Circuits

Control in Synthetic Biology (Part III)

13:00 - 14:30

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Irene Chen - Simple Model Systems in Synthetic Biology: RNA Replicators and Bacteriophages
Xiao Wang - Engineering Complex Dynamics Using Synthetic Gene Networks
Tom Ellis - Designing and Building Synthetic Biology – an Engineering Challenge

Controls in Synthetic Biology (Part IV)

15:30 - 17:00

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Rahul Sarpeshkar - Analog Electronic Circuit Design for Synthetic Biology and Systems Biology
Jacob White - Numerical Subtleties in Biochemical Oscillator Sensitivity Analysis in the Presence of Conservation Constraints
Mark Brynildsen - Metabolic Engineering to Potentiate Immunity

Controls in Synthetic Biology (Part V)

17:15 - 17:45

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers: Deborah Hung - RNA Expression Signatures to Determine Antibiotic Responses

Saturday, September 3, 2011

General Program

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

08:00 - 9:30

Open to all registered conference attendees

Exhibits

09:00 - 17:00

Visit the exhibits located on the 4th floor of the Marriott hotel.

Visit the exhibits located on the 3rd floor of the Westin hotel.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

09:30 - 11:00

Open to all registered conference attendees

Special Session for Students

Alternative Careers in BME

11:15 - 12:45

Marriott 3rd floor, Berkeley

Open to all students registered for the conference

Organizer: Ming Jack Po

About 80% of Masters and PhD students end up in non-faculty positions. If you haven't started exploring your options yet, rest assured there is a broad range of career opportunities for science PhDs beyond the ivory tower. If you are thinking of alternative careers and have an interest in business and solving problems, then come join us for this informative and practical event. We've gathered four PhDs who have established careers outside of academia to speak on how they made the transition from academic research or medicine and provide real-world examples of the type of work they now do.

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

11:15 - 12:45

Open to all registered conference attendees

Keynote Lectures and Panel Discussion

13:00 - 15:30

Marriott 4th floor, Salon G

Open to all registered conference attendees

Speakers:

Dirk Beernaert, PhD - European Commission

John Parrish, MD - Center for Integration of Medicine & Innovative Technology

Subra Suresh, PhD - National Science Foundation

Xian-En Zhang, PhD - Chinese Ministry of Science & Technology

This session will be organized in short talks followed by a panel discussion. The first three talks by Dr. Subra Suresh, Dr. Dirk Beernaert, and Dr. Xian-En Zhang will be focused on their vision on the impact of research and technology on the way medicine will be practice in the future. These talks will be followed by a short presentation given by Dr. John Parrish who will elaborate on how research and technology could be translated into the practice of medicine from a physician's point of view. Dr. Parrish will moderate a discussion among the keynote speakers that will follow their talks.

Subra Suresh, PhD - Study of Human Diseases Across Disciplinary Boundaries

Major advances in various branches of engineering and natural sciences, coupled with transformational developments in information technology, computational modeling and simulation, genetics, genomics, and nanotechnology, have provided unprecedented opportunities to explore human health and diseases at the cellular, subcellular, and molecular levels. Such developments have also facilitated completely new opportunities to study fundamental mechanistic processes with the goal of developing basic scientific understanding, new diagnostic tools, and novel therapeutics across a wide variety of human diseases. This presentation will provide an overview of some recent accomplishments and opportunities for future exploration. Specific examples are drawn from the study of infectious diseases, hereditary blood disorders, and cancer.

