

CURRICULUM VITAE

September, 2006

NAME: Joseph D. Bronzino

OFFICE ADDRESS: Trinity College, Department of Engineering
Hartford, Connecticut 06106 Office Phone: (860) 297-2224

DEGREES: BSEE - Worcester Polytechnic Institute - 1959
MSEE - U.S. Naval Postgraduate School - 1961
Ph.D. EE - Worcester Polytechnic Institute - 1968

CAREER RESUME

2000-Present President Biomedical Engineering Alliance and Consortium (BEACON)

1997-2000 Director Biomedical Engineering Alliance for Central Connecticut (BEACON)

1990-Present Cooperating Staff. Boston University Medical School.

1977-Present Vernon Roosa Professor of Applied Science: An endowed chair at Trinity College.

1975-Present Full Professor, Engineering Department, Trinity College, Hartford, Connecticut.

1969-2000 Director and Chairman of Biomedical Engineering Program, The Hartford Graduate Center,

1968-1990 Cooperating Staff, Worcester Foundation for Experimental Biology, Shrewsbury, MA

1982-1990 Chairman, Department of Engineering and Computer Science, Trinity College, Hartford, CT

1971-1977 Clinical Associate, Department of Surgery, University of Connecticut Health Center,

1968-1975 Associate Professor, Engineering Department, Trinity College, Hartford, Connecticut.

1967-1968 National Science Foundation Faculty Fellow, Worcester Foundation for Experimental Biology, Shrewsbury, Massachusetts.

1966-1967 Assistant Professor, Electrical Engineering, Univ. of New Hampshire, Durham, NH

1964-1966 Instructor, Electrical Engineering, University of New Hampshire, Durham, New Hampshire.

1963-1964 Central Office Engineer, New York Telephone Company, Bronx, New York.

1959-1961 Instructor, Electrical Engineering, U.S. Naval Postgraduate School, Monterey, California.

MILITARY

SERVICE: U.S. Army Signal Corps, 1961-1963, 1st Lt.

ADMINISTRATIVE EXPERIENCE

2000 - Present President Biomedical Engineering Alliance and Consortium (BEACON).

On December 1, 2000 BEACON was incorporated as a non-profit (5013c) entity. At the inauguration appointed President by the nine member BEACON Board of Directors. The mission of BEACON is to encourage collaborative research, stimulate industrial partnering and facilitate the development of incubating companies.

1997 - 2000 Director of Biomedical Engineering Alliance for Connecticut BEACON

In 1996 initiated collaborative regional BME program which includes the University of Hartford, Trinity College, the Hartford Graduate Center, the University of Connecticut and the University of Connecticut Health Center. Submitted preliminary grant to the Whitaker Foundation on 3/31/96. Admitted to second phase of the grant process. Final proposal was submitted 8/1/96. Whitaker Foundation award of \$1 Million was granted January 1, 1997 to establish a Biomedical Engineering Alliance for Central Connecticut (BEACON). As a result, the Clinical Engineering Internship program which presently involves Hartford Hospital, the Dempsey Hospital, the Baystate Medical Center (in Springfield), the Yale/New Haven Hospital and NOVAMED/Bridgeport Hospital was transferred from HGC to the University of Connecticut. Appointed as a Professor-in-residence at the University of Connecticut (1997 - present) and Director of the Clinical Engineering Internship program (1997 - 2000).

1969 - 2000 Director of Biomedical Engineering and Clinical Engineering Internship Programs

Director of Biomedical Engineering Program, Trinity College - Hartford Graduate Center 1969-2000. Responsible for curriculum development and implementation of educational objectives for an interdisciplinary, interinstitutional, graduate program in biomedical engineering, as well as the selection of faculty and advising students in the program. Initiated "Clinical Engineering Internship" in the region of greater Hartford area in 1974 and, active in stimulating regional approach to interdisciplinary education. Because of the interdisciplinary nature of this program, this responsibility also involved coordinating the activity of students in the program within participating medical institutions as they became engaged in various research projects. In the process it has been possible to cooperate with The University of Connecticut Medical School, Hartford Hospital, the Saint Francis Medical Center, the Baystate Medical Center, Bridgeport Hospital and Yale/New Haven Hospital to develop courses of common interest, such as the establishment of continuing education courses for clinical engineers and health professionals (i.e. physicians and nurses). This program also received a grant of \$100,000 from the Stone Foundation, for five years (1979-1983). The program was transferred to the University of Connecticut in 1997 (see above).

1982 - 1990

Chairman of the Department of Engineering and Computer Science, Trinity College, Hartford, Connecticut. Initiated the development of a long range plan for programs in electrical, mechanical, and biomedical engineering, as well as computer science involving faculty, students and alumni in the process. Long range plan was completed June 1, 1982 and submitted to the president of the College. Involved in the proposal to the Pugh Foundation for \$400,000 to renovate the Hallden Engineering Laboratory. Received funds September, 1982 and renovation was completed September, 1983. Developed proposal for Computer Science major which was implemented fall of 1985 and Computer Coordinate major in 1987. Played major role in planning for a new academic building for Engineering and Computer Science which was completed January 1990.

June 1, 1981 - 1994 University of Connecticut Health Center (UCHC)

Managerial and Computing Consultant to the office of the Executive Director of University of Connecticut Medical School. Chairman of Task Force established at the UCHC to evaluate existing financial management information systems and initiate design for an optimal system. Specific responsibilities for the Task Force included: (1) gain an in-depth knowledge of present system, (2) identify short-comings and make specific recommendations for short-run change to present system, and (3) prepare recommendations and specifications for an optimal financial management system. In October 1981, phase I of this project was completed and a report submitted to Dr. James Mulvihill, Vice President of UCHC. This report included the status of present systems and recommendations for the process for development of an on-line financial operating system. Phase II, an intensive investigation of existing software packages and the development of a request for proposal (RFP) was undertaken during the summer of 1982. The RFP was released November 1982. Evaluation criteria were established during spring of 1983 and final recommendations made to Dr. Mulvihill July 1983. Implementation of financial accounting system (FAS) was completed July 1, 1984. The next phase consisted of developing plans to optimize user accessibility to FAS and facilitating office automation in fiscal services and facilities

management. As a result, information flow in accounts payable and payroll departments was enhanced and software packages developed on personal computers to automate various clerical functions within these departments throughout 1986 and into 1987. System analysis of information flow in the departments of Facilities Management and Affirmative Action took place in 1987 and 1988. From 1989 to 1994, efforts involved the design and development of a space inventory and project management system. Since January, 1994 have been instrumental in establishment of the Children's Health Care Network in greater Hartford, and served as liaison for CIO at UCHC. This system was completed and operational in 1994.

January 1981 - June 1981 UCHC

As part of my sabbatical leave experience, served as an Administrative Assistant to Associate Executive Director (Mr. James Leming) of the University of Connecticut Health Center in Farmington, Connecticut. In this capacity responsible for managerial review of the Public Safety Division, involved in the initial planning for the development of a financial management system at the Health Center, and the implementation of the recommendations made in reviewing activities of the Physical Plant Department. Exposure to administrative tasks at the highest levels of operation of the Health Center was an important part of this activity.

