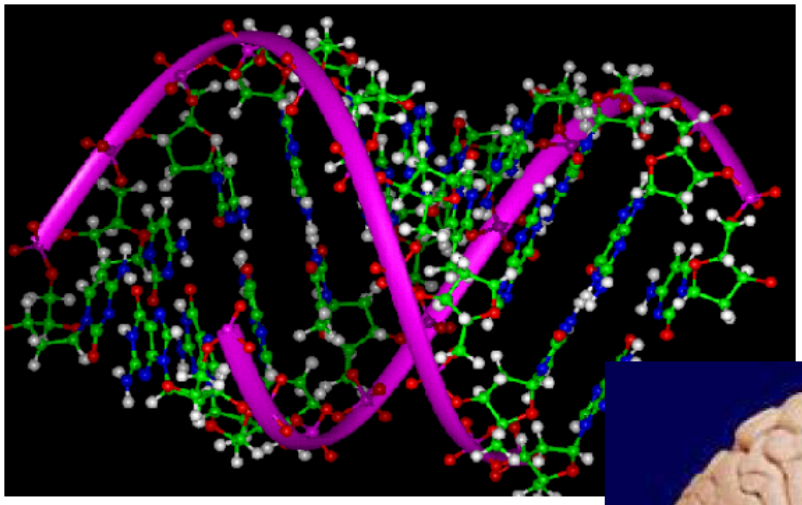
Proceedings of the 7th IEEE International Conference on
Bioinformatics and Bioengineering



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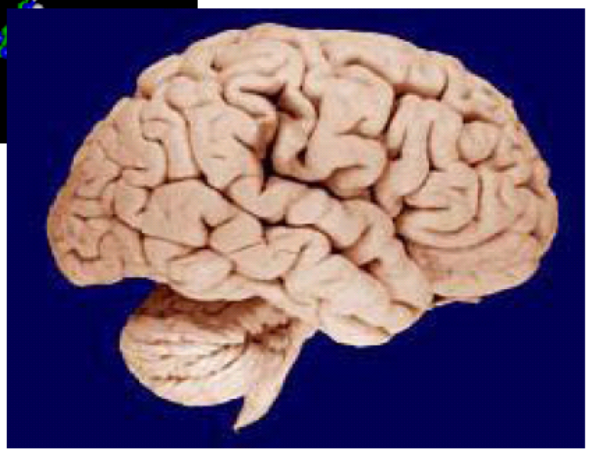

The Conference Center at
Harvard Medical School
Boston, Massachustts USA
October 14 - 17, 2007

Volume I

Editors
Jack Y. Yang, Mary Qu Yang, Michelle M. Zhu
Yanqing Zhang, Hamid R. Arabnia, Youping Deng and Nikolaos G. Bourbakis

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EMB IEEE Engineering in Medicine and Biology
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ISIBM International Society of Intelligent Biological Medicine
Systems, Man, & Cybernetics Society IEEE

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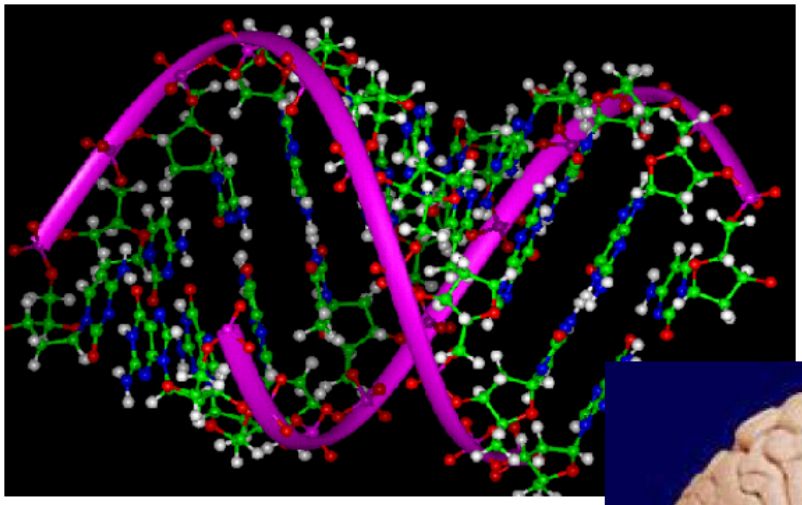

