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PROFESSOR BILL MCGINNIS, Dean
Division of Biological Sciences

PROFESSOR LAURIE SMITH, Director of Undergraduate Education
Division of Biological Sciences

SUBJECT: Undergraduate Program Review for the Division of Biological Sciences

Dear Professors McGinnis and Smith,

The Undergraduate Council has discussed the Division of Biological Sciences 2015 Program Review. The Council supports the findings and recommendations of the review subcommittee and congratulates the Division on a highly positive review. The Council also appreciates the thoughtful and proactive response from the Division, and we understand that the one suggestion the Division could not do much to address was minimizing exam "pileups" due to the vast combination of classes that students take in any given quarter.

The Council will conduct its follow-up review of the Division in Winter Quarter 2016. At that time, our goal is to learn about the Division's progress in implementing the recommendations of the program review subcommittee and the Undergraduate Council. The Council extends its thanks to the Department for its engagement in this process and we look forward to the continued discussion.

Sincerely,

Leslie Carver, Chair
Undergraduate Council

cc: G. Boss
R. Continetti
G. Cook
R. Rodriguez
B. Sawrey
M. Sidney

Undergraduate Program Review:
UCSD Division of Biological Sciences

March 13, 2015

Program Review Chair: Professor Sarah Creel, Department of Cognitive Science, UC San Diego
Professor Ruth Williams, Department of Mathematics, UC San Diego
Professor Craig Walsh, Department of Molecular Biology and Biochemistry, UC Irvine

Dear Professor Carver and Associate Vice Chancellor Sawrey:

The Undergraduate Council review of the Division of Biological Sciences took place on March 3-4, 2015. Reviewers were Sarah Creel (UCSD, Cognitive Science), Ruth Williams (UCSD, Math), and Craig Walsh (UCI, Biology).

Our review report is divided into three sections, covering, respectively, the operations of the division; curriculum; and operations of the division with respect to university-wide policies. Suggestions for improvements are made in each section, but they use a single numbering scheme, for ease of reference.

Overall, the committee was impressed with the diligence that the Division of Biological Sciences devotes to undergraduate education. We hope that our feedback encourages them to continue their good work while shoring up areas that can be improved.

Operation of division: strengths and weaknesses

The organization of the Division of Biological Sciences is as follows. There are four Sections: Cell & Developmental Biology; Ecology, Behavior & Evolution; Molecular Biology; and Neurobiology. The 92 faculty and 9 teaching faculty are divided amongst these sections. Each section has a chair, and separate faculty meetings. The chairs of the four sections meet regularly to discuss department issues. The entire division is headed by the Dean of the Division, plus the Council of Chairs. Answering to the Dean of the Division are the Associate Dean and the Associate Dean for Education, as well as several full-time employees, including the Divisional Business Officer. The Divisional Business Officer's reports include managers who handle animal facilities, payroll, personnel, finances, computer services, Undergraduate Student and Instructional Services (USIS), and graduate student services. The Associate Dean for Education supervises teaching professors, unit 18 lecturers, and running of undergraduate labs.

At the level of the Division, there is also an Education Committee, headed by the Associate Dean for Education. This committee plays a pivotal role in undergraduate education, handling planning of courses, program requirements, and other issues impacting undergraduates.

There is also an advising unit—Undergraduate Student and Instructional Services (USIS). USIS serves a number of functions. These include course scheduling, advising (in-person and on-line), and running the do/bio center. The individuals advised are biology majors, biology minors, and other students interested in taking classes in Biology. In the past year, they made just over 11,000 contacts with students either in-person or on-line via the Virtual Advising Center (VAC). Seniors sought advising most often, followed by juniors, with underclassmen less likely to seek advising assistance. This is a daunting task considering that the Division currently has approximately 5500 majors.

Ladder-rank faculty teach approximately 1.5 courses per year. One course is typically a large, lower-division course, but usually not a lab course. The other is half of a graduate seminar, or half of a smaller upper-division undergraduate course. Teaching faculty teach 6 courses per year, including many of the lab courses.