January 1980 - December 1980 UCHC

Project manager - responsible for the managerial review of the Physical Plant Department of the University of Connecticut Health Center in Farmington, Connecticut. Coordinated activities of staff of the Physical Plant Department and consultants from Arthur Andersen. The scope of this study involved the establishment of an appropriate mission statement, review of managerial accounting procedures, personnel utilization, etc. Report was completed November, 1980.

1985 - 1988 Aetna

Educational consultant to the Aetna Institute. Involved in the formulation of long range plans to restructure curricular design based upon Company needs. Developed and delivered an Aetna Institute course entitled "Problem Solving and Decision Analysis." Involved in developing specific cases designed to focus on modern managerial techniques (such as the utilization of critical success factors, long range planning, etc.).

1982 - 1985 IEEE

Served as President (1984-1985) and as Vice President - Technical Activities (1982-1984) of IEEE-EMBS. Was responsible for the development of a long range plan for the society services. This plan was completed and approved by ADCOM in September, 1984. As President, initiated the first international meeting of EMBS held in Chicago 1985.

1973 - 1978

Regional Director of IEEE-EMBS (5 years) Region I. Responsible for the formation of a temporary regional council. Involved in the establishment of a permanent position with a voice in the proceedings of the administrative committees (ADCOM) of IEEE.

1964 - 1967 University of New Hampshire

Assistant Director Engineering Design and Analysis Laboratory (EDAL) (3 years) University of New Hampshire. Responsible for administrative services provided by EDAL to participating faculty members. The focus of EDAL's activity was primarily "ocean engineering". EDAL's task was to solicit funds, coordinate activity of faculty from various departments, advise students and supervise various interdisciplinary projects.

AWARDS AND HONOR SOCIETIES

1. National Science Foundation, Science Faculty Fellowship, 1967-1968
2. The Skull (Senior Honor Society, Worcester Polytechnic Institute)
3. Tau Beta Phi
4. Eta Kappa Nu
5. Sigma Xi
6. Fellow IEEE – 1991
7. Fellow AIMBE – 1991
8. Honorary Member Italian Experimental Biological Society – 1998
9. Honorary Member, Strathmore's "Who's Who-1999"
10. IEEE Millennium Award, EMBS – 2001
11. Distinguished Professional Development Award ACCE -- 2002

MAJOR FIELDS OF TEACHING AND RESEARCH ACTIVITIES

1. Electrical Engineering - Signal analysis concepts and applications. Computer technology - design and application. Utilization of spectral analysis techniques to investigate signals in noise. Development of computer/instrumental interfaces for a variety of biomedical and clinical applications. Employment of computer simulation techniques, utilizing both analog and digital computer systems, to develop an understanding of the behavior of physical or biomedical systems.
2. Biomedical Engineering - Application of specific electrical engineering techniques (signal analysis, systems analysis, computer processing, instrumentation development) to specific biomedical problems. To date, these problems have included nuclear instrumentation, development of "eye physiometer" for clinical ophthalmologists, non-invasive measurement of pulmonary gases, quantification of the EEG, automatic sleep state scoring, automated clinical chemistry laboratories, ECG interpretation, automation of the medical record, development of an expert system to monitor the drug treatment of psychiatric patients, development of sleep apnea instrumentation, and creators of virtual instruments.
3. Neurophysiology - Basic neurophysiological concepts involved in identifying specific neural circuits associated with specific functions of the brain. For example, neurophysiological substrates associated with the generation of theta rhythm in the hippocampal EEG, and of sleep and waking; electrical and chemical mapping of hypnogenic circuits; identification of neuronal circuits associated with pain modulation. Since 1966 have developed and utilized signal analysis techniques to quantify the EEG effects of such insults as pharmacological manipulations, protein malnutrition and aging. Involved in quantifying measures of hippocampal synaptic plasticity induced by long term potentiation and kindling during maturation in normal animals as well as those subjected to prenatal protein malnutrition and neonatal isolation.

RESEARCH SUPPORT

1. National Science Foundation, Grant BES 0074530 "Ontogeny of frequency-dependent hippocampal synaptic plasticity in freely moving rats."
\$196,900 September 1, 2001 - August 31, 2004
Supplement \$ 69,691 September 1, 2004 – August, 2005
2. Connecticut Innovations Inc. (CII), Yankee Ingenuity Award "Encapsulation of islet cells for the treatment of diabetes."
\$199,779 October 1, 1999 - September 31, 2001
3. Donaghue Foundation Grant "Oversight of cardiovascular engineering projects: Patient-based investigation of aortic aneurysm mechanics and nanofabrication for cardiovascular tissue engineering."
\$340,291 September 1, 1999 - August 31, 2001
4. National Science Foundation, Grant BES-9618935 "Ontogeny of frequency dependent plasticity in the hippocampal dentate gyrus."
\$186,890 September 1, 1997 - August 31, 2000
5. Donahue Foundation Grant, "Fetal Malnutrition, Neonatal Isolation and Brain Plasticity."
\$272, 640 January 1, 1998 - December 31, 1999
6. National Institute of Health, AREA Grant #1R15NS/OD35287 "Hippocampal Neuroplasticity of Infant Stress."
\$120,000 June 1,1996 - May 31, 1998
7. National Science Foundation, Grant BES-9509117 "Bispectral and Paired Pulse Analysis of the Ontogeny of Hippocampal theta Rhythm in the Freely Moving Rat."
\$81,250 June 1, 1996 - August 31, 1997
8. National Science Foundation, Grant BCS-9208128 "Ontogeny of Modulation of Dentate Granule Cell Excitability in the Freely Moving Rat."
\$191,051 September 1992 - February 28, 1996
9. National Science Foundation, Grant BCS-9010616 "Ontogeny of Modulation of Dentate Granule Cell Excitability in the Freely Moving Rat."
\$120,940 August 1, 1990 - January 31, 1992
10. National Institutes of Health, Grant 1 PO1 HD225 539-01 "Fetal Protein Malnutrition and Mental Retardation."
 - a.) \$225,000 (Direct Costs) September 1987 - August 31, 1990
 - b.) \$240,000 (Direct Costs) December 1, 1990 - November 31, 1993
extended funding to July 1, 1994
 - c.) \$180,000 (Direct Costs) December 1, 1994 - November 31, 1998
11. Principal Investigator, National Institutes of Health Grant 1 R15NS24135-01A1. "Microcomputer-based Analysis of Hippocampal Unit Activity."
\$49,880 (Direct Costs) August 1987 - July 31, 1989
12. Principal Investigator, Connecticut High Technology Research and Development Grant. "Respiration Monitor for Patients at Risk."
\$120,625 June 1987 - August 31, 1988
13. Principal Investigator, National Science Foundation Grant E41688416708. "Cellular Bases of Hippocampal EEG."
\$123,4634 August 1, 1985 - July 31, 1987