Dr. Subra Suresh, distinguished engineer and professor, was sworn in as the 13th director of the National Science Foundation (NSF) on October 18, 2010. Suresh leads the only federal agency charged with advancing all fields of fundamental science and engineering research and education. He oversees the NSF's \$7-billion budget, directing programs and initiatives that keep the United States at the forefront of science and engineering, empower future generations of scientists and engineers, foster economic growth and innovation, and improve the quality of life for all Americans. Prior to his confirmation as NSF director, Suresh served as Dean of the Engineering School and Vannevar Bush Professor of Engineering at the Massachusetts Institute of Technology (MIT). He joined MIT's faculty ranks in 1993 as the R.P. Simmons Professor of Materials Science and Engineering. During his more than 30 years as a practicing engineer, he held joint faculty positions in four departments at MIT as well as appointments at the University of California at Berkeley, Lawrence Berkeley National Laboratory and Brown University. A mechanical engineer interested in materials science and biology, Suresh pioneered research to understand the mechanical properties of materials. His most recent research tackled the biomechanics of red blood cells under the influence of diseases such as malaria. In 2006, Technology Review magazine selected Suresh's work on nanobiomechanics as one of the top 10 emerging technologies that "will have a significant impact on business, medicine or culture." Holding true to his personal ideals, Suresh successfully leveraged his renowned research and leadership positions in academia to increase the number of women and minority engineers. He personally mentored more than 100 engineers and scientists in his research group. As department head and dean of engineering, he also led a successful campaign to increase the number of women among MIT's engineering faculty ranks. The Padma Shri Award (2011) from the President of India, Indian Science Congress General President's Award (2011), Society of Engineering Science Eringen Medal (2008), European Materials Medal (2007) and Acta Materialia Gold Medal (2006) are among the many prestigious awards Suresh has received for his innovative research and commitment to improving engineering education around the world. He holds honorary doctorate degrees from Sweden's Royal Institute of Technology and Spain's Polytechnic University of Madrid. He has been elected a fellow or honorary fellow of all the major materials societies in the United States and India, including the American Society of Materials International, Materials Research Society, American Society of Mechanical Engineers, American Ceramic Society, the Indian Institute of Metals and the Materials Research Society of India. Suresh has authored more than 230 research articles in international journals and is a co-inventor in more than 18 U.S. and international patent applications. He is author or co-author of several books that are widely used in materials science and engineering, including *Fatigue of Materials* and *Thin Film Materials*. He has consulted with more than 20 international corporations and research laboratories and served as a member of several international advisory panels and non-profit groups. Suresh has been elected to the U.S. National Academy of Engineering, American Academy of Arts and Sciences, Spanish Royal Academy of Sciences, German National Academy of Sciences, Academy of Sciences of the Developing World, Indian National Academy of Engineering and Indian Academy of Sciences.

He earned his bachelor's degree from the Indian Institute of Technology in Madras in 1977; his master's from Iowa State University in 1979; and his doctorate from MIT in 1981. Suresh married his wife, Mary, in 1986, and they have two children, Nina and Meera.

Dirk Beernaert, PhD - A European Strategy for Smart, Sustainable and Inclusive Growth: How Research and Innovation in ICT, Miniaturisation and Micro-Nano-Bio Systems Meet the Future Challenges for Health and Well Being

The European Framework Program for Research, Development and Innovation has to elaborate world-class advanced research results and to contribute to the larger policy objectives of the Union. Europe has still to overcome the fragmentation of its' research landscape and to create a true integrated single European research area. It needs to invest more in innovation and manufacturing to bring research results faster to the market and has to invest in smart, sustainable and inclusive growth. We should make best use of these competence Regions in Europe where knowledge in specific fields is concentrated for the benefit of the EU competitiveness at large and for the well being of the European citizens. The first part of the presentation will address these policy objectives and the recent flagships and activities launched. The second part will go more into detail on the research activities being executed and planned in the near future in order to meet the European challenges for health, well being and assistance of aging population. In particular, we will look at how smart miniaturisation, smart integration and smart systems can contribute to a more healthy future for our aging citizens. How can miniaturisation help elderly to stay longer independent? Comfort, predictability, reliability and cost are the issues. What can we expect from the convergence of micro-nano-bio-ICT technologies and smart systems for the

future personalized healthcare? What opportunities may offer the mix of different scientific disciplines, the integration of different technologies and how will this multi-disciplinarity affect the research and engineering landscape? A holistic view on this emerging field covering research on technologies and products, manufacturing and market and business opportunities need to be considered. Examples of ongoing European projects and planned activities will be given and some opportunities for international collaboration elaborated.

Dr. Dirk Beernaert is an engineer in physics, in nuclear science and in material science (University of Ghent – Belgium -1976). Before joining the European Commission he was involved in statistics and as engineering and technology manager in setting up a laboratory to sustain the design of microelectronic components and subsequently in setting up a manufacturing site in micro-electronics to produce digital, analogue and high voltage components. He was responsible for a team dealing with technology development and technology transfer between different organisations. He has joined the European Commission in 1990 where he has been responsible for research initiatives in micro-electronics under different European Frameworks (FP) for Research and for cooperation with Eureka in that field. He also was responsible for setting up the workplan for research in e-work, e-business, e-commerce (FP5). He has started a Unit and a Program dealing with 'Integrated Micro and Nanosystems' (FP 5 and 6) including Microsystems, sensors, interfaces, displays and large area integration and for setting up the workplan for Photonics at the start of the 7th Framework. He is now responsible for running within Directorate General Information Society the Unit of 'nano-electronics' dealing with the implementation of Framework 6 and 7 activities, with planning the future activities and with all related research, innovation stimulation and regulatory activities in these fields. He is recently nominated Executive Director – at interim – of the first public private partnership between industry, European Member States and the European Commission in the field of Nanoelectronics (The Joint Undertaking ENIAC). Owner of 2 patents and author of more than 100 articles on diverse research topics, on commercialisation, on innovation and research strategies mainly in the field of micro-nano-technologies and miniaturisation.

