

**Committee on Educational Policy Undergraduate Program Review
Department of Bioengineering**

April 2-3, 2009
Subcommittee Report

The Undergraduate Program Review Committee for the UCSD Department of Bioengineering consists of Professor Sadik Esener (Nanoengineering, UCSD), Professor Jerome S. Schultz (Bioengineering, UC Riverside), and Professor Charles L. Perrin (Chemistry & Biochemistry, UCSD) as Chair. We met on April 2 and 3, 2009. We interviewed the Department Chair and the Vice-Chair of Undergraduate Education, various faculty, a group of Lecturers and teaching assistants, a group of undergraduate majors, the department MSO and the Undergraduate Advisors, and two College Deans of Academic Advising. We base our judgment on those interviews, on the statement of self-study provided by the department, on the statistical data provided to us by the administration, on written comments solicited from students, and on further discussion with the Chair and Vice-Chair.

STRENGTHS AND WEAKNESSES OF THE CURRENT OPERATION OF THE DEPARTMENT

ADMINISTRATIVE STRUCTURE OF THE DEPARTMENT

Bioengineering began at UCSD in 1966 as a joint program between the School of Medicine and the Department of Aerospace and Mechanical Engineering. In 1994 an independent Department of Bioengineering was established. This is the first CEP review of this department's undergraduate program.

The department is very well served by the conscientious and effective administration of Shankar Subramanian as Chair and David Gough as Vice-Chair of Undergraduate Education. A staff of 16 includes 4 who advise students, manage student support, and advise on scheduling, requirements, grades, and prerequisites.

COMPOSITION OF THE FACULTY

The department has 11 full professors (including one emeritus), 3 associate professors, 6 assistant professors, and 1 LPSOE. There are also 12 adjunct faculty and a variable number of lecturers many of whom participate extensively in the teaching, plus 16 affiliates from other departments at UCSD.

Workload and Distribution of Activity

Departmental policy is for each full-time faculty member to teach three standard lecture courses per year. Credit for courses taught by more than one faculty member is divided among the instructors. Assignments are divided between undergraduate and graduate teaching. Lower-division teaching in the department is minimal.

ENROLLMENT OF MAJORS

There are four separate tracks within the majors offered by the department: (1) Bioengineering, (2) Bioengineering: Biotechnology, (3) Bioengineering: Bioinformatics, and (4) Bioengineering: Premedical. Only the first two majors are ABET-accredited. Enrollment in Bioinformatics is shared among four departments, has few majors within Bioengineering, and obligates little involvement of Bioengineering faculty. Because of the small numbers of students, we have not concerned ourselves with this track.

Enrollment in the other three programs are subject to restrictions. The Premedical option is controlled with a pre-major that requires a minimum GPA of 3.0 in eight required courses: Math 20ABC, Physics 2AB, Chem 6A, MAE 9 or 10, and one other. Enrollments in the Bioengineering and the Bioengineering: Biotechnology options are controlled by their Impacted Status. The current agreement with CEP is to restrict enrollment to 75 per class in

each of these two majors, including the present 50 students per class, plus 10 continuing students transferring from other majors and 15 transfer students.

Substantial changes are planned. The department plans to discontinue the Bioengineering: Premedical major as soon as possible. Although it contains some engineering courses, it is not a regular engineering degree. This committee strongly supports this plan. The Premedical designation is misleading. It is the only such designation among majors at UCSD. Consequently it induces freshmen (and their parents) to choose it, often without realizing the rigor of the program and without realizing that there are other undergraduate routes to medical school, including the Bioengineering: Biotechnology major. However, some students may have chosen this pathway because of the impacted status of the other programs. If this major had been designed to attract bioengineering majors, it has now served its purposes and instead attracts unsuitable students, many of whom leave the program. Owing to the necessity of notifying high-school prospects, it is anticipated that four years will be required to phase out this major.

We note that the department plans to modify the Bioengineering major to accommodate some of the students displaced from the Premedical major. However, it will be a challenge to meet the premedical requirements while continuing to meet ABET requirements, because it will be necessary to include three quarters of organic chemistry and a quarter of laboratory.

The department plans to create a new Bioengineering major, Systems Bioengineering. This will combine the areas of electrical bioengineering, systems engineering, and neurosciences. The curriculum will be analogous to the two existing Bioengineering majors and will seek ABET accreditation. This proposal seems rather tentative at this time, but we strongly support it.