14. Principal Investigator, National Science Foundation Grant #ECS8118440. "Neuronal Mechanisms Involved in Sleep-Waking Oscillation."
\$145,596 April 1982 - March 1985
15. Principal Investigator, National Institute of General Medical Sciences Grant GM27226-01 "Brain Stem Mechanisms Involved in Pain Modulation."
\$198,000 January 1980 - December 31, 1983
16. Principal Investigator, National Science Foundation Grant ENG77-04271. "Neuronal Mechanisms Controlling Cortical EEG Synchronization and Slow-Wave Sleep."
\$88,000 July 1977 - July 1980
17. Principal Investigator, National Science Foundation Grant GK-41123 "Mechanisms Controlling EEG Synchronization."
\$36,000 December 1973 - May 1976
18. Principal Investigator, Connecticut Research Commission Grant 28807 "Investigation of Neural Feedback System in the Brain Stem Regulating the Sleep Waking Process."
\$14,620 June 1970 - September 1971
19. Co-principal Investigator, National Science Foundation Grant "COSIP" Biotelemetry - EEG Activation Project.
\$23,820 June 1970 - December 1973

RESEARCH ASSIGNMENTS

The Worcester Foundation for Experimental Biology, participating investigator, NIMH Grant MH-02211 to Dr. Peter Morgane, Investigation of the Neural Circuitry of Sleep-Waking Process - Utilization of Signal Analysis Techniques to Quantify Changes in EEG, 1968-1973.

The Worcester Foundation for Experimental Biology, consulting research associate for Program Project Grant PI, Dr. O. Resnick, "Effect of Protein Malnutrition of the Developing Brain," 1972-1985; 1985-present serving as Co-PI, Neurophysiology Division of Program Project at Boston University Medical School. PI, Janina Galler.

The University of Connecticut Medical School, Clinical associate to Dr. O'Rourke, Director of Ophthalmology, "Nuclear Instrumentation Applications and Computer Analysis of Intraocular Dynamics", 1971-1977.

The Institute of Living, Hartford, Connecticut, research associate, Computer Analysis of Human EEG, 1968-1986. Development of expert system to monitor drug treatment of psychiatric patients 1987-1996.

The Hartford Primary Care Consortium, technical manager of the design and development of the Children's Health Care Network (CHN) for the pediatric community 1994-2000.

TRAINING GRANT PROGRAMS

Preceptor, National Institute of Mental Health Training Program in Neurobiology, The Worcester Foundation for Experimental Biology, April 1, 1970-1974.

PROFESSIONAL ACTIVITIES

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| (1) | <u>Licensed Professional Engineer State of Connecticut</u> | 1974-present |
| (2) | <u>IEEE Activities</u> | |
| | a. Chairman of IEEE Connecticut Group of Engineers in Medicine and Biology | 1970-1974 |
| | b. Appointed Senior Member of IEEE | 1974-present |
| | c. Regional Director - Region I of IEEE Group of Engineering in Medicine and Biology | 1973-1978 |
| | d. Member Finance Committee-IEEE Headquarters, NY | 1978-1980 |
| | e. Member Signal Processing and Information Handling Committee - IEEE/EMBS | 1978-1984 |
| | f. IEEE-ECPD Ad Hoc Visitor | 1979-1985 |
| | g. Chairman Education Committee - IEEE/GEMB | 1980-1984 |
| | h. Elected Ad Com Committee | 1981-1987 |
| | i. Elected Vice President Technical Activities - EMBS | 1982-1984 |
| | j. <u>President IEEE-EMBS</u> | 1985-1986 |
| | k. Chairman of IEEE Health Care Engineering Policy Committee | 1986-1990 |
| | l. Chairman of IEEE Technology Policy Council | 1990-1993 |
| | m. Program Co-Chair World Congress 2000 | 1999-2000 |
| (3) | <u>ASEE Activities</u> | |
| | a. New Engineering Educator Delegates Committee | 1969-1974 |
| | b. Urban and Environmental Curricula Committee | 1970-1971 |
| | c. Ocean Engineering Committee | 1972-1973 |
| | d. Executive Committee of the Biomedical Engineering Division of ASEE | 1973-1983 |
| | e. Vice Chairman of Career Development | 1974-1976 |
| | f. Vice Chairman of Professional Development | 1976-1977 |
| | g. Newsletter Editor of BME Division | 1977-1979 |
| | h. Chairman-Elect of BME Division | 1979-1980 |
| | i. <u>Chairman of BME Division</u> | 1980-1981 |

SOCIETY MEMBERSHIPS

1. Institute of Electrical and Electronics Engineers (Fellow)
2. American Society for Engineering Education
3. American Association for the Advancement of Sciences
4. Society for Neuroscience
5. American Institute for Biological Engineering (AIMBE) - Fellow
6. American College of Clinical Engineering (ACCE) - Fellow

COMMUNITY ACTIVITIES

- | | | |
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| (1) | Member Rotary Club of Simsbury | 1971-1992
1973-secretary of club
1974- <u>president of club</u> |
| (2) | Member District 789 Rotary
Foundation Committee | 1978-1981 |
| (3) | Town Planning Commission | elected 1976-1981 |
| (4) | Board of Directors-Camp Fire Girls | 1977-1979 |
| (5) | Scientific Adviser Connecticut Science Museum | 1985-1990 |
| (6) | Governor's High Tech Committee
Greater Hartford Chamber of Commerce | 1984-1990 |
| (7) | Connecticut Academy of Science and
Engineering (CASE) - Biotechnology
Task Force Director | 1996-1997 |

BOOKS PUBLISHED

1. TECHNOLOGY FOR PATIENT CARE: Applications for Today, Implications for Tomorrow.

Published by C.V. Mosby Publishing Company, St. Louis, MO
July 1977

This text provides an introduction to the impact technology has had in health care in the past, highlights some of the major applications in current use, and explores the consequences of these technological innovations in the future. Topics include:

- I. Evolution of the Modern Health Care System and the Discipline of Biomedical Engineering.
- II. Technology utilized to assist patients in cardiac or pulmonary distress.
- III. Computers and Patient Care.
- IV. Non-invasive testing - covering the fields of nuclear medicine, diagnostic ultrasound and
- V. Biofeedback - basic concepts and methodology.
- VI. Principles of Electrical Safety.
- VII. The Moral and Ethical Aspects of Technology in Medicine.