Xian-En Zhang, PhD - Development of Medical Devices: China's Perspectives.

Medical Technology may have broad sense, including medical devices, therapy technology and medication. This report provides an overview on the development of medical devices in China. Medical device industry is a typical innovation-driven, interdisciplinary and global competitive emerging strategic industry. Currently, United States, West Europe and Japan account for over 84% of global medical device market share, while China accounts for only 3% with low-end products. China's 1.37 billion people as well as more than 300 thousand medical and health institutions make China the world's third largest medical device market after US and Europe. The annual growth rate has been more than 20% in recent years. The goal of building a moderately prosperous society and the reform of the medical and health system further secure this fast growth. By the end of 2015, total demand of medical devices in China is expected to reach 50 Billion RMB (about 1% of GDP). "Early health" philosophy is changing the patterns of medical development. This will give a strong push in developing a series of sophisticated-techniques medical devices, such as new imaging technology, non-invasive diagnosis, neural and brain signal detection analysis, interventional therapy, new medical sensors/biosensors/biochips, personal genomics/proteomics and other core technologies. Strengthening the primary medical care system is one of the priorities of the medical system reform. Rural and community health care as well as family care require a huge amount of medical equipment, which should have features of high performance, low cost, intelligence, portability and easiness of operation. Multi-functional and mobile medical platforms are also important especially for rural and field work people. Such demands are giving the researchers opportunities and challenges. Standardization of diagnosis and treatment of traditional Chinese medicine (TCM) create opportunities for the development of modern TCM apparatus, comprising high-precision pulse meter, tongue imaging, new acupuncture treatment instrument, and so on. Real success of these devices will depend on a wide range of clinical investigation. Data banks of pathological/physical signs are also to be built. To achieve the goal mentioned above will largely rely on the development of multi-/inter- disciplinary, particularly nano technology, photonics and microelectronics, new and biocompatible materials, high precision imaging technology, network technology, remote medicine technology, genome sequencing and bioinformatics, etc.

Dr. Xian-En Zhang received his first degree in Hubei University in 1982, MPhil. (microbiology) and Ph.D. (biochemistry) later in the Chinese Academy of Science (CAS). He became a full professor in Wuhan Institute of Virology, CAS in 1993. He is specializing in analytical biotechnology (particularly recombinant biosensors) with 160 peer-reviewed papers and three books on biosensors and biochips. He serves as a vice chair of the Chinese Society for Microbiology, a vice chair of Biophysical Society of China, editorial member of a few international scientific journals (such as *Biosensors & Bioelectronics*, *Biocatalysis & Biotransformation*), and guest professor in a number of universities. Since 2002, Dr. Zhang has been serving as director general of Basic Research Department, China Ministry of Science and Technology, where he mainly involves in policy study and national planning for science development, and implantation of national major basic research program and the State Key Laboratories. He is the author or coauthor of many science and technology development reports, including the book "The role of science and technology in building the powers".

John Parrish, MD - The Power of Collaboration to Improve Medicine

CIMIT is a consortium of greater Boston's premier clinical, research and academic institutions. Its mission is to improve patient care by facilitating collaboration among scientists, engineers and clinicians to catalyze the discovery, development and implementation of innovative technologies and procedures/systems. CIMIT has evolved its model of investing in clinical innovations and innovators for more than a decade. With the benefit of this accumulated experience, it was an opportunity to study how well CIMIT has achieved its mission. A key motivation behind the study is to further improve CIMIT's ability to help investigators create devices, systems and procedures to care for patients, including the many unmet medical and psychological needs of wounded warriors, as well as be able to share those factors responsible for success with others. CIMIT developed and pursued a novel "Quantitative Anthropology" approach involving retrospectively quantifying the objective and subjective inputs and outputs of CIMIT's project portfolio. To extract the key "lessons learned", the statistically significant correlations were examined to better understand the nature of the correlations and where causality was likely. The study confirmed many of CIMIT's experiences. In particular it implied that small to modest grants to a collaborative team of clinical and engineering investigators, when properly stimulated and expertly facilitated in the pre-proposal as well as post-award stage can be a very powerful catalyst for innovation and a driver for implementation.