The problem of enrollment management is discussed below.

JOINT PROGRAMS OFFERED WITH OTHER DEPARTMENTS/COLLEGE

The department maintains cooperative arrangements between the Schools of Engineering, Medicine, and Management. These benefit primarily the graduate program, but it can also provide valuable internships for undergraduates. Such cooperation is to be encouraged, because the component of engineering in medicine can be expected to increase.

STRENGTH AND WEAKNESSES OF THE CURRICULUM

In the first year there is only one lower-division course, BENG 1 (Intro to Bioengineering). This is a 1-unit course where faculty present the research that is ongoing in the department. Freshmen do not have the sophistication to benefit from this class. It would be more useful to present an overview of what bioengineering is, in order to attract dedicated majors.

Students do not reach core classes in Bioengineering itself until the junior year. In their second year students take BENG 100 (Intro to Bioengineering Design), which is a useful survey, although with too much emphasis on statistics, according to some students. The Bioengineering and Premedical students take BENG 109 (Bioengineering Statics & Dynamics). Some students felt that this duplicated Physics 2A, which is a prerequisite. There was some sense that the Physics labs that accompany Physics 2B/C would be more appropriate with a laboratory more specific to bioengineering, but it is unlikely that the department can offer this. Instead of BENG 109 Biotechnology students take BENG 130 (Molecular Physical Chemistry) in their second year. Some students feel that this is too intense for one quarter, but this may be a consequence of the presence of Bioengineering students, who take this course in their fourth year.

Students claim that instructors in Biotech and Premed do not know what students in their courses have had, but this may be a consequence of students forgetting material from prerequisite courses. Students are very concerned that courses are offered only once a year. The rigidity of the schedule means that they lose time if a course is missed.

There was much dissatisfaction with split courses. They waste time in transition from one instructor to the subsequent one. They allow instructors to focus on their own research. No one instructor has responsibility for thorough coverage or for establishing the connections between topics or for avoiding repetition. The department has agreed to limit split courses to not more than two instructors, but even this seems to place faculty convenience over pedagogy.

There were various student complaints about rigid requirements for each of the separate tracks. For example, it was proposed that Biotech should have biomechanics and organismal biology, whereas Bioengineering should have fluid dynamics as an alternative to continuum mechanics and should allow Chem 6C and Organic Chemistry, which are necessary for physiology. Rather than micromanage, we suggest that the department might better organize the requirements by offering a Bioengineering major with core courses and several tracks that converge to a single coherent major, with options that allow students to choose courses to match their interests.

OVERALL ACADEMIC QUALITY, AS COMPARED WITH OTHER INSTITUTIONS

According to the US News rankings of college departments of bioengineering or biomedical engineering, UCSD's undergraduate program has ranked between #2 and #4 in the nation during the period from 2002 to 2008. It is essential that any changes suggested by this review not jeopardize the standing of the department. We defer to last year's graduate review for any proposed revisions to the graduate program and to research emphases.

OPERATION OF THE PROGRAM IN RELATION TO NEEDS OF STUDENTS FROM OTHER DEPARTMENTS and/or PROGRAMS

GENERAL EDUCATION AND THE COLLEGE SYSTEM AT UCSD

Our college system makes it difficult to complete a Bioengineering major in 4 years. The general-education requirements vary from college to college. In particular, Revelle and ERC have a language requirement, which can be an additional obstacle for some students. Only those Bioengineering majors who enter with proficiency in a foreign language succeed in graduating in the same 12 quarters as those who went to other UCSD colleges. Besides, some colleges relax their general-education requirements for engineering majors.

These inequities are at the heart of our college system. They are part of what makes each college distinctive. We do not propose that requirements be homogenized across the colleges. Instead, we urge that applicants to UCSD continue to be advised about the requirements of each of the colleges, and we approve of the department's notification in the Catalog that some colleges require more than the ten HSS courses indicated in the curriculum tables, so that students in those colleges may take longer to graduate than the four years indicated in the schedule.

HOW WELL DOES THE DEPARTMENT MEET THE OBJECTIVES OF THE VARIOUS GROUPS ON CAMPUS? HOW EFFECTIVE IS THE DEPARTMENT'S TEACHING FUNCTION IN RELATION TO STUDENTS OF DIVERSE OBJECTIVES?