2. COMPUTER APPLICATIONS FOR PATIENT CARE

Published by Addison Wesley Publishing Company, Menlo Park, California
May 1982

This text provides an introduction to the computer and its utilization in patient care. It presents basic concepts in the hardware and software aspects of computer operation and explains in depth its use in particular clinical areas. Topics include:

- I. Evolution of Computing Technology
- II. Inside The Computer - Hardware and Software
- III. Computers in the Clinical Laboratory
- IV. Automated Multiphasic Health Testing
- V. Automation of the Medical Record
- VI. Computerized Diagnostic Support Systems
- VII. Computerized Patient Monitoring
- VIII. Medical Imaging

3. BIOMEDICAL ENGINEERING AND INSTRUMENTATION: Basic Concepts and Applications

Published by PWS Engineering, Div. of PWS Publishers, 20 Park Plaza Boston, MA 02116
1986

A comprehensive, integrated-interdisciplinary approach to understanding the modern methods used in designing, developing and applying biomedical instruments. Designed as a survey course in Biomedical Engineering and as an introductory text for Biomedical Instrumentation, Clinical Engineering or Bio-Engineering curriculums, the book is also appropriate for professionals in hospitals, medical schools and societies. Topics include:

- I. Biomedical Engineering: An Interdisciplinary Profession
- II. Biosensors: Transducers, Electrodes, and Physiological Systems
- III. Cardiovascular Assist and Monitoring Devices
- IV. Pulmonary Assist and Measurement Devices
- V. Neurophysiological Measurements
- VI. Musculoskeletal Biomechanics: Fundamental Measurements and Analysis
- VII. Computer and Medical Instrumentation
- VIII. Basic Science and Practice of Nuclear Medicine
- IX. Principles of Diagnostic Ultrasound
- X. Radiographic and Nuclear Magnetic Resonance
- XI. The Moral and Ethical Aspects of Technology in Medicine

4. MEDICAL TECHNOLOGY AND SOCIETY: An Interdisciplinary Perspective

Published by MIT Press (New Liberal Arts Series), Cambridge, MA
1990

This book is intended to explain the technological bases of some of the most important innovations in medical technology and the economic and ethical issues associated with their development and use. It is written for the reader with little or no specialized background in either medicine, engineering, economics, or philosophy and for those who wish to become familiar with the social issues posed by the use of medical technology.

- I. Evolution of the Modern Health Care System: The Impact of Technological Development
- II. Economics of Medical Technology
- III. Ethics of Medical Technology
- IV. Cardiac Technology
- V. Critical Care Medicine
- VI. Computers in Health Care
- VII. Medical Imaging
- VIII. Contemporary Medical Technology: Major Social and Ethical Issues

5. EXPERT SYSTEMS: Basic Concepts and Applications

Monograph Series of the New Liberal Arts Program of the Alfred P. Sloan Foundation

Published by Research Foundation of State University of New York, Stony Brook, NY 11794
1990

This book was developed as a Module on Knowledge Based Expert Systems as part of the Sloan Foundation Series for the New Liberal Arts. Because the field of AI and some of its basic applications are important and need to be properly understood, this module was written to present the basic concepts underlying the general field of artificial intelligence and highlight the techniques employed in the development of knowledge-based expert systems.

- I. Artificial Intelligence
- II. Expert Systems
- III. Knowledge Representation and Inference: Basic Approaches
- IV. Building An Expert System: The Knowledge Engineering Process
- V. The Expert System Debate: Issues and Questions

6. MANAGEMENT OF MEDICAL TECHNOLOGY: A Primer for Clinical Engineers.

Published by Butterworth Publishing Co., Boston, MA
1992

The purpose of this text is to introduce and examine the functions and activities of clinical engineering within the medical environment of the modern hospital. The text is intended for use by senior or graduate level students in engineering, and others in the health-care community (administrators, clinicians, nurses, etc.) who are interested in technology management in the modern health-care system. With this in mind, the text has been organized to address those topics that will provide insight into the role that clinical engineers play in the management of medical technology.

- I. Clinical Engineering: Evolution of a Discipline
- II. Safety in the Clinical Environment
- III. Technology Management
- IV. Medical Technology: Assessment and Acquisition
- V. Codes, Standards, and Regulations
- VI. Facilities Management and Design
- VII. Management and Supervision
- VIII. Development and Operation of a Clinical Engineering Department
A Practitioner's Perspective
- IX. Computer Systems of Interest to Clinical Engineers
- X. Moral and Ethical Issues in Clinical Engineering Practice
- XI. Clinical Engineering: International Comparisons and Future Directions.

7. HANDBOOK OF BIOMEDICAL ENGINEERING, J. D. Bronzino, Editor-in-Chief

Published by CRC Press

1995

The Biomedical Engineering Handbook, the first handbook ever written for the field, contains comprehensive information on every aspect of biomedical engineering. Edited by one of the pioneers and leaders in biomedical engineering research, education, and bioethics, The Biomedical Engineering Handbook reflects the current perception of the field as one that encompasses emerging and expanding disciplines of investigation and application. It includes a complete review of the major physiological systems and presents state-of-the-art knowledge of the current and accepted practices involving bioelectric phenomena, biomechanics, biomaterials, biosensors, biomedical signal analysis, imaging, medical instruments and devices, biological effects of nonionizing electromagnetic fields, biotechnology, tissue engineering, prostheses and artificial organs, rehabilitation engineering, human performance engineering, physiological modeling, clinical engineering, medical informatics, and artificial intelligence.

8. INTRODUCTION TO BIOMEDICAL ENGINEERING, J. Enderle, S. Blanchard and J. D. Bronzino

Published by Academic Press

2000

The purpose of this text is to serve as an introduction to and overview of the field of biomedical engineering. The text is primarily for engineering students (juniors/advanced sophomores). The 20 chapters include:

1. Biomedical Engineering: A Historical Perspective
2. Anatomy and Physiology
3. Bioelectric Phenomena
4. Biomedical Sensors
5. Bioinstrumentation
6. Biosignal Processing
7. Physiological Modeling
8. Compartmental Analysis
9. Biomechanics
10. Cardiovascular Dynamics
11. Biomaterials
12. Tissue Engineering
13. Biotechnology
14. Radiation Imaging
15. Ultrasound
16. Nuclear Magnetic Resonance and Magnetic Resonance Imaging
17. Biomedical Optics and Lasers
18. Rehabilitation Engineering
19. Clinical Engineering
20. Moral and Ethical Issues

9. THE BIOMEDICAL ENGINEERING HANDBOOK (2ND EDITION), J. D. Bronzino. Editor-in-Chief

Published by CRC Press

2000

This Second Edition of the Biomedical Engineering Handbook now consists of two (2) separate volumes. This expanded set includes several completely new sections and changes to 70 percent of the chapters that were in the first edition published in 1995. As a result, it contains an updated version of the extent of the field of biomedical engineering.

10. BIOMECHANICS: PRINCIPLES AND APPLICATIONS, D. J. Schneck and J. D. Bronzino, editors

Published by CRC Press

2002

11. BIOMATERIALS: PRINCIPLES AND APPLICATIONS, J. B. Park and J. D. Bronzino, editors

Published by CRC Press

2002

BIBLIOGRAPHY

ABSTRACTS:

