Att. IV

Agenda Item 4.02.A.2

New Program Proposal
B.S. in Biomedical Engineering
USC-Columbia

Summary

The University of South Carolina requests approval to offer a program leading to the Bachelor of Science degree in Biomedical Engineering, to be implemented in Fall 2006.

The proposal was approved by the USC Board of Trustees on October 27, 2005, and submitted for Commission review on November 15, 2005. The proposal was reviewed with substantive discussion and voted upon favorably by the Advisory Committee on Academic Programs at its meeting on January 18, 2006.

The purpose of the program is to prepare undergraduates to meet the growing demand for advanced-level research and development, and to take advantage of entrepreneurial opportunities, in the biomedical industry. The proposed program reflects the recent emergence of a theoretical understanding and conceptual framework among researchers that biology must be considered a "core science" in the education of future generations of engineers, physicists, mathematicians, and chemists.

It should be noted that the B.S. degree in Biomedical Engineering is being proposed concurrently with a proposal from USC-Columbia to offer the M.S. and Ph.D. degrees in Biomedical Engineering. In concert, these three degree programs complement each other and provide academic continuity from the freshman year to the completion of the terminal degree. The B.S. degree provides a conceptual foundation and rigorous academic preparation for students intending to pursue graduate study in the same field. Due to the synergistic nature of these programs, their respective proposals identify, and will share, many of the same resources for program delivery, including faculty and support staff, physical plant and laboratories, and library holdings.

USC is uniquely qualified to offer this program because it is the only institution in South Carolina with both a medical school and an engineering school. The proposed program distinguishes itself in its interdisciplinary emphasis on mechanical and chemical engineering (in addition to the biological sciences), and a focus on the development of biomedical devices such as heart pacemakers,

bone and joint replacements, and kidney dialysis machines. There are no other Biomedical Engineering or Bioengineering programs in South Carolina, and although Clemson is concurrently proposing a program leading to the B.S. degree in Bioengineering, its emphasis is on biomaterials (electrical and materials engineering), a field of study distinctly different from medical devices (which emphasizes chemical and mechanical engineering). Both Clemson and USC have worked closely in the preparation of their respective proposals in order to avoid unnecessary program duplication. Regionally, similar undergraduate programs can be found at Duke University, the University of Tennessee – Knoxville, Vanderbilt University, the University of Miami (Florida), Tulane University, and Louisiana Tech University.

The proposed program has the full endorsement of Clemson and MUSC, and represents yet another dimension of biomedical research collaboration between Clemson, MUSC, and USC that has evolved and matured over the last 22 years. In 1984 the three institutions entered into the South Carolina Bioengineering Alliance, an effort to forward inter-institutional research while ensuring that programs and research projects are synergistic and not duplicative. The Alliance is recognized by both CHE and the South Carolina General Assembly. The three institutions are also part of the NIH-funded Biomedical Research Infrastructure Network, a national program designed to enhance research capacity through inter-institutional cooperation and information sharing. Finally, the proposed programs are aligned with research foci in South Carolina's Research Centers of Economic Excellence ("Endowed Chairs"), a state-funded effort to encourage economic growth through the recruitment of nationally recognized scientists and researchers.

The proposal notes that there is already a substantial demand among current and prospective students for a program in Biomedical Engineering. Projected enrollment for the proposed program is 50 students in the first year, increasing to 95 students in the second year, increasing to 135 students in the third year, and increasing to 175 students in years four and five. At its full operational capacity, enrollment is projected at 175 students per year, with 40 students graduating each year. If enrollment and program completion projections are met, the program will meet the Commission's productivity standards.

The proposed program will consist of 130 semester hours, including: general education requirements of 19 semester hours; science education requirements of 58 semester hours; biomedical engineering education requirements of 33 semester hours; and technical and biomedical engineering electives of 21 semester hours.

Twelve new courses associated with the proposed programs include: BMEN 101, 102, and 301 Professional Development and Ethics in Biomedical Engineering; BMEN 211 Modeling and Simulation of Biomedical Systems; BMEN 260 Introduction to Biomechanics; BMEN 271 Introduction to Biomaterials; BMEN 321 Biomedical Circuits and Systems; BMEN 354 Transport in Biological Systems; BMEN 361 Biomedical Measurements and Instrumentation; BMEN 390 Thermodynamics and Kinetics in Biomolecular Systems; and BMEN 427 and 428 Senior Biomedical Engineering Design.

