



## History of Biomedical Engineering at Rensselaer

### Introduction

This essay provides a brief record of the founding and early activities of Biomedical Engineering at Rensselaer. Activities that would today be called biomedical engineering began in the 1950's. But there were no formal academic programs in the discipline until the 1960's when Rensselaer began to recognize the need for formal training in the field. The first undergraduate degree in Biomedical Engineering was awarded in 1967, making it one of the oldest programs of its kind in the US, and the center of Biomedical Engineering, which later formed the Department of Biomedical Engineering, was formally established in 1974. This essay provides some detail about these efforts.

### Original Participants and Structure

The BME effort at Rensselaer was begun by Dean Arthur Burr in the mid-1960's. He established a "curriculum" under the auspices of the Environmental Engineering Department. Burr named Steven F. DiZio, a chemical engineering Ph.D. from RPI as Assistant Professor and Chairman. Early BME students were recruited primarily from Biology or Chemical Engineering. Also in 1968, Gerald S. Moss, MD, Ph.D., a practicing surgeon in Albany and Biochemist at Albany Medical College, was appointed as a Research Associate Professor at RPI. Dr. Moss began advising students, and graduated 14 MS students and 2 Ph.D.'s before 1975. He was an energetic and independent individual whose activity never became integrated with the developing academic department.

By the late 1960's, a collaborative research project with the Albany Medical College began to change the focus of BME. In 1966, Albany Medical College received a grant entitled "On-Line Computer Study of Therapy for Human Shock" from the National Institutes of Health. The grant funded a one-bed research "Trauma Unit" at AMC for the next 22 years. Three Rensselaer researchers were integral to that effort, starting a long-standing relationship between RPI and Albany Medical Center (AMC).

Dr. Samuel R. Powers Jr., a surgeon at Albany Medical Center, was the principal investigator of the grant. He enlisted the collaboration of three Rensselaer faculty - Profs. David G. Gisser, Edward J. Smith and Rob J. Roy, all from the Electrical Engineering Department. The Center for Research and Development of General Electric, in Niskayuna, also played a lesser role in that project. In these years, Rensselaer students advised by these faculty earned degrees, primarily in Electrical and Computer Engineering.

One of these students, Jonathan Newell, completed his Master's Degree in 1968 and took a job in Massachusetts for a year. He was recruited by Dr. Roy in 1970 to return to AMC to run the daily technical operations of the Trauma Unit. Newell spent two years working at the bedside of critically-ill patients in the Trauma Unit and then returned to student status to complete his doctorate at Albany Medical College. Shortly after graduating in 1974, he was hired by Rensselaer as its first full-time Biomedical Engineering faculty member.

Another early leader was Dr. Wayne G. Custead, a metallurgist with extensive experience at Esso Research and Engineering. He joined the Trauma Unit as a post-doctoral fellow supported by NIH, and had a major role in helping to define the academic program of BME at RPI. He also earned a second Ph.D. in Biomedical Engineering from RPI in 1972.

Custead was instrumental in obtaining a grant from the Surdna Foundation to support the development of a curriculum in Clinical Engineering. That was the new term that had been invented to describe those engineers trained to work in the clinical environment, and to bridge the technical gap to the practice of medicine.



The first faculty to join the department were professors in other RPI departments who were interested in biomedical engineering. These included two of the three collaborating with the Trauma Unit at AMC. In 1970, Prof. Edward Smith became Chairman of the BME group, and held this position until 1974, when the School of Engineering underwent a major reorganization. From 1970 to 1974, the biomedical engineering activities were loosely organized, but a few students did obtain Ph.D. degrees, sometimes in a short-lived organization re-named Bio-Environmental Engineering. BME was such a small activity at that time that it was administratively combined with Environmental Engineering, another new engineering field that also relied on knowledge of biology.

In 1974, the School of Engineering was reorganized under a new Dean, George S. Ansell, who created the Center for Biomedical Engineering. It was one of three Centers which reported directly to the Dean, but were too small to be granted full Department status. Dr. J. Lawrence Katz, a Professor of Physics at Rensselaer, was named Director of the Center.

### Facilities

The BME Center was originally located in North Hall with laboratories in nearby Blaw Knox I. When the Jonsson Engineering Center was completed in 1977, the Biomedical Engineering Teaching Laboratory and the research labs were moved to the top floor of the new building. The building had provisions to conduct experiments on dogs and other animals, and the top floor was thought to be a less visible site. Animal work in an engineering school was very rare at that time. An Animal Facility was built at Blaw Knox I and II in 1970, was licensed by the State, and was accredited by the Association for Assessment and Accreditation of Laboratory Animal Care throughout its existence. Dogs were used in the teaching lab until about 2000.