1. BRONZINO, J.D., R. CORELL and D. MELVIN. Full Scale Simulation of the IRLS buoy Program. NEREM Record. 194-195. November, 1967.
2. BRONZINO, J.D. Verification of Neural Pathway Between Reticular Formation and the Nucleus Tractus Solitarius. Proceedings 8th International Conference on Engineering in Medicine and Biology, Alliance for Engineers In Medicine and Biology (ACEMB), Chevy Chase, Maryland. 11:4.3. July 1969.
3. BRONZINO, J.D. Review of Neurological Control Systems by Lawrence Stark, New York: Wiley and Sons, Inc., Quarterly Review of Biology. 44:340-341. 1969.
4. BRONZINO, J.D. Gain Modification of Neural Feedback Circuit Associated with Sleep-Waking Process. Proceedings of the 23rd Annual Conference of Engineers in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 12:11.16. November 1970.
5. BRONZINO, J.D., A.W. CLEARWATERS AND C.F. STROEBEL. Automatic Sleep State Scorer. Proceedings of the 23rd Annual Conference of Engineers in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 12:17.9. November 1970.
6. MORGANE, P.J. AND J.D. BRONZINO. Direct Stimulation of the Area Postrema of Cat Brain with Serotonin. Federation Proceedings. 30:317. 1971.
7. STERN, W.C., J.D. BRONZINO, and P.J. MORGANE. Effects of Lysergic Acid Diethylamide (LSD) on Sleep and Spiking Activity in the Lateral Geniculate Nucleus (LGN) of the Cat. The Pharmacologist. 13:306. 1971.
8. BRONZINO, J.D., J. BRUSSEAU, P.J. MORGANE and W.C. STERN. Power Spectrum Analysis of Serotonin Effect on EEG of Cat. Proceedings 24th Annual Conference on Engineering in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 13:182. 1971.
9. BRONZINO, J.D., A.W. CLEARWATERS and C.F. STROEBEL. Reliability Study of Automatic Sleep State Scorer. Proceedings 24th Annual Conference of Engineering in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 13:364. 1971.
10. MORGANE, P.J., W.C. STERN and J.D. BRONZINO. Effects of Centrally Administered Carbachol on Sleep in Cats. Psychophysiology. 9:86. 1972.
11. MORGANE, P.J., W. STERN and J. BRONZINO. Effects of LSD on LGN Spike Activity and Upon Sleep-Waking Patterns in the Cat. Sleep Research, (M. Chase, Ed.), Los Angeles: Brain Research Institute. 1:70. 1972.
12. NASHESKY, L., W.C. STERN, J.D. BRONZINO, R. BESCHLE and P.J. MORGANE. Analysis of EEG Characteristics Using a Small Digital Computer. Sleep Research, (M. Chase, Ed.), Los Angeles: Brain Information Service and U.C.L.A. Brain Research Institute. 1:175. 1972.
13. BRONZINO, J.D., J. O'ROURKE AND C. MILLER. Dynamic Measurement of Clearance of Radioisotopes from the Eye. Proceedings 25th Annual Conference of Engineers in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 15:387. 1973.

14. BRONZINO, J.D., J. BRUSSEAU, W.C. STERN and P.J. MORGANE. Effect of Protein Undernutrition Upon the Visual Evoked Potential of the Rat. Proceedings of 26th Annual Conference of Engineers in Medicine and Biology. (ACEMB), Chevy Chase, Maryland. 15:387.
15. BRONZINO, J.D., J. BRUSSEAU, W.C. STERN and P.J. MORGANE. Special Fingerprints of the Vigilance States of the Cat. Proceedings of the 26 ACEMB. 405. September 30 - October 4, 1973.
16. FORBES, W.B., W.C. STERN, J.D. BRONZINO and P.J. MORGANE. Chronic Protein Malnourishment and the Development of Brain Functioning in Rats. Proceedings Neuroscience Society. 425. November 1973.
17. STERN W.C., W.B. FORBES, J.D. BRONZINO and P.J. MORGANE. Electrophysiological Effects of Protein Malnutrition During Development in the Rat. Proceedings of 81st Annual Meeting of Psychol. Assoc. August 1973.
18. BRONZINO, J.D. Internships-In-House Training. Proceedings of 2nd Annual New England Conference on Biomedical Engineering. 258. 1974.
19. BRONZINO, J.D. and R. HOWARD. A Miniature Implantable Telemeter For Measuring Body Temperature in the Rat. Proceeding of 27th Annual Conference of Engineers in Medicine and Biology (ACEMB), Chevy Chase, Maryland. 16:379. 1974.
20. D'AMATO, D., J.D. BRONZINO, C. MILLER and J. O'ROURKE. A Minicomputer System For Dynamic Radioisotope Studies In The Eye. Proceeding of 22nd Annual Meeting of the Society of Nuclear Medicine. June 1975.
21. BRONZINO, J.D., J. O'ROURKE, C. MILLER and D. D'AMATO. Methodology Required to Investigate Microvascular Dysfunction In the Eye. Proceeding of 22nd Annual Meeting of the Society of Nuclear Medicine. June 1975.
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LECTURES, SYMPOSIA, CONFERENCES

1. Conference Speaker, 46th Annual Fall Meeting of the New England Section of the American Society for Engineering Education (ASEE), New London, Connecticut. Biomedical Engineering Education. October 1968.
2. Lecturer, Mason Research Foundation, Worcester, Massachusetts. Neural Feedback Circuits. April 1969.

3. Conference Speaker, 8th International Conference of Engineers in Medicine and Biology, Chicago, Illinois. Verification of Neural Circuit Between Midbrain Reticular Formation and Nucleus Tractus Solitarius. July 1969.
4. Conference discussant, 47th Annual Fall Meeting of the New England Section of the ASEE, Boston, Massachusetts. Report of the Comments of Young Faculty members Pertaining to Engineering Education. October 1969.
5. Guest Speaker, ASEE Regional Institute for Effective Teaching, Hartford, Connecticut. Using Technology to Help Gain Objectives. April 1970.
6. Guest Speaker, Earth Day, Hartford, Connecticut. Technology and Over-population. April 1970.
7. Guest Speaker. Western New England College, Springfield, Massachusetts. Opportunities in Biomedical Engineering. April 1970.
8. Conference Speaker, ASEE Annual Meeting, Ohio State University, Columbus, Ohio. Engineering New Environments - Biomedical Engineering. June 1970.
9. Conference Speaker, 48th Annual Meeting of the New England Section of ASEE, Durham, New Hampshire. Introducing Students in the Natural Sciences to Analog Computation. October 1970.
10. Conference Speaker, 23rd Annual Conference on Engineering in Medicine and Biology, Washington, D.C. Automatic Sleep State Scorer. November 1970.
11. Guest Speaker, University of Hartford, Hartford, Connecticut. The Biomedical Engineer - The Roles He Can Play. November 1970.
12. Conference Speaker, 4th Annual Neuroelectric Conference, San Antonio, Texas. Evidence of a Neural Feedback Circuit Associated with sleep-Waking Process. March 1971.
13. Lecturer, Worcester Foundation for Experimental Biology, Shrewsbury, Massachusetts. Computer Simulation of Biological Systems. April 1971.
14. Guest Speaker, St. Joseph's College, West Hartford, Connecticut. Electrical Stimulation of the Brain. May 1971.
15. Conference Speaker, 49th Annual Meeting of the New England Section of the ASEE. Technological Courses for Non-Technical Students. October 1971.
16. Conference Speaker, 24th Annual Conference of Engineering in Medicine and Biology, Las Vegas, Nevada. Power Spectrum Analysis of Serotonin Effect on EEG of the Cat. November 1971.
17. Panel Member, 24th Annual Conference of Engineering in Medicine and Biology, Las Vegas, Nevada. Automatic Sleep State Scoring. November 1971.
18. Guest Speaker, University of New Hampshire, Durham, New Hampshire. Electrical Aspects of Biological Signals. January 1972.
19. Guest Speaker, Worcester Polytechnic Institute, Worcester, Massachusetts. Electrical Stimulation and Evoked Response Techniques. May 1972.
20. Guest Speaker, Rensselaer Polytechnic Institute, Troy, New York. Electrical Stimulation of the Brain. May 1972.