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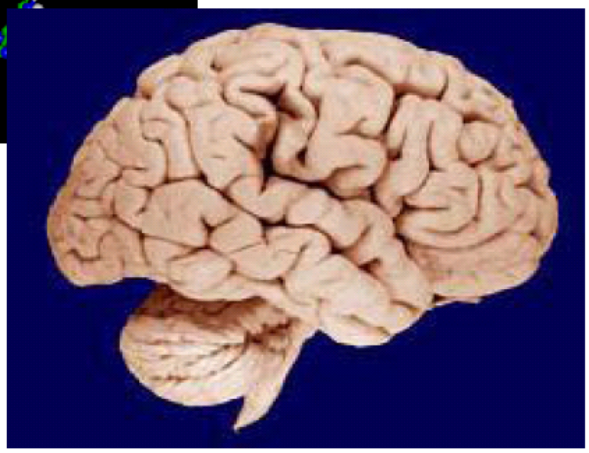

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Volume II

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Message from the General, Program and Steering Committee Chairs

On behalf of the committees of the 7th IEEE International Conference on Bioinformatics and Bioengineering (IEEE BIBE), we are delighted to welcome you to the conference center at Harvard Medical School, Boston, Massachusetts in October 14-17, 2007.

Bioinformatics and Bioengineering are complementary disciplines that hold great promise for the advancement of research and development in complex biomedical systems, agricultural, environmental, pharmaceutical and medical sciences as well as public health, drug designs, genomics and so on. The 7th IEEE BIBE provides a common platform for the cross fertilization of ideas, to help shape knowledge and scientific achievements by bridging these two very important and complementary disciplines into an interactive and attractive forum. The 7th IEEE BIBE is a large international conference with 7 years of tradition and leading reputation.

The synergy of bioinformatics and bioengineering has been well received by researchers. This year, the 7th IEEE BIBE has received more than 600 high-quality full research papers. Each paper was reviewed and ranked by at least 4 professors and scientists in the program and scientific review committee. As a result of the rigorous review process and stringent evaluation, the committee selected 66 papers as full regular research papers, 58 special interest research papers, 23 workshop research papers, and 77 regular research short papers. Lastly, there are 14 keynote and tutorial lecture papers and abstracts from world renowned scientists in the fields that are within the scope of the 7th IEEE BIBE. The acceptance rate for the full regular research papers is less than 12%. In addition to the 600+ submissions of full-length research papers, there are also large numbers of poster abstract submissions. The 272 professors and scientists in the program and scientific review committee have spent tremendous amount of time and efforts for this academic event in evaluating all submitted papers. The anticipated participation exceeds 500 people, most of them from academia, medical and research centers. All accepted papers (except for poster papers and abstracts) are published in the IEEE proceeding books indexed in EI, INSPEC, DBLP and Library of Congress. The conference also offers a supplementary journal issue of BMC Genomics (Impact Factor 4.09, PubMed/Medline and SCI indexed). The 7th IEEE BIBE is a large international gathering that is aimed to promote synergistic inter/multidisciplinary research and education to solve important but difficult biomedical problems that need both expertise in biomedical sciences and engineering.

Major organizers of the 7th IEEE BIBE who hold formal degrees in the fields of both engineering and biophysical/biomedical sciences with many years of research, teaching and engineering practice experiences realized the power and needs of synergistic engineering and biomedical research based on their professional experience. They and all other organizers are dedicated to promote such inter/multidisciplinary research and education. Therefore, the 7th IEEE BIBE has been designed to be responsive to the need for synergistic inter/multidisciplinary research and education. For that reason, it is the only meeting whose components are also defined dynamically in response to specific needs of largest number of keynote lectures, cutting-edge research tutorial lectures, special interest research workshops and special sessions with academic supports and contributions from leading scientists at NIH, national laboratories and research universities. Each proposal and nomination has been reviewed and voted by the 7th IEEE BIBE committee to ensure that participants will be benefited significantly from the academic event. We are very grateful for the IEEE BIBE Plenary Keynote Lectures given by:

Dr. A. Keith Dunker	(Indiana University and Purdue University),
Dr. Mary Qu Yang	(National Human Genome Research Institute, National Institutes of Health, U.S. Department of Health and Human Services and Oak Ridge, DOE),
Dr. John Quackenbush	(Harvard School of Public Health and Dana-Farber Cancer Institute),
Dr. Andy Baxevanis	(National Human Genome Research Institute, National Institutes of

Health, United States Department of Health and Human Services),
Dr. Steven E. Seltzer (Harvard Medical School and Brigham & Women's Hospital),
Dr. Tony Xiaohua Hu (Drexel University and the IEEE Computer Society),
Dr. Xudong Huang (Harvard Medical School and Brigham & Women's Hospital),
Dr. Yi Pan (Georgia State University),
Dr. Jay Steve Loeffler (Harvard Medical School and Massachusetts General Hospital),
Dr. Jun S. Liu (Harvard University and Massachusetts Institute of Technology),
Dr. Ferenc A. Jolesz (Harvard Medical School and Brigham & Women's Hospital),
Dr. Ruzena Bajcsy (University of California at Berkeley and Member of United States National Academy of Engineering and, Member of United States Institute of Medicine of the National Academies).

And the Advanced Research Frontier and Education Tutorial Lectures given by:

Dr. Mark Borodovsky (Georgia Institute of Technology),
Dr. Vladimir N. Uversky (Indiana University School of Medicine),
Dr. Patrick S. P. Wang (Northeastern University and Massachusetts Institute of Technology)
Dr. Arif Ghafoor (Purdue University, West Lafayette),
Dr. David Lightfoot (Southern Illinois University, Carbondale),
Dr. Igor B. Zhulin (Oak Ridge National Laboratory, DOE and University of Tennessee),
Dr. May D. Wang (Georgia Institute of Technology and Emory University),
Dr. Yehuda Braiman (Oak Ridge National Laboratory, U.S. Department of Energy),
Dr. Craig A. Stewart (Indiana University, Bloomington),
Dr. Tian Zheng (Columbia University),
Dr. Larry O. Hall (University of South Florida and the IEEE Systems, Man and Cybernetics Society).

The 7th IEEE BIBE brings together top researchers from the United States and around the world to exchange research results and address open issues in all aspects of bioinformatics and bioengineering. The IEEE conference hosts a number of cutting-edge research workshops in collaboration with the National Human Genome Research Institute (NHGRI) and National Cancer Institute (NCI), National Institutes of Health (NIH), U.S. Department of Health and Human Services, Oak Ridge National Laboratory, U.S. Department of Energy, Indiana University, Purdue University, Georgia Institute of Technology, Southern Illinois University, University of Illinois, University of Michigan, University of California, University of Massachusetts, Harvard Medical School, Harvard University and a number of other national laboratories and major research universities. We are especially grateful for the Cutting-Edge Research Workshops and the IEEE BIBE Plenary Keynote Lectures given by:

Dr. Laura L. Elnitski (National Human Genome Research Institute, National Institutes of Health (NIH), U. S. Department of Health and Human Services),
Dr. Brian D. Athey (University Michigan and the National Center for Integrative Biomedical Informatics),
Dr. Linda Molnar (National Cancer Institute, National Institutes of Health (NIH), United States Department of Health and Human Services),
Dr. Eric Jakobsson (University of Illinois at Urbana-Champaign and the National Center for Design of Biomimetic Nanoconductors
Dr. Chih-Ming Ho (University of California at Los Angles and Member of United States National Academy of Engineering and Academician of Academia Sinica).