### Personnel

Starting in 1974, the Center grew slowly. New hires included Prof. Allen Zelman in 1975, Lee Ostrander, an electrical engineer in 1976, and then John Brunski, a mechanical engineer in 1977. Also in 1975, Prof. Paul Daitch, an experienced engineering educator, transferred from another RPI department to BME. In 1981, Prof. Rena Bizios, an MIT graduate joined the Department, and became the first faculty who had been trained in Biomedical Engineering. She quickly established a successful research program and brought tissue engineering and biomaterials aspects to the department. Prof. Rob Roy returned to RPI, after a leave of absence to earn an MD degree at AMC, and established a research lab in Biomedical Engineering in 1976. He became Chairman of Biomedical Engineering in 1985, when J.L. Katz left to become a Dean at Case-Western Reserve University. Prof. Roy took an early retirement in 1994, and Prof. Robert Spilker, a Professor of Mechanical Engineering and long-time colleague of John Brunski, was appointed Chairman. In 2005, Dr. Spilker resigned the chair, and Dr. Natacha DePaola, a faculty member since 1994, became the first female Department Head in the history of the School of Engineering.

It may be useful to note here that since its inception, the Center and later the Department of Biomedical Engineering enrolled comparable numbers of female and male students at both the undergraduate and graduate levels. This is in stark contrast to the SoE as a whole, where men have outnumbered women by two or three to one.

### Curriculum

The early BME Curriculum had several “core” courses required of all undergraduates, and four “options”, allowing students to focus on their individual interests. The BME Lab course and the Human Physiology and Advanced Human Physiology courses were required of all. The lab course





started as a single semester, but soon grew to both semesters. It was developed by Profs. Newell and Gisser, and was characterized by experiments covering a wide assortment of different disciplines and techniques. Human Physiology was taught by faculty from the Biology Department, and the advanced course was taught at Albany Medical College by the Physiology Department, as a subset of the course they taught to first-year Medical Students. The objective of this arrangement was to give students a level of familiarity with the medical school, its curriculum, and the world of basic medical science.

The “options” were initially Electrical, Chemical, and Materials/Mechanics. Student enrollment was very small for the Chemical option, and it was dropped after a few years. Materials was separated from Mechanics. The Electrical option was also dropped many years later when four of the five faculty who offered it retired or resigned. It has later been re-instituted with an imaging and instrumentation focus.

Today, the Biomedical Engineering Department bears little resemblance to its earliest days. In the late 1960’s, the technology of health care and of biomedical research lagged behind that of most other technical disciplines. Specialized Intensive Care Units were a new phenomenon. The main task at that time was therefore to catch up, and bring the benefits of technology to health care and medical research. It’s now 50 years later, and that task has been done. Today’s Intensive Care Unit is filled with instruments developed in the last 50 years. The discipline has now evolved to take advantage of the explosive growth in the knowledge of the basic science of life processes. The engineering of new tissues has come to the fore, and the techniques of cell biology are being harnessed to solve medical problems at a cellular and molecular level. The Department has new facilities in the Center for Biotechnology and Interdisciplinary Studies, and is staffed by individuals hired in the last fifteen years.

### **Recent History**

The department saw a rapid expansion of faculty during the last decade when the department was led by Profs. DePaola, Vashishth, and Hahn. 15 new tenure track/tenured faculty members have been hired during this time, more than in the previous 30 years combined. The department now has 15 faculty members, approximately 400 undergraduate and 60 graduate students as well as 10 post-doctoral researchers. At the undergraduate level, the department offers concentrations in Biomaterials, Biomechanics, Bioimaging/Instrumentation as well as a pre-med option and a management minor. Research activity in the department has greatly expanded and now includes the areas of Biomolecular Science and Engineering, Biomedical Imaging, Musculoskeletal Engineering, Neural Engineering, Systems Biology and Biocomputation, and Vascular Engineering. The department is currently home to seven NSF CAREER award winners and departmental faculty serve as principal investigators on eight NIH R01s. Nine of the faculty serve as editors/associate editors of leading journals in their field and four are fellows in their professional societies.

### **Acknowledgment**

The departmental faculty want to express their thanks to Prof. Jonathan Newell for putting this history of the department together. He has been in the department from the beginning and was able to tell the history better than we could have reconstructed from documentary evidence alone. He also gratefully acknowledges the assistance of Prof. Rob Roy in reconstructing the early years.

It should be noted that this document is not intended to provide a complete history of events and personnel that have been involved in the department. However, it does attempt to capture the most important actions and players.





## Department Heads

J. Lawrence Katz	1974-1985
Rob Roy	1985-1994
Robert Spilker	1994-2005
Natacha DePaola	2005-2009
Deepak Vashishth	2009-2013
Juergen Hahn	2013-

## Tenure-track/tenured Faculty

<u>Name</u>	<u>Joined BME</u>
J. Lawrence Katz	1974
Jonathan Newell	1974
Paul Daitch	1975
Allen Zelman	1975
Lee Ostrander	1976
Rob Roy	1976
John Brunski	1977
Rena Bizios	1981
Albertus van Grondelle	1983
Robert Spilker	1984
Timothy Holmes	1989
Natacha DePaola	1994
Deepak Vashishth	1999
Wolf von Maltzahn	2002
Jan Stegeman	2002
Eric Ledet	2004
Deanna Thompson	2004
David Corr	2006
Xavier Intes	2006
James Cooper	2008
Guohao Dai	2008
Stanley Dunn	2008
Ryan Gilbert	2010
Shiva Kotha	2010
Leo Wan	2011
Juergen Hahn	2012
Mariah Hahn	2012
Ge Wang	2013