21. Conference Speaker, 25th Annual Conference of Engineering in Medicine and Biology, Miami, Florida. Dynamic Measurement of clearance of Isotopes from Eye. October 1972.
22. Conference Speaker, 1972 International Conference on Cybernetics and Society, Washington, D.C. Analyses of EEG Synchronization Using Power Spectrum Techniques. October 1972.
23. Conference Speaker, Annual New England Conference on Bioengineering, Burlington, Vermont. (1) Implantable Telemetry Devices and (2) Dynamic Analysis of EEG Using Power Spectrum Techniques. April 1973.
24. Conference Speaker, 26th Annual Conference of Engineering in Medicine and Biology, Minneapolis, Minnesota. (1) Effect of Malnutrition Upon VER of Rat and (2) Spectral Fingerprints of Vigilance States of Cat. October 1973.
25. Guest Speaker, 23rd Annual Conference of Operating Room Nurses, New Orleans, Louisiana. Engineers Penetrate the Operating Room. February 1974.
26. Guest Speaker, University of Connecticut, Storrs, Connecticut. Electrical Stimulation of the Brain. March 1974.
27. Conference Speaker, 27th Annual Conference of Engineering in Medicine and Biology, Philadelphia, Pennsylvania. A Miniature Implantable Telemeter for Measuring Body Temperature in the Rat. October 1974.
28. Guest Speaker, Worcester Polytechnic Institute, Worcester, Massachusetts. Electrical Activity of the Nervous System - The Action Potential, Evoked Responses and the Electroencephalogram. November 1974.
29. Guest Speaker, IEEE - Connecticut Group of Engineers in Medicine and Biology. Hospital Internship Program for Biomedical Engineering Graduate Students. November 1974.
30. Guest Speaker, IEEE Connecticut Chapter. Past, Present and Future Directions for Biomedical Engineering. February 1975.
31. Guest Speaker, Institute of Environmental Sciences - Connecticut Chapter. Past, Present, and Future Directions for Biomedical Engineering. January 1975.
32. Conference Speaker, Association for the Advancement of Medical Instrumentation (AA&MI). Automated Eye Physiometer for Dynamic Radioisotope Measurements of the Eye. March 1975.
33. Conference Speaker and Panel Chairman, AAMI Annual Meeting. Biomedical Engineering - The Internship Approach. March 1975.
34. Guest Speaker, Rensselaer Polytechnic Institute, Troy, New York. The Evolution of Biomedical Engineering. April 1975.
35. Conference Speaker, 22nd Annual Meeting of the Society of Nuclear Medicine. Methodology Required to Investigate Microvascular Dysfunction in the Eye. June 1975.
36. Conference Speaker, Frontiers in Education Meeting. Hospital Based Biomedical Engineering Program. October 1975.
37. Guest Speaker, Hartford Engineering Club. Evolution of a Discipline - Biomedical Engineering. January 1976.

38. Guest Speaker, Instrument Society of America - Connecticut Section. Automated Multiphasic Screening. March 1976.
39. Conference Speaker, 4th New England Bioengineering Conference. Power Spectral Analysis of Transitional Periods in Rat EEG. May 1976.
40. Guest Speaker, The Old Guard, Hartford, Connecticut. The Evolution of Technology in Health Care Delivery. October 1976.
41. Series Speaker, The Horizon's Program - Trinity College. The Doctor's Black Bag Revisited - The New Technologies in Medicine. October 1976.
42. Conference Speaker, Society for Neuroscience, Toronto, Canada. EEG Synchronization and Sleep - The Role of the anterior Raphe and the Region of the Area Postrema. November 1976.
43. Conference Speaker, AAMI Annual Meeting. How to Educate Clinical Engineers - The Internship Approach. March 1977.
44. Conference Speaker, 5th Annual New England Bioengineering Conference. Computer Applications in Patient Management - Its Impact on Medical Technology. April 1977.
45. Conference Speaker, 30th ACEMB Conference. Quantification of the EEG of the Developing Rat. November 1977.
46. Conference Speaker, Society of Neuroscience, Anaheim, California. EEG Ontogeny of the Developing Rat. November 1977.
47. Conference Speaker, 11th Asilomar Conference on Circuits, Systems and Computers. Biomedical applications Based on Electrical Engineering concepts. November 1977.
48. Guest Speaker, St. Francis Hospital, Hartford, Connecticut. CAT Scanning. January 1978.
49. Guest Speaker, University of Bridgeport. Biomedical Engineering Education. March 1978.
50. Conference Speaker, 6th Annual New England Bioengineering Conference. A Regional Model of a Hospital Based Clinical Engineering Internship Program. March 1978.
51. Conference Speaker, 6th Annual New England Bioengineering Conference. Utilization of a Computer System for Spectral Analysis of Electrical Activity in a Neural Circuit Associated with Sleep-Waking. March 1978.
52. Guest Speaker, Drexel University. The impact of Technology upon the Evolution of the American Health Care System. June 1978.
53. Keynote Speaker, International Symposium of Biomedical Engineering, University of Naples, Italy. Lectures: (1) The Impact of Technology in Health Care and the Application of Biomedical and Clinical Engineering in the United States, (2) Computers in Medicine, (3) Non-invasive Diagnostic Techniques - CAT Scanning. July 1978.
54. Conference Speaker, 31st Annual ACEMB, Atlanta, Georgia. Coherence Studies in a Neural Circuit Associated with Sleep-Waking. October 1978.
55. Conference Speaker, 31st Annual ACEMB, Atlanta, Georgia. A Regional Clinical Engineering Education Center. October 1978.