In such a demanding major, unqualified students will always be a problem. In lower division a bimodal distribution is apparent, with some students of exceptional ability. By the upper division major courses one estimate is that 10% are unqualified. However, these weak students do not retard the level of the course, which is aimed at students who can cope with the rigor.

WHAT ARE THE SUPPORTS AND IMPEDIMENTS TO ITS EFFECTIVENESS?

A further dilemma for Bioengineering majors is that they feel that it is not possible to study abroad. Because nearly every required course is taught only once a year, scheduling a period abroad becomes difficult. The department ought to accept courses taken abroad, even though they are not fully equivalent. The scarcity of eminent bioengineering programs in other countries should not prohibit students from taking advantage of the

broadening experience of foreign study. It is not sufficient to restrict study abroad to the first two years, when bioengineering is only a small part of the curriculum.

The fact that nearly every required course is taught only once a year creates problems more generally. Students who miss a course, for whatever reason, are set back severely in progress to degree.

ANY TRENDS OBSERVED WITH RESPECT TO THE DEMAND FOR DEPARTMENT MAJORS AND/OR MINORS, SERVICE TEACHING

The department offers no service teaching, neither to other engineering majors, nor to science majors and premedical students, nor in support of general education. We propose that they create a JSOE-wide service course on biology for engineers or on engineering in biology and medicine, preferably to be taken in the freshman year. Another possible service course is Medical Technology in Today's Society, open to all students with no prerequisites. The department has expressed willingness to consider such courses.

METHODS OF INSTRUCTION, SUPERVISION AND TRAINING OF TEACHING ASSISTANTS AND TEMPORARY INSTRUCTORS,

In return for a two-year guarantee of support and as part of the educational training, Ph.D. students are required to TA for 4 quarters @25%. In practice a greater time commitment is often required. TAs receive preparation at UCSD's Center for Teaching Development. Majors found the TAs often very helpful, but sometimes a TA did not know the material (or could not make it clear).

Generally 4 TAs are assigned to 100 undergraduates or 10 TAs for 200 undergraduates in Introductory Bioengineering. It is claimed that TAs are responsible for large numbers of students, but these numbers do not represent a large burden, especially since section attendance is optional. Of course, if grading of homework is a large part of the duties, that can represent a large time commitment. Insofar as cooperation on homework is allowed, extensive grading of homework is a poor use of TA time, which might be better spent on instruction.

Many of the TAs felt that they could do a better job if the requirement were two quarters at 50%. A 50% TAship would be more efficient, because attendance at lecture and setting aside office hours are necessary regardless of the percent appointment. A further request was to separate TA duties from grading.

Supervision and training of temporary instructors is not a problem! Jeff Omens and Peter Chen are exceptionally highly regarded by students. The department is fortunate to have them. Students did complain about one instructor with a heavy load, but this may be simply be due to a lack of experience, which will soon be remedied.

GRADING POLICIES

From 2003 to 2008 the average GPA in all Bioengineering courses was 3.23. This is higher than the 3.00 of the entire JSOE, and higher than the campus average of 3.04. It is very unlikely that this is due to any grade inflation, but rather that most of the department teaching is upper-division, and to a selected or self-selected group of students.

APPROACHES TO EVALUATION OF COURSES AND TEACHING WHETHER ACADEMIC LEARNING OBJECTIVES AND ASSESSMENT PROCESSES ARE CLEARLY DEFINED FOR EACH MAJOR. ARE METHODS IN PLACE FOR CONVEYING LEARNING OBJECTIVES TO STUDENTS?

The department's flow charts are very informative about the sequence of courses.

HAVE THE FACULTY INSTITUTED PROCESSES FOR ASSESSING THEIR OWN PROGRAM'S STRENGTHS AND WEAKNESSES ON A REGULAR BASIS?

There are student members on the Undergraduate Affairs Committee, one per track. This is a valuable resource for reviewing the curriculum, regulating overlap between courses, establishing policy on petitions, and designing the capstone design course to make it accessible to large number of students. It is intended to add a member from the School of Medicine, to advise on issues of application to medical school and research opportunities in the School of Medicine.

STRENGTHS AND WEAKNESSES OF THE DEPARTMENT IN THE CONTEXT OF CAMPUS AND UNIVERSITY POLICIES

A key feature of the curriculum is the capstone project, beginning with four one-unit courses BENG 187A-D, followed by a sequence of two three-unit laboratory design projects, available in various areas of bioengineering. The SVCAA provides \$1500 per team, which is high relative to other engineering departments, but does not cover much research that has a strong biological component.

Many students perceive that their training is largely aimed at graduate school. Indeed, 53% of the 2003-2007 graduates continued to graduate school (including 15% to medical school). It might be noted that of those 15% slightly more than two-thirds were from the Bioengineering: Premedical track. It is unlikely that this track provides a better conduit to medical school, but rather that it provides fewer alternatives for further graduate study.

As for the other 47%, they do receive excellent training, so that UCSD Bioengineering graduates are well regarded in industry. They are perceived to work well in teams and to communicate effectively (attributed to the often maligned college system). John Watson has been a valuable member of the faculty in maintaining close relations with industry, helping students get jobs, directing internships, and dealing with professional issues in bioengineering. Bioengineering 196 provides credit for these internships. The Whittaker Center for Biomedical Engineering also provides useful liaisons with biotechnology and pharmaceutical firms.

Opportunities for community service are available under the auspices of the Biomedical Engineering Student Society (BMES) chapter. Its outreach programs send undergraduates to local schools, where young students can learn about engineering. The chapter also instituted a Bioengineering Day, when undergraduates can present their research. Now they are helping other campuses to establish chapters, even internationally.

ASPECTS OF THE TOTAL CAMPUS CONTEXT THAT MAY POSITIVELY OR NEGATIVELY AFFECT THE OPERATION OF THE UNDERGRADUATE PROGRAMS.

ENROLLMENT POLICIES

THE MOST IMPORTANT ISSUE FOR THE BIOENGINEERING DEPARTMENT IS ENROLLMENT CONTROL. The department has had Impacted Status since 2002. Initially this applied to all its major tracks, but soon thereafter Bioengineering: Premedical was opened to all students, but controlled with a pre-major. In 2004 the impacted majors were under-enrolled and students were admitted to the ABET majors from Premedical. In the current academic year CEP was poised to rescind Impacted Status but on appeal from the department agreed to extend Impacted Status for the ABET majors for one more year. The department would like to continue this indefinitely.

The quality of education suffers because of large class sizes. It was a concern of the ABET-accrediting committee. The capstone course is difficult because of the number of students. Moreover, without control over enrollment, weak students retard the level. A course to equip students, especially transfer students, with sufficient background is under consideration. Another possibility suggested is to raise the prerequisite grades.

Various sources of data indicate that there are too many students for too few faculty in the Bioengineering majors. A March 2008 table compiled by Victor Rodgers and Jerry Schultz (a member of this review committee) of UC

Riverside shows that there are 1000 Bioengineering majors at UCSD, with only 20 core faculty, or a ratio of 50:1. For comparison, these numbers are 1482 and 124, summed over the other campuses, or a ratio of 12:1. This disparity is not so extreme as it seems, because approximately half of the majors in Bioengineering are Premedical or pre-Premedical, who take many of their courses outside the department. A more telling statistic is the department's latest Penner ratio, 1.42. For comparison the Penner ratio is 1.09 for the entire JSOE and 0.95 for UCSD as a whole. These are weighted ratios, which recognize the greater effort and individualized instruction required in upper-division courses. These values demonstrate that the department needs approximately 40% additional faculty FTEs to handle its current student load.

Charting the Course IV had promised 8 additional FTEs, to reach a steady state of 26, and with a long-term goal of 28-30. Recruitments are ongoing and will continue, especially to staff the new systems bioengineering major. Hiring lecturers and adjunct faculty might be a temporary solution as long as quality can be maintained. The more serious issue is providing startup funding for new faculty.

Unfortunately there is great uncertainty about the number of students in the future. Much depends on how successful the new (and as yet vague) Systems Bioengineering becomes. Much depends on the redistribution of students from the Premedical major, as it is phased out. Discontinuing the Bioengineering: Premedical major will reduce the number of majors in the department, but will not provide teaching relief in the same proportion, because the Premedical majors take approximately half their major courses outside the department. Besides, the demand for Bioengineering at UCSD may be alleviated as a wider distribution of these students among campuses becomes possible, but it will also be increased, now that biology is also impacted.