John A. Parrish, MD, proudly served in the United States Marine Corps and was a battlefield doctor in Vietnam. He is the Chief Executive Officer and co-founder of the Center for the Integration of Medicine and Innovative Technology (CIMIT), a consortium of academic and engineering research laboratories, universities and more than 40 private-sector companies. Through CIMIT, clinical investigators work to advance the standards of care for all patients through the development and the adoption of targeted medical devices and technologies. Trained in internal medicine, dermatology and clinical research, Dr. Parrish has been recognized as a visionary and innovator who lists among his accomplishments the development of therapies to treat skin disease, including the now-common use of ultraviolet light. For two decades, Dr. Parrish served as chief of the Department of Dermatology at Massachusetts General Hospital, founding the Wellman Center for Photomedicine, the first – and now the world's largest – multidisciplinary research group to study the effects of lasers on tissue. A graduate of Duke University and Yale University School of Medicine, Dr. Parrish is a member of the Institute of Medicine, National Academy of Science, the National Space Biomedical Research Institute and the Defense Science Board. He has earned the Discovery Award from the National Dermatology Foundation; the Bowditch Prize from Massachusetts General Hospital for enhancing the quality of patient care while reducing the cost of that care; and the U.S. Army's Thurman Award, honoring the late Gen. Maxwell Reid Thurman, who championed the advancement of lifesaving medical technologies within the U.S. Army. Dr. Parrish is the author or co-author of more than 300 publications, including six books.

Keynote Lecture

The Importance of Neuromechanical Limb Models in the Design of Leg Prostheses and Orthoses

14:45 - 15:30

Westin 3rd floor, Essex Ballroom

Open to all registered conference attendees

Speaker: Hugh Herr, PhD - Massachusetts Institute of Technology

A long-standing goal in rehabilitation science is to apply neuromechanical principles of human movement to the development of highly functional prostheses and orthoses. Critical to this effort is the development of actuator technologies that behave like muscle, device architectures that resemble the body's own musculoskeletal design, and control methodologies that exploit principles of biological movement. In this lecture, I discuss how agonist-antagonist actuation, polyarticular limb architecture, and reflex behaviors can result in quiet, stable, and economical legged mechanisms for walking and running. Neuromechanical models are presented to examine the importance of limb morphology and neural control on locomotory performance. These models are then used to motivate design strategies for prosthetic and orthotic mechanisms.

Hugh Herr is an associate Professor within MIT's Program of Media Arts and Sciences, and The Harvard-MIT Division of Health Sciences and Technology. His primary research objective is to apply principles of biomechanics and neural control to guide the designs of wearable robotic systems for human rehabilitation and physical augmentation. In the area of human augmentation, Professor Herr has employed cross bridge models of skeletal muscle to the design and optimization of a new class of human-powered mechanisms that amplify endurance for cyclic anaerobic activities. He has also built elastic shoes that increase metabolic economy for running, and leg exoskeletons for walking load-carrying augmentation. In the area of assistive technology, Professor Herr's group has developed powered orthotic and prosthetic mechanisms for use as assistive interventions in the treatment of leg disabilities caused by amputation, stroke, cerebral palsy, and multiple sclerosis. Professor Herr has authored or coauthored over 60 technical publications in biomechanics and wearable robotics, and was the recipient of the 2007 Heinz Award for Technology, Economy, and Employment.

Poster Session and Coffee Break

Westin 4th floor, America Ballroom

15:30 - 17:00

Open to all registered conference attendees

Oral Sessions

Marriott 3rd and 4th floors and Westin 3rd floor

17:15 - 18:45

Open to all registered conference attendees

Saturday, September 3, 2011

Courses, Tutorials, and Workshops

Half-Day Workshop

Toward a Global Neuroinformatics Infrastructure

14:45 - 18:45

Marriott 1st floor, Boylston

Registration required

Organizers: Pontus Holm, PhD - International Neuroinformatics Coordinating Facility

Speakers: Jan Bjaalie, PhD - University of Oslo

David van Essen, PhD - Washington University School of Medicine St. Louis

Sean Hill, PhD - * International Neuroinformatics Coordinating Facility

Mitsuo Kawato, PhD - ATR, Japan Science and Technology Agency

Large-scale data-intensive integrative neuroscience projects are paving the way for a next generation international neuroinformatics infrastructure. Large-scale data integration is redefining neuroscience and creating new domains such as digital brain atlasing, connectomics, brain modeling and more. Some of the issues addressed are data federation, ontologies, spatial references, common data models, analysis, visualization and simulation techniques. This workshop will include presentations from the leaders of large neuroscience infrastructure projects from around the world. Such integrative infrastructures will enable new insights about the structure and function of the brain in health and disease.

Saturday, September 3, 2011

Program in Systems and Synthetic Biology

Modeling Biomedical Systems

9:30 - 11:45

Marriott 4th floor, Provincetown

Open to all registered conference attendees

Speakers:

- Madhusudan Natarajan - Predictive Patient Stratification through Parameter Reduction, Modeling, and Simulation
- Aravind Subramanian - Large Scale Gene Expression Analysis of Cellular States
- John Luk - HEPAPrint: A Metagene Expression Signature for Individualized Risk Assessment of Hepatocellular Carcinoma after Surgery
- Hongyue Dai - Systematic Study of HCC Tumors by RNA and DNA Profiling of Matched Tumor and Normal Tissues