Strengths

Since the last undergraduate program review (February of 2007), Biology has made several substantial changes in the way that it educates undergraduates. The most substantial change involves large increases in lab space, which allow more labs to be taught. A concern in the previous review was that biology majors were not getting enough lab courses. However, since that time, Biology has been able to renovate lab space in York Hall to accommodate more students, and has received a donation of lab space from Chemistry. These changes now allow more lab courses to be taught, including a new lab for first-year students (discussed at more length in the Curriculum section, below). Biology should be commended for their efforts to increase laboratory resources, as it stands to substantially improve undergraduate learning.

Another area in which Biology should be commended is in their efforts to diversify the undergraduate population and the faculty. Through efforts of the Divisional Diversity Committee—established since the last review—as well as the general faculty and student organizations (Biological Sciences Student Association, Bioscholars), there are numerous outreach efforts ongoing. First are summer research experiences aimed at increasing STEM participation by groups underrepresented in science (the STARS and CAMP programs), including an exchange program that is being set up with a historically-black college (Spelman College). Diversity committee members also do outreach to local high schools that are high-performing academically but are located in historically lower-income underrepresented neighborhoods.

Transfer students are directed to a summer bridge program to introduce them to research university life. Two new courses (BILD 91 for incoming freshmen, BISP 191 for incoming transfers), in the pilot stages, have been designed to acclimate new students to campus life, and to provide them with information about campus research, academic, and leadership opportunities. Another brand-new (planned) course on Race, Ethnicity, and Gender in Biology and Medicine (BILD 60) has been designed to address the Diversity, Equity, and Inclusion requirement for all undergraduates at UCSD. The course focuses on issues of diversity and ethics in science without sacrificing meaty biology course content.

Finally, it should be noted that all Biology faculty on hiring committees are required to complete diversity training before reviewing job applicants, in an effort to be inclusive and unbiased at all stages of the hiring process. One measure of diversity success in hiring is gender diversity: among assistant and associate professors, the ratio of female to male faculty is nearly 1:1 (though the figure is somewhat lower for full professors, due to a combination of historical trends and faculty "poaching"). All things considered, Biology's diversity efforts are commendable and a model for the rest of campus. The committee encourages Biology to continue to focus on diversity, broadly construed, for both students and faculty.

A new program available to students of biology is a new marine biology major at Scripps Institute of Oceanography (SIO). This new connection to SIO, which was an improvement suggested in the previous review, not only provides more biology educational options, but also provides a new source of alternative courses for main campus biology majors. This increase in available courses should ease some of the problems with "bottleneck" courses impeding time to graduation.

A final helping of praise should be heaped upon the advising staff in Biology. Students, advisors, and college advising deans all concurred that Biology advisors were responsive and knowledgeable. While the previous review highlighted concerns with advising—perhaps not surprising given the volume of undergraduate students who flood through biology courses—the input the committee heard was uniformly positive. In particular, students and advisors liked the Virtual Advising System. Students liked that they were certain to get an answer, while advisors liked that they were able to track a student's previous inquiries and see whether they had or had not consulted with an in-college advisor. The deans of advising at Revelle and Marshall (the other four did not attend) commended Biology as a model of collaboration on advising between departments/divisions and the college system.

Suggestions for improvement

While there is a great deal to admire in the Division of Biology's progress in the past several years, a few areas emerged as having the potential for improvement.

(1) One set of issues involved getting the word out about opportunities for research, leadership, and employment. The previous review asked for more mentored research opportunities for students. While such research opportunities currently abound in and around UCSD, students that we spoke to reflected limited awareness of research opportunities. Presumably these students are among the more serious ones in the department, so their levels of awareness may *over*estimate knowledge among the general student body about such topics as 199 research opportunities, practical knowledge about how often to contact professors about conducting research in the lab, and how many professors to contact. The postbaccalaureate survey suggested that students are keen to have more leadership opportunities and resources for improving their communication skills. Of course, their responses are based on experiences in years prior to the implementation of new initiatives, including the do/bio center in Advising, which is geared toward increasing students' awareness of career opportunities.

Undergraduate students made two further suggestions that the committee found reasonable, so they are repeated here. The first was to provide more complete documentation of the Biology website for research opportunities to include instructions on how to approach professors about doing research—things as simple as form and content of an email might be helpful to many students. An additional suggestion was to publish information about the current job status of Biology graduates from different majors: how many are in medical school, graduate school, biotech, education, etc. As these data are contained in the recent postbaccalaureate survey, this should be fairly simple to publish and would be quite illuminating for potential majors.