Further uncertainty is associated with the attrition rate. According to the data in Table 14, the retention rate is quite high and the graduation rate is reasonably high, especially for first time freshmen. In contrast, according to the data in Tables 14 and 13, the number of majors in the Bioengineering track has dropped from 247 in 2004 to 177 in 2008, and the number of degrees granted has dropped from 49 in 2003-4 to 22 in 2007-8.

In view of these uncertainties we cannot recommend that Impacted Status be continued on any long-term basis. We agree that the department must be able to protect against unmanageable numbers of students, and we think that a yearly review of numbers, in cooperation with CEP, would be a practical approach. Besides, students strongly resent the imposition of Impacted Status.

To protect the department against a precipitous drop in their Penner ratio, we recommend that they consider offering service courses that would attract large numbers of motivated students.

TRANSFER STUDENTS

Transfer students often lack prerequisites. On the average they take 3 years to degree, and very few graduate in two years. It is difficult to coordinate with the junior colleges to advise transfer student on what they will need to succeed in Bioengineering at UCSD.

ADEQUACY OF FUNDING AND PERSONNEL ALLOCATIONS; PHYSICAL FACILITIES, INCLUDING LABORATORIES AND LIBRARIES

Teaching of laboratories is a major departmental responsibility, but with limited resources. Lab experience for students is in high demand by industry. BENG 172 is required of Bioengineering and Bioengineering: Premedical majors, but its enrollment is strictly limited. The average number of students in BENG 186A (Principles of Biomaterials) during the past four years has been 147, in a course that requires a three-student term project and an oral presentation. The 1800 sqft of undergraduate lab space, of which only 944 sqft is actual lab, with 8 stations that can handle 24 students at a time, is inadequate. It costs \$20K to equip a station, so expansion is expensive. One proposed solution is to offer the labs more often, perhaps also in Winter and Summer. It has also been

proposed to offer an additional BENG 172 in Fall, although this may become unnecessary as the Premedical major is discontinued. Another possibility is to use simulations instead of wet labs.

RECOMMENDATIONS FOR ALLEVIATING ANY SHORTCOMINGS SUGGESTED BY THE DESCRIPTION AND ANALYSIS

1. Institute a single core with options rather than the current tracks.
2. Elimination of Premedical.
3. Add new track in Systems Bioengineering.
4. Move some professional courses to earlier, in the Junior year.
5. Students seem to like more engineering courses: Biomechanics and Fluid Dynamics. Some adjustments of requirements might be warranted.
6. Recruit FTEs in Systems Bioengineering via IEM and Radiology department.
7. Try solving the problem of start-up funding by soliciting private donations and by using two FTE positions for one without giving up on the quality of teaching and research
8. Present students with a better explanation of what Bioengineering is.
9. Avoid split courses.
10. Support TAs for two quarters at 50%, if it is possible to avoid interfering with graduate course load.
11. Split grader positions from TAs
12. Suggest Capstone project input from medical school and industry.
13. Better course load distribution: Junior faculty are teaching too many courses and are stretched too thin.
14. Some Courses could be offered more than once a year, especially lab courses, where the lab facilities are a constraint. Use simulations instead of wet labs.
15. Include a medical school representative on the UG committee.
16. Create a JSOE-wide service course on biology for engineers or on engineering in biology and medicine.

To: CEP

From: Bioengineering Department

Shankar Subramaniam, Chair

David Gough, Undergraduate Affairs

Date: January 15, 2010

RE: Response to External Review of the Undergraduate Programs (April 2-3, 2009)

The Bioengineering Undergraduate Program Review Committee consisting of Professor Sadik Esener (ECE) (chair), Professor Charles Perrin (Chemistry) and Professor Jerome Schultz (Bioengineering, UC Riverside) provided a written report to CEP on September 1, 2009. The department has considered the comments and has formulated responses below at three levels. The Committee correctly noted that this has been the first CEP review since the department was founded in 1994, although there has been three ABET reviews of two of the tracks since 1994 and two prior to that date. The Committee noted that the department has ranked 2 to 4 nationally in all ranking systems over the last two decades, but did not mention that all other competing top-ranked bioengineering programs are found in top private universities. This unique ranking of a public university department has been appreciated by many aspiring programs. The department is committed to maintaining this level of excellence, welcomes external comments, and will continue to use its collective best judgment in evaluating suggestions and making improvements to the programs.

Responses to specific program details.

Review of teaching: The Undergraduate Affairs Committee has recommended that the department include additional means of teaching evaluation such as colleague review. This is needed because of the reduced presence of CAPE and its frequent bias toward higher grading practices.

TA support: The department plans to make more effective use of TA's by separation of teaching and grading where appropriate.

Multiple course offerings: The department plans to provide multiple offerings of certain key courses such as BENG 100 and BENG 172 as resources allow.

Split courses: The department policy is to have one, or at most, two shared instructors for each course.

Addition to the Undergraduate Affairs Committee: An appropriate colleague from the UCSD Medical School is being sought to serve on the Undergraduate Affairs Committee.

Grading policies: The department is aware that the average GPA (3.23) is higher than that of the other JSOE departments (3.03), but notes that similar differences exist in GPA of respective incoming freshmen. As there is now no Impacted Status for departmental majors, the department is now monitoring quarterly the GPA of each course, and may recommend a target GPA as a means of enrollment control.

Course sequence: The Undergraduate Affairs Committee has begun a review of the content of individual courses to optimize prerequisite preparation, avoid overlap, and strengthen learning continuity.

Responses to Program structure

Bioengineering: Premedical track elimination: The department is facing turbulent times. Close attention to program changes is needed to avoid unnecessary chaos while maintaining highest quality and most effectively serving the students. The elimination of the PreMed track was strongly supported by the review committee. This will be carried out over the next four years in a very deliberate way.

Introduction of a Bioengineering: Biosystems track: The review committee supported the introduction of a new Systems Bioengineering track, while agreeing that details remained to be completed. The department is pursuing this new track, but there are trepidations, given the present difficult budget climate. The launching of a new program during a period when the enrollments are in flux due to loss of Impacted Status for the existing majors and readjustments due to discontinuation of the PreMed program can only lead to uncertainty, and the Department will carefully consider the timing for launching the new track.

Restructuring the major: The review committee suggested eliminating the existing distinction between the two current tracks, Bioengineering and Bioengineering: Biotechnology, allowing students to enroll in courses as they wish. This has advantages and certain disadvantages, and is being evaluated. The concern is imparting enough sequential material in one engineering area for students to be appealing to employers and remain competitive with other engineering majors, versus striving for even greater breadth. These issues are being evaluated in departmental discussions. At the same time that the committee recommended merging of the two existing tracks, it curiously supported the development of a new track rather than simply including new courses in a merged track. These issues are also being evaluated by the department. The new curriculum must be truly innovative and take maximal advantage of existing UCSD talent, while complementing that talent base with carefully chosen new recruits. CEP should not expect these important issues to be immediately resolved.

Responses to department needs

The reviewers pointed out that the departmental Penner ratio is 1.42 compared to 1.09 for other JSOE departments and 0.95 for the university overall, and that the student-to-faculty ratio is 50:1 compared

to 12:1 for the campus overall. Not only has this over enrollment been noted repeatedly in campus documents, but it has been mentioned by bioengineering colleagues at other universities who question our ability to continue to provide quality education under these conditions. This disparity is real and has existed in Bioengineering since the 1980's. Nevertheless, the teaching load of three lecture courses per year has long been viewed as acceptable to the bioengineering faculty. The concern is that teaching advanced engineering subjects in large class settings (>60-75 students) is not acceptable at competing top rated engineering departments, and leads to substantial student dissatisfaction at UCSD. Without enrollment controls of any kind, the concern is that educational quality will inevitably decline. The department is committed to monitoring this very closely during the near future period of anticipated enrollment increases, and may request further controls from CEP.

At the same time, the department is committed to recruit new faculty who are able to teach in existing curricular areas as well as in the new biosystems area. As pointed out by the committee, recruiting the very top new faculty will be a substantial challenge in the present budgetary climate.

Summary

The review was useful to bring additional outside perspectives on the undergraduate curricula, and has stimulated self-examination from which some changes have been made and others are being considered. The Bioengineering Department is fully committed to defining and delivering solid and innovative undergraduate education of the highest quality.

June 1, 2010

PROFESSOR SHANKAR SUBRAMANIAM, Chair
Department of Bioengineering

SUBJECT: CEP Review of the Undergraduate Program

At its May 14, 2010 meeting, the Committee on Educational Policy (CEP) considered the report of the CEP Undergraduate Program Review Committee for the Department of Bioengineering and the Department's response to that report.