Obviously, the conference would not have achieved such a great success without the hard work and voluntary efforts by many contributors. Organizing such a major academic event in the fields is not possible without contributions from members of program and scientific review committee. Thanks must be given to them for their professionalisms. We must express our sincere gratitude to Mary Qu Yang, Vladimir N. Uversky, Yunlong Liu and the program and scientific review committee members for their high-quality timely evaluation of more than 600 full-length regular research papers, as well as an additional large set of poster submissions. We must extend our sincere thanks to all chairs, organizers and committee members (names and affiliations are listed below) for their dedications and professional services. In particular, Hamid R. Arabnia, Walker Land, Jr., Homayoun Valafar and the award committee members dedicated themselves to the unbiased evaluation and selection of the best papers, and the NSF student travel fellowships; Yanqing Zhang managed the paper submission system and handled various important organizing and academic affairs; Youping Deng handled not only registration and finance but also reviewed a large number of papers; Alex Zelikovsky, Yuehui Chen and Yufang Jin managed the overall publication matters; Jonathan Jesneck and Pengyu Hong helped local arrangements; Zejin Jason Ding, Qingzhong Liu and Bingxin Shen maintained the website. Walker Land, Guo-Zheng Li, Hamid R. Arabnia, Youping Deng, Michelle M. Zhu and Jack Y. Yang helped Scientific Review Committee Co-Chairs in the overall systematic evalutions of all reviewers' comments and ranks. Nikolaos G. Bourbakis, Michelle M. Zhu and Heng Huang helped in the overall organization of the conference and Michelle M. Zhu arranged the scientific presentations and program schedules; Jack Y. Yang initiated the organization of the 7th IEEE BIBE and guided the committees as well as managed the overall infrastructure of the IEEE conference. Mary Qu Yang and Jack Y. Yang initiated not only the journal issues but also the NSF proposals that provided funds to support students' travel; this is the first time that IEEE BIBE is now not only offering leading scientific journal issues, but also receiving grants and support from the National Science Foundation. Mary Qu Yang and Jack Y. Yang reformed the traditional IEEE BIBE with new components that are defined dynamically in response to specific needs of inter/multidisciplinary cutting-edge research and education, therefore, Mary Qu Yang and Jack Y. Yang initiated and arranged the organization of cutting-edge research workshops, tutorial lectures, special sessions and poster presentations in addition to the traditional keynote lectures. Mary Qu Yang and Jack Y. Yang took the initiatives and invested significant efforts to expand the size of IEEE BIBE from traditional 100-200 papers each year for past 6 years to more than 600 full-length regular research paper submissions this year.

The 7th IEEE BIBE committees would like to acknowledge our appreciation of the Institute of Electrical and Electronics Engineers (IEEE), IEEE Systems, Man and Cybernetics Society, IEEE Engineering in Medicine and Biology Society, the Biological and Artificial Intelligence Society (BAIS), the International Society of Intelligent Biological Medicine (ISIBM) and the National Science Foundation (NSF) for their academic supports and sponsorships, as well as the support and collaboration from the IEEE Computer Society. The 7th IEEE BIBE is 100% fully sponsored both financially and academically by the IEEE. Finally, we would like to express our sincere appreciation to the excellent professional services provided to the 7th IEEE BIBE by Elizabeth Aubrey, an IEEE officer. Once again, welcome to the 7th IEEE BIBE. We encourages participants to consider submitting proposals for workshops, special interest research sessions and tutorials in order to ensure that the conference continuously plays the leadership role in promoting inter/multidisciplinary research and education in the fields. We hope your experience at the conference center at Harvard Medical School, Boston, Massachusetts during October 14-17, 2007 would be pleasant, productive, and memorable.

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Linda Molnar, National Cancer Institute, NIH, U.S. Dept. of Health and Human Services, USA.
Eric Jakobsson, National Center for Design of Biomimetic Nanoconductors, and National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign, USA

Organizer of Workshop on Progress toward Petascale Applications in Bioinformatics and Computational Biology
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David Bader, Georgia Institute of Technology

Organizers of Workshop on Joint Research in the Southern Illinois University, University of Illinois, and Oak Ridge National Laboratory, U.S. Department of Energy, U.S.A.
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Yehuda Braiman, Oak Ridge National Lab, DOE, USA

Organizers of 7th IEEE BIBE Special Workshop - The 4th Annual University of Massachusetts Bioinformatics Conference (folded into main conference)
Georges Grinstein and Ken Marx, University of Massachusetts Lowell, USA

Organizers of Pacific Bioinformatics and Biomedical Engineering Research Workshop (folded into main conference)
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J. Paul Robinson, Purdue University, West Lafayette, USA
Andrew H. Sung, New Mexico Tech., USA
Guo-Zheng Li, Shanghai University, China

Organizer of Special Session on Sequence Alignment and Phylogenetic Analysis.
Mark Clement, Brigham Young University, USA

Organizers of Special Session on DNA Microarray Data Analysis.
Chris Ding, Lawrence Berkeley National Laboratory and University of California, USA
Heng Huang, University of Texas at Arlington, USA

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Organizers of Special Session on Bio-Medical Soft Computing
Qingzhong Liu, Srinivas Mukkamala and Andrew H. Sung, New Mexico Tech., USA

Organizers of Special Session: Developing Algorithms for Solving Problems in Molecular Biology and Bio-Medicine.
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Saurabh Sinha, University of Illinois at Urbana-Champaign, USA

Organizer of Special Session on High-throughput Data Analysis for Genomics and Proteomics.
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Organizers of Special Session on Evolutionary Systems Biology.
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