(2) A second set of issues surrounds course scheduling. Students, advising staff, and teaching professors all raised concerns with large courses holding exams on the same day, such that students frequently experienced final exam "pile-ups." While we realize that there is no perfect solution, it seems as though advising staff could at least attempt to preschedule the largest courses and/or those most likely to be taken by the same students in a given quarter so as to minimize exam collisions. Whether this might be accomplished across departments (e.g. Chemistry) is less clear, but some systematicity would be helpful in this regard and would lessen student distress.

(3) Many Biology faculty expressed substantial concern at a change in enrollment procedures that was unilaterally announced by the Registrar recently. For some campus departments, the procedure is already in place. However, for Biology, it is a significant change. Under the new procedure, students enrolling for Biology classes will be required to enroll by section rather than by class. While there are other departments on campus that already enroll students by section, the very large size of some Biology classes may introduce a different dynamic. Some faculty had ideas about how to adapt to the new system, while many others saw serious shortcomings. Furthermore, although a notice was sent by the Registrar informing faculty of the change, the fact that this change was introduced without any prior consultation with Biology faculty caused considerable consternation. Clearly, some resolution of this matter is needed, involving discussion amongst faculty and with the Registrar. In the future, it would be helpful if the Registrar's office consulted substantial stake holders before announcing major changes.

(4) A suggestion with respect to staff would be to have some staff time devoted to tracking diversity efforts. The Diversity Committee identified an interest in tracking the progress of students who have participated in various enrichment programs, but there is currently no staff time devoted to maintaining contact with such students.

Curriculum: strengths and weaknesses

The committee was very impressed by the strong commitment of the administrators and faculty toward providing outstanding instruction for biology undergraduates. A large representation of the faculty attended during the two-day review, a clear demonstration to the committee that the Division faculty members are highly devoted to undergraduate teaching. This was also made evident by many Biological Sciences undergraduates attending the review, with students voicing enthusiastic support for the programs offered by the Division.

To enhance the impact of the efforts of the faculty, the Division has developed an Education Committee. This group of faculty and administrators is charged to address current problems, identify novel approaches to overcome these challenges and to enhance the quality of undergraduate education in the Biological Sciences. The Division also has a small group of teaching faculty, some with LSOE/LPSOE appointments, not only providing instruction but also developing new instructional methods and resources. Overall, the Committee believes that the Division has more than adequately addressed most concerns raised in the previous review, although some issues remain.

Strengths

During the review, the Committee observed many positive attributes in undergraduate teaching by the Division. These included the high quality faculty, many of whom are conducting cutting-edge research in various disciplines in the biological sciences. Many of these instructors typically solo teach in large undergraduate classes, particularly in lower division courses. While such large courses are frequently team taught at other research universities, the Committee applauds this policy, since undergraduates appreciate the enhanced consistency of courses taught by a single instructor. Additionally, the Committee was impressed by the topics addressed, particularly so in the lower and upper division laboratory courses. Major strengths in these intensive laboratory courses were the focus on introduction of the scientific method during first year coursework, and the emphasis on cutting-edge technologies (e.g. quantitative PCR, sequencing, mutagenesis, etc.) likely to be relevant to Biological Sciences students following their graduation from UCSD. The Division is to be commended for the introduction of pedagogical research and innovative approaches (e.g. clickers, classroom-flipping, synchronous distance learning) to improve the outcomes of instruction. The Committee also noted a strong desire of the Division to reach out to other Schools and Divisions, seeking to offer instruction in multi-disciplinary areas of the Biological Sciences (e.g. systems biology) through collaboration.

During the previous review in 2007, several concerns were raised that have been addressed by the Division. One major challenge identified was that bottlenecks existed in required courses, leading to extended time-to-degree problems. To relieve some of these bottlenecks, the Division creatively obtained supplemental laboratory space to provide additional upper division laboratory sections. In addition, several required courses are now offered during the summer quarter, alleviating pressures on academic year enrollments in such courses.

Another major concern was that students took few lab courses, and those relatively late in their coursework. Students are now required to take two upper-division laboratory courses (although these upper division laboratory requirements need to be updated in the General Catalog). Further, a new lower division laboratory (BILD4) is now offered that introduces beginning Biological Sciences undergraduates to biological research early in their academic careers. This has several benefits, including the early introduction to the scientific method and the fostering of interest in biology. BILD4 has no prerequisites, thus allowing students an opportunity to gain a perspective of biological research not typically experienced until later during the third and fourth years. This helps to contextualize later coursework, motivating many students to pursue careers in biological and biomedical science careers. This early introduction to biological research has the added benefit that students may find that they are less interested in biology prior to undertaking all of the prerequisite coursework, thus reducing impaction in such courses. Additional measures taken

by the Division to address the issue of extended time-to-degree have included trimming upper division electives for different majors, though these changes are too new to know whether they have significantly reduced time-to-degree.

The Division has also provided a number of new research opportunities to its undergraduates, with many opportunities to conduct independent research under the mentorship of numerous UCSD research advisors. These opportunities are available through the 199 program, and additional opportunities are available through participating faculty of nearby research institutions (e.g., the Salk Institute, Scripps Research Institute, Sanford-Burnham, etc.) via the 197 program. Many of the students interviewed highlighted such independent research experiences, describing the positive influence of such undergraduate research. In addition, the Division has also developed new intensive upper division laboratory experiences. These efforts largely address concerns regarding student access to faculty raised during the previous review.

Suggestions for improvement

While the Division has clearly made important strides since the previous review, there are several areas where improvement can be made.

(5) One issue highlighted by both faculty and undergraduate students were the large classes, particularly in the lower division. While this is clearly a challenging issue for a Division with such a large number of undergraduates, additional efforts should be placed toward reducing class size. This will have the benefit of enhancing faculty/student interactions, and may alleviate some scheduling problems associated with larger lecture halls. However, this must be balanced with the need to minimize course access barriers, particularly in highly subscribed and required courses. Given concerns regarding time-to-degree delays, it is suggested that prerequisites for upper division biology courses be given a more thorough analysis. Students felt that such prerequisites seemed arbitrary, and in some cases, unjustified. While course requirements are important to ensure that students are properly prepared, these needs must be balanced with course access to fulfill such requirements.

(6) Undergraduate students raised a concern regarding Advanced Placement (AP) credit. Upon entry into UCSD, students with significant AP credit in biology are (apparently) not offered access to certain lower division courses such as BILD1-3. In one case, a student described frustration with this, since this student had taken AP Biology as a freshman in high school, and would have valued the opportunity to enroll in these introductory biology courses. Another raised the concern that general biology courses such as these are required by US medical schools. The committee suggests that honors sections be made available in BILD1-3 (or in other courses such as BILD4) to accommodate such students.

(7) The previous review raised concerns regarding the use of undergraduates in the role of instructional assistants (IAs). The committee was pleased to find that instructors found such undergraduate IAs to be highly qualified and motivated, often demonstrating greater empathy to their undergraduate peers than graduate student IAs. However, the committee also felt that the exclusion of graduate TAs in lower division courses to be problematic. The committee suggests the policy be revised to include at least one graduate TA serving in a mentoring capacity to

undergraduate IAs. The committee also recommends that inexperienced IAs be required to attend at least one section of a more senior IA (or graduate student IA) per week to develop instructional skills. The committee also recognizes that offering undergraduate IA-ships provides a means for such students to attain leadership and instructional skills, addressing a concern raised in the previous review. One faculty member also noted that organizing undergraduate IAs would be a good leadership experience for graduate IAs.

Some faculty reflected difficulty getting IAs to stay around for grading during or after finals week. This seems easily remedied by a contractual agreement (for pay or for course credit) requiring the IA's continued presence during grading.

(8) In addition to these recommendations, the committee also suggests that efforts be put into improving information available to instructors. First, improvements should be made to the online student information available in the Blink system (blink.ucsd.edu). For example, some faculty would find it useful to aggregate information across students in their classes to see what courses students have taken before. Currently, faculty must look at each student's record individually. Some simple analytics tools would be valuable in determining how to teach a particular group effectively.

Division in context of campus and University policies

A number of issues affecting the Division of Biological Sciences also affect other units on campus. Here we address those issues, with suggestions directed both toward Biological Sciences and toward university leadership who are in better positions to institute university-wide improvements.

Strengths

The previous review identified a campus-wide issue relating to academic standards. Academic Senate regulