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Volume 20

BIOMEDICAL ENGINEERING TOWARDS THE YEAR 2000 AND BEYOND

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Edited by
**H.K. Chang
Y.T. Zhang**



PART 2/6 : Medical Imaging and Image Processing, Developing Areas

Theme 2 : Imaging and Image Processing
Theme 12 : Developing Areas

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- City University of Hong Kong
- The Chinese University of Hong Kong
- The University of Hong Kong
- The Hong Kong Polytechnic University
- The Chinese Society of Biomedical Engineering
- Hong Kong Hospital Authority

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ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY
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Greetings to all delegates and guests,

On behalf of the IEEE-Engineering in Medicine and Biology Society, it is my honor and pleasure to welcome you to our 20th Annual International Conference.

I am excited that this meeting, our first in Asia, will be in the vibrant and exciting city of Hong Kong and its spectacular Conference Center. This venue reflects the growing contributions our Asian members are making to the EMBS. It also emphasizes the society's commitment to providing service to members wherever they reside.

A major objective in coming to Hong Kong was to provide a forum for interaction between Asian scholars and colleagues from around the world. Consequently, I am delighted that the technical program incorporates so many presentations from China, Japan, Korea, Australia and other Asian countries while at the same time maintaining a strong representation from Europe and North America.

The key to the success of any conference is the talent, enthusiasm, and hard work of the local organizing committee. The Hong Kong Organizing Committee, under the able leadership of Dr. H.K. Chang, has done an admirable job of mounting an International Conference that nevertheless will have a strong flavor of Hong Kong. The Technical Program Chair, the indefatigable Dr. Y. T. Zhang, has developed an exciting and truly international set of workshops, mini-symposia and technical sessions.

The EMBS also greatly appreciates the assistance and support of our two technical co-sponsors-The Biomedical Division of the Hong Kong Institution of Engineers and The Chinese Biomedical Engineering Society - and the cooperation of the Hong Kong Hospital Authority. We also wish to acknowledge with gratitude grants in support of the conference from the National Science Foundation of the USA, the K.C. Wong Education Foundation and the Croucher Foundation.

I am certain that the meeting will be a great success - both as a technical event and as a cultural experience. Enjoy your time in Hong Kong; I am sure that it will be memorable.



Robert E. Kearney,
President,
IEEE-EMBS
October, 1998.



PREFACE



The proceedings of the 20th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS'98) form the archival record of recent advances in biomedical engineering. This year's proceedings consist of six parts, each of which contains papers in related subject areas. Approximately 930 papers by more than 2,520 authors from 46 countries have been contributed to the proceedings of this historical conference. In addition to traditional research areas of strength such as cardiovascular systems, biomedical signal processing and modeling, neuromuscular systems, and medical imaging, the 1998 proceedings cover increasing activities in current research areas of interest such as biosensors, cellular and tissue engineering, brain and neural engineering, and biomedical informatics.

The EMBS'98 conference theme "Biomedical Engineering Towards The Year 2000 And Beyond" is evident not only in the keynote lecture by Dr. Robert Plonsey but throughout the program. The scientific program this year consists of 130 sessions on a broad range of subjects, 13 mini-symposia, 9 special sessions, 6 workshops, 1 panel discussion, and about 25 scientific/commercial exhibits.

We would like to take this opportunity to thank the theme and track chairs, the members of the conference committees, the reviewers, the special session chairs, the mini-symposia organizers, animators, and all authors, who have contributed mightily to the success of the EMBS'98 conference. Special thanks go to the conference secretaries and volunteers, Carmen Wong, Vivienne Shuet, Ellen Ko, Joanne Yam, D. Chen, and Alice Chan for their dedicated efforts.

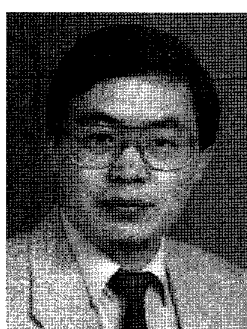
We hope you would find the EMBS'98 to be technically stimulating and socially exciting experience for you all. Enjoy the conference and the work presented in the proceedings.



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Second	1980	Washington, DC		Lee Ostrander
Third	1981	Houston, TX		Bernard Cohen
Fourth	1982	Philadelphia, PA		Alfred Potvin
Fifth	1983	Columbus, OH		Glen Gerhard
Sixth	1984	Los Angeles, CA	Walter Welkowitz	
Seventh	1985	Chicago, IL	Barry Feinberg	James Lin
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Ninth	1987	Boston, MA	Ronald Newbower	Kenneth Foster
Tenth	1988	New Orleans, LA	Cedric Walker	Gerald Harris
Eleventh	1989	Seattle, WA	Francis Spelman	Yongmin Kim
Twelfth	1990	Philadelphia, PA	Banu Onaral	Peder Pedersen
Thirteenth	1991	Orlando, FL	Joachim Nagel	William Smith
Fourteenth	1992	Paris, France	Swamy Laxminarayan	Robert Plonsey
			Jean-Louis Coatrieux	Jean-Pierre Morucci
Fifteenth	1993	San Deigo, CA	Andrew Y.J. Szeto	Rangaraj Rangayyan
Sixteenth	1994	Baltimore, MD	Gideon Kantor	Murray Eden
Seventeenth	1995	Montreal, Canada	Fernand Roberge	Robert E. Kearney
Eighteenth	1996	Amsterdam, The Netherlands	Herman Boom	Wim Rutter
			Charles J. Robinson	Michael Neuman
Nineteenth	1997	Chicago, IL	Robert Jaeger	Gyan Agarwal
Twentieth	1998	Hong Kong SAR, China	H.K. Chang	Y.T. Zhang
			Andrew Y.J. Szeto	Rangaraj M. Rangayyan
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