56. Conference Speaker, 7th Annual New England Bioengineering Conference. Power Spectral Analysis of EEG Development in the Rat. March 1979.
57. Guest Speaker, Drexel University. Computers in Medicine. April 1979.
58. Conference Speaker, 3rd Annual Symposium on Computer Application in Medical Care. Utilization of Power Spectral Techniques to Quantify Alternations in the EEG. October 1979.
59. Conference Speaker, Society of Neuroscience, Atlanta, Georgia. Effects of Electrical Stimulation of Area Postrema/Nucleus of the Solitary Tract upon Raphe Units in the Anesthetized Rat. November 1979.
60. Guest Speaker, Rose-Hulman Institute of Technology. Quantification of the EEG. January 1980.
61. Conference Speaker, 8th Annual New England/Northeast Bioengineering Conference. Effects of Electrical Stimulation of Area Postrema/Nucleus Tractus Solitarius of Raphe Activity and Cortical EEG in the Anesthetized Rat. March 1980.
62. Conference Speaker, 22nd Annual New England Conference of Radiologic Technologists. Imaging Modalities For Patient Care - Application for Today, Implications For Tomorrow. September 1980.
63. Conference Speaker, First Annual IEEE-GEMB Conference, Washington, D.C. Utilization of Amplitude Histograms in Quantification of EEG. September 1980.
64. Conference Speaker, Society of Neuroscience, Cincinnati, Ohio. Effect of Systemic Administration of Morphine Upon Cortical EEG of the Rat. November 1980.
65. Conference Speaker, 14th Annual Hawaiian International Conference on System Sciences. Oahu, Hawaii. Medical Information Processing In Hospitals. January 1981.
66. Guest Speaker, Greater Hartford Community College, Hartford, Connecticut. Biomedical Engineering: Its Past and Its Future. November 1981.
67. Special Lecturer, Annual Conference of the American Nursing Association (ANA), Washington, D.C. Computer Applications for Patient Care. July 1, 1982.
68. Guest Speaker, Third Annual IEEE-GEMB Conference, Philadelphia, Pennsylvania. Future Directions for Clinical Engineering. September 1982.
69. Guest Speaker, Sigma Xi Club, University of Hartford, Hartford, Connecticut. Computer applications for Patient Care. November 8, 1982.
70. Guest Speaker, 2nd Annual Northeast Regional Symposium on Technology In Medicine, Windsor Locks, Connecticut. The BMET/CE Ladder Concept. November 11, 1982.
71. Guest Speaker, Systems and Electrical Engineering Colloquium, University of Connecticut, Storrs, Connecticut. Quantification of the Electroencephalogram. December 3, 1982.
72. Guest Lecturer, St. Joseph's College, Hartford, Connecticut. Computer Applications in Medicine. March 1983.
73. Guest Speaker, 7th Annual Great Lakes Biomedical Conference. Computer Applications in Patient Care. April 1983.
74. Conference Speaker, IEEE-EMBS Annual Conference. Electrophysiological Signal Techniques. September 1983.

75. Conference Speaker, IEEE-EMBS Annual Conference. Analysis of Spectral Characteristics of Cortical and Hippocampal EEG During Development. September 1983.
76. Guest Speaker, University of Hartford, Hartford, Connecticut. Biomedical Engineering - A Continually Evolving Discipline. March 1984.
77. Guest Speaker, University of Hartford, Hartford, Connecticut. Biomedical Engineering - Future Prospects. March 1984.
78. Guest Speaker, University of Texas Medical School, Dallas, Texas. Quantification of the EEG. July 1984.
79. Conference Speaker, 6th Annual IEEE-EMBS Conference, Los Angeles, California. Lectures: (1) Multidisciplinary Team Approach in Orthopedic Medicine, (2) Clinical Engineering Education is not a Traditional Academic Experience, (3) Direct Application of 6-Hydroxydopamine to the Region of the Nucleus Tractus Solitarius - Effects on Cortical and Hippocampal EEG. September 1984.
80. Guest Speaker, Aetna Institute, Hartford, Connecticut. The Future of Educational Technology: Curriculum of the Future. October 1984.
81. Guest Speaker, University of Connecticut School of Business Administration, Center for Health Systems Management. Computer Technology and Cost Containment Policies. November 1984.
82. Conference Speaker, Northeast Conference on Bioengineering, Worcester, Massachusetts. Lectures: (1) Development of Equations to Utilize Helix in Orthodontic Wire, (2) Coherence and Phase Analyses of the Hippocampal EEG During Various Vigilance States. March 1985.
83. Guest Speaker, University of New Hampshire. Quantification of the EEG. May 1985.
84. Guest Speaker, Greater Hartford Community College, Hartford, Connecticut. Biomedical Engineering: Career Perspectives. July 1985.
85. Conference Speaker, 7th Annual IEEE-EMBS Conference, Chicago, Illinois. Coherence and Phase Analysis of Hippocampal Theta Rhythm. September 1985.
86. Guest Speaker, Columbia University Medical School. Evolution of the American Health Care System: Economic and Ethical Implications. March 1986.
87. Conference Speaker, Northeast Conference on Bioengineering Center of Spectral Mass, Yale University, New Haven, Connecticut. Measure of EEG Ontogeny. March 1986.
88. Conference Speaker, 8th Annual IEEE-EMBS Conference, Fort Worth, Texas. Quantification of EEG and Unit Activity. November 1986.
89. Conference Speaker, 8th Annual IEEE-EMBS Conference, Fort Worth, Texas. Measures of EEG Ontogeny - Spectral Analysis Approaches. November 1986.
90. Conference Speaker, 8th Annual IEEE-EMBS Conference, Fort Worth, Texas. Health Care Engineering Policy - The Role of IEEE in Government Regulation. November 1986.
91. Guest Speaker, University of Pennsylvania, Biomedical Engineering Today. March 1987.
92. Conference Speaker, 9th Annual IEEE-EMBS Conference, Boston, Massachusetts. The Role of the IEEE in Health Care Policy. November 1987.
93. Guest Speaker, University of Connecticut, Quantification of the EEG and Unit Activity. April 15, 1988.

94. Conference Speaker, 9th Annual IEEE-EMBS Conference, Boston, Massachusetts. Clinical Engineering: Educational Aspects. November, 1988.
95. Conference Speaker, 12th Annual SCAMC Conference. Washington, D.C. "Overseer": An expert system for the psychiatric hospital. November, 1988.
96. Conference Speaker, 15th Annual NE Bioengineering Conference. Boston, Massachusetts. The Paired Pulse Response: A Means of Analyzing Granule Cell Excitability. March, 1989.
97. Conference Speaker, 11th Annual IEEE-EMBS Conference. Seattle, Washington. Altered Neural Circuit Activity: Prenatal Protein Malnutrition. November, 1989.
98. Conference Speaker, 11th Annual IEEE-EMBS Conference. Seattle, Washington. Clinical Engineering Education: The Internship Approach. November, 1989.
99. Conference Speaker, Northeast Bioengineering Conference. An Investigation of Activity and Mobility Waveform Descriptions for Use in Real-Time Spike Separation Systems. College Park, PA. March 1990.
100. Conference Speaker, 1990 ASEE Annual Conference. Design and development of course material for the liberal arts student. Toronto, Ontario, Canada. June 1990.
101. Conference Speaker, 1990 ASEE Annual Conference. Medical Imaging: Economic and Technological Assessment Issues. Toronto, Ontario, Canada. June 1990.
102. Guest Speaker, Hines VA Rehabilitation Engineering Program. Chicago, IL. The Six Million Dollar Man -- Who Gets What?. April 1990.
103. Guest Speaker, University of Chicago Medical School. Chicago, IL. Who's in Charge - The Patient or the Physician?. April 1990.
104. Guest Speaker, Rensselaer Polytechnic Institute. Troy, NY. Clinical Engineering-Past, Present and Future. April 1990.
105. Conference Speaker 1990 IEEE-EMBS Conference. Philadelphia, PA. Clinical Engineer Education: The Internship Approach. November 1990.
106. Conference Speaker, 1991 ASEE Conference. New Orleans, LA. Clinical Engineering Internship. June 1991.
107. Conference Speaker, 1991 ASEE Conference. New Orleans, LA. The Field of Biomedical Engineering. June 1991.
108. Conference Speaker, 1991 IEEE/EMBS Conference. Orlando, Florida. Cross-spectrum of the rat EEG during REM sleep. November 1991.
109. Guest Speaker, University of Hartford. The Field of Biomedical Engineering. November 1991.
110. Guest Speaker, IEEE Technology Policy Symposium. Washington, DC. The Role of the Engineer in Public Policy. November 1991.
111. Conference Speaker, International IEEE/EMBS Meeting. Paris, France. Clinical Engineering: Evolution of a Discipline. October 1992.