The Department's commitment to providing a rigorous undergraduate academic curriculum and retaining its national ranking are laudable goals. The reputation of UCSD's bioengineering students with local industry—that they are perceived to work well in teams and to communicate effectively-- speaks well of the educational achievements of the Department. Also noteworthy are the opportunities for student community service available under the Biomedical Engineering Student Society (BMES) chapter, which is currently helping other campuses to establish chapters, even internationally.

On the other hand, the Committee did note that the Department has made a carefully crafted response to the rather lengthy list of recommendations listed in the review report and that, "CEP should not expect these important issues to be immediately resolved." As has been clear in the past, and is clear in this response to this undergraduate program review, the Department's paramount priority is maintaining low numbers of undergraduate majors via impacted status with the justification that this is the *only* way to preserve the "innovative undergraduate education of the highest quality."

As you know, at its March 5, 2010 meeting, the CEP considered and approved the Department's request to declare the Bioengineering and Bioengineering: Biotechnology majors impacted with minimum enrollment target numbers of 50 Freshman, 10 Transfers and 10 Continuing effective Fall quarter 2010. The proposal, again, included only a draft proposal for the new Biosystems major. CEP approved the Department's request to discontinue the Premedical pre-major and formal procedures (Appendix IV) are currently ongoing to that end. Since approval of impacted status, CEP has not received a final proposal for the new Biosystems major.

Early on, CEP cautioned that, with the elimination of the largest major, i.e., Premedical, the introduction of a new Biosystems major would be necessary to maintain the current number of undergraduate majors. CEP has been informed that the total number of students, who have accepted admission to UCSD and have chosen a Bioengineering major for Fall 2010, is 94. Per the Enrollment Management Policy, "*These target numbers must **not** be smaller than the minimum target numbers approved by CEP in the application.*" Please note, CEP will address with the Department the specific issue of impacted status under separate cover.

The Committee concluded that the following issues warrant serious attention and will be the focus of the follow-up review in Spring 2011:

- What is the status of the proposed new Biosystems major which was to replace the Premedical major?
- The departmental response to the suggestion for restructuring the major is indefinite. The CEP recommends that the Department consider how to relax requirements that students often find too

rigid in order to create a single coherent Bioengineering major with core courses and options that allow students to choose courses to match their interests.

- CEP recommends that the Department think about offering service courses and an introductory course for majors that presents an overview of what bioengineering is.
- CEP concurs with the review committee that splitting courses between instructors seems to ignore students' dissatisfaction with such courses and to place faculty convenience over pedagogy. The negative aspects of these courses are many and substantive including, a) time wasted because of the transition from one instructor to the other; b) no one instructor has responsibility for thorough coverage of course content; c) no one instructor has responsibility for establishing the connections between topics, or: d) for avoiding repetition of course content.
- The Department did not respond to the suggestion that courses could be offered more than once a year, especially required laboratory courses, where the limited lab facilities are a constraint and part of the Department's justification for impacted status.



Stefan Llewellyn Smith, Chair
Committee on Educational Policy

Cc: P. Drake
W. Hodgkiss
M. Ramirez
F. Powell
B. Sawrey
F. Seible
ChronFile

August 31, 2011

PROFESSORSHANKAR SUBRAMANIAM, Chair
Department of Bioengineering

SUBJECT: Undergraduate Program Review: Department of Bioengineering Follow Up Report

Dear Professor Subramaniam,

On June 10, 2011, the Committee on Educational Policy and Courses (CEP) considered the follow up review for the Department of Bioengineering. Professor Perrin, Chair of the Review Subcommittee, reported on his meeting with the Department to discuss the Department's progress in implementing the recommendations outlined in CEP's June 1, 2010 memo.

The Committee is pleased to learn that that the Department is moving forward with plans to develop the BioSystems major submitted previously to CEP, and we reiterate our offer to discuss the Committee's comments on the original proposal further. Additionally, we are encouraged by the measures taken by the Department to improve the educational experience of students, such as developing a lower-division course to introduce the field of Bioengineering (BENG 1). The Committee is aware that the Department faces limitations in implementing the other recommendations, and we encourage regular considerations of these recommendations (e.g., offering the courses more than once, reconsideration of splitting courses, etc.). Overall, we consider this to have been a positive review cycle and thank the Department for its continued efforts in support of undergraduate education.

Sincerely,



Mark Appelbaum, Chair
Committee on Educational Policy and Courses

cc: D. Hamann
F. Powell
B. Sawrey
J. Sobel