The Accreditation Board for Engineering and Technology (ABET) is the recognized entity for the accreditation of engineering disciplines. For Bioengineering programs, ABET requires that program graduates demonstrate mastery of certain skill sets. The proposed program has been developed in accordance with ABET guidelines, and USC-Columbia expects that the process of seeking accreditation will begin with the graduation of the program's first class in 2010.

Faculty for the proposed programs will be drawn from the College of Engineering and Information Technology (Departments of Mechanical and Chemical Engineering), as well as from the College of Arts and Sciences (Biochemistry and Biological Sciences) and the School of Medicine. Five existing faculty (2.0 FTE) will be supported by the hiring of six new faculty over the next five years. The proposed programs anticipate hiring two new faculty members in the first year, and one new faculty in each subsequent year, totaling eleven faculty (5.0 FTE) in year five. One administrator (0.25 FTE) is dedicated to the proposed programs, as well as two staff members (1.0 FTE).

There are no new physical plant requirements associated with the proposed programs, though existing space may be reallocated along with the dedication of new space in the USC Research Campus which is currently under development. There will be new specialized laboratory equipment, hardware, and software needs associated with the proposed program. These expenses are estimated at $300,000 and will be met through University resources and recurring funds.

The proposal also notes that current library holdings to meet program needs are supported by an existing annual allocation of about $8,000 from the current library budget. These include access to NIH, PubMed, and Science Direct information resources, as well as 522 books and 31 periodicals in biomedical engineering and related fields. The proposal's budget includes an annual allocation of $2,500 to add books and periodicals explicitly devoted to biomedical engineering.

New costs for the program are estimated to begin at $337,500 in the first year, increasing to $460,000 in the second year, increasing to $502,500 in the third year, decreasing to $415,000 in the fourth year, and increasing to $467,500 in the fifth year. Categories of costs over the first five years of the program's implementation include faculty salaries ($850,000); graduate assistants ($350,000); a program administrator ($150,000); clerical and support personnel ($260,000); library resources ($12,500); equipment ($300,000); and other operating expenses ($100,000). Total estimated new costs for the program during the first five years will be $2,222,500.

Shown below are the estimated Mission Resource Requirement (MRR) costs to the state and new costs not funded by the MRR associated with implementation of the proposed program for its first five years. Also shown are the estimated revenues projected under the MRR and the Resource Allocation Plan as well as student tuition.

Year	Estimated MRR Cost for Proposed Program	Extraordinary (Non-MRR) Costs for Proposed Program	**Total Costs**	State Appropriation	Tuition	**Total Revenue**
2004-05	$1,081,288	**$0**	**$1,081,288**	$0	$539,183	**$539,183**
2005-06	$2,056,437	**$0**	**$2,056,437**	547,551	$1,025,631	**$1,573,182**
2006-07	$2,905,546	**$0**	**$2,905,546**	1,041,718	$1,449,702	**$2,491,419**
2007-08	$3,754,655	**$0**	**$3,754,655**	1,472,256	$1,873,773	**$3,346,029**
2008-09	$3,754,655	**$0**	**$3,754,655**	1,902,794	$1,873,773	**$3,776,567**

These data demonstrate that if the institution meets the projected student enrollments and contains costs as they are shown in the proposal, the program will not be able to cover costs in its first four years, but will be able to cover costs in year five.

In summary, USC-Columbia will offer a program leading to the Bachelor of Science degree in Biomedical Engineering. The proposed program reflects the coordinated efforts of USC and Clemson University to design, without unnecessary program duplication, an undergraduate course of study that prepares students for further research in Biomedical Engineering, as well as private sector careers with entrepreneurial companies focusing on the growing need for medical devices and related biomedical technologies.

Recommendation

The Committee on Academic Affairs and Licensing recommends that Commission approve USC-Columbia's proposed program leading to the B.S. degree in Biomedical Engineering, to be implemented in Fall 2006, provided that no additional "unique cost" or other special state funding be required or requested.