112. Conference Speaker: International IEEE/EMBS Meeting. Paris, France. Analysis of Long-Term Potentiation in the Freely Moving Rat. October 1992.
113. Guest Speaker: University of Naples Medical School. Malnutrition and the Developing Brain. November 1992.
114. Guest Speaker: Annual Winter Conference on Neuroplasticity. Ontogeny of Long-Term Potentiation. February 1993.
115. Guest Speaker: University of Connecticut at Storrs. Electrophysiology: An Integration of Disciplines. April 1993.
116. Conference Speaker, International EMBS Conference. San Diego, CA. Who's in Charge, The Physician or The Patient? November 1993.
117. Conference Speaker: International EMBS Conference. San Diego, CA. The Role of the Engineer in Public Policy. November 1993.
118. Guest Speaker: Annual Winter Conference on Neuroplasticity. LTP: Changes in the preweaning animal. February 1994.
119. Guest Speaker: North Carolina State University. The 6 Million Dollar Man: Can We Afford It? April 1994.
120. Guest Speaker: Duke University. Who's In Charge, The Physician or The Patient? March 1994.
121. Symposium Speaker: Washington, DC. Cost of Health Care: Is Technology The Culprit? March 1994.
122. Symposium Speaker: Springfield, MA. Bioengineering -- What Does the Future Hold? June 1994.
123. Keynote Address: Effect of Prenatal Protein Malnutrition on Brain Plasticity. Ruinione Congiuta. Ischia, Italy September 1994
124. Symposium Speaker: Rio de Janeiro, Brazil World Congress on Medical Physics and Biomedical Engineering. *Clinical Engineering: Education of a Discipline and Clinical Engineering Education: The Internship Approach*. August 1994.
125. Conference Speaker: Winter Conference on Neuronal Plasticity. *Stress and LTP*. February 1995.
126. Symposium Speaker: SPIE Conference. *The Role of Technology in Health Care Reform*. May 1995.
127. Conference Speaker: International EMBS Conference. *Paired Pulse Index: Developmental Changes*. November 1995.
128. Conference Speaker: Winter Conference on Neural Plasticity. *Effect of Prenatal Protein Malnutrition on LTP in the Freely Moving Rat*. February, 1996.
129. Conference Speaker: Northeast Bioengineering Conference. *Quantitative Measures of Neuronal Plasticity*. March, 1996.
130. Guest Speaker: University of Connecticut. *Evolution of Biomedical Engineering*. April, 1996.
131. Conference Speaker: International EMBS Conference. Amsterdam, November, 1996.

132. Conference Speaker: Winter Conference on Neuronal Plasticity. *Evoked Field Responses and Neural Plasticity*: St. Lucia, February, 1997.
133. Guest Speaker: NJIT. *Moral and Ethical Issues of Medical Technology*: April, 1997.
134. Conference Speaker: IEEE/EMBS International Conference. *Ontogeny of Dentate Paired Pulse Response*: Chicago, November 1997.
135. Guest Speaker: NE Clinical Engineering Society. *BEACON: A Regional BME Program*: Sturbridge, MA, November, 1997.
136. Guest Speaker: University of Hartford. *BEACON - A Light of BME in the Region*. November, 1997.
137. Conference Speaker: Winter Conference on Neuronal Plasticity. *Paired-Pulse Index: A Measure of Dentate Granule Cell Modulation*: February, 1998
138. Conference Speaker: NE Bioengineering Conference. *Simultaneous Recording of Electrophysiological and Neurochemical Data in the Freely Moving Adult Rat*: April, 1998.
139. Guest Speaker: University of Connecticut. *BEACON: A Merger of Private and Public Institutions*: April, 1998.
140. Conference Speaker: 20th Annual International Conference of the IEEE/EMBS. *Ontogeny of Paired-Pulse Responses in Dentate Gyrus*. Hong Kong, November, 1998.
141. Conference Speaker: Winter Conference on Neuronal Plasticity. *Effect of prenatal protein malnutrition on hippocampal plasticity*. St. Lucia, February 1999,
142. Conference Speaker: Northeast Bioengineering Conference. *Simultaneous hippocampal electrophysiological and microdialysis recording in the freely moving animal*. Hartford, March, 1999.
143. Conference Speaker: IEEE/EMBS Conference. *"Transition from LTD to LTP."* Atlanta, November, 1999.
144. Conference Speaker: Winter Conference on Neuronal Plasticity. *NE increases during LTP induction*. February, 2000.
145. Guest Speaker: University of Texas at San Antonio. *Effect of Neonatal Stress on LTP in the Adult Freely Moving Rat*. April, 2000.
146. Guest Speaker: University of Stuttgart *Biomedical Engineering*. June, 2000.
147. Conference Speaker: Winter Conference on Neuronal Plasticity. *Subcortical Control of LTP Induction*. February, 2001.
148. Guest Speaker: Central Connecticut State University. *Computer Applications in Medical Care*. April, 2001.
149. Guest Speaker: University of Texas at Dallas. *How Medical Technology Changes the Patient/Doctor Relationship*. May, 2001.
150. Guest Speaker: Wesleyan University. *The Evolution of BEACON*. October, 2001.
151. Guest Speaker: Boston University. *Effect of Neonatal Stress on Hippocampal Plasticity*. November, 2001.

152. Conference Speaker: Winter Conference on Neuronal Plasticity. *Ontogeny of Frequency-dependent Hippocampal Synaptic Plasticity in the Freely Moving Rat*. February, 2002.
153. Guest Speaker: Annual Meeting of the Connecticut Academy of Science Engineering (CASE). *Evolution of Biomedical Engineering/BEACON*. May, 2002.
154. Guest Speaker: CCSU Symposium on Opportunities in Biotechnology for the Hartford Region. *Biotechnology– An Engine of Regional Economic Development*. May, 2002.
155. Guest Speaker: Drexel BME Lecture Series. *Evolution of Biomedical Engineering and BEACON*. January, 2003.
156. Conference Speaker: Winter Conference on Neuronal Plasticity. *Quantification of LTP and LTD in the Freely Moving Animal*. February, 2003.
157. Guest Speaker: University of New Haven Lecture Series. *Evolution of Biomedical Engineering and BEACON*. March, 2004.
158. Guest Speaker: New Jersey Institute of Technology Lecture Series. *Evolution of Biomedical Engineering and BEACON*. April, 2004.
159. Guest Speaker: CIBA Annual Meeting. *Technology Outlook for the Future of Connecticut*. September, 2004.
160. Guest Speaker: University of Hartford Lecture Series. *Evolution of Biomedical Engineering and BEACON*. September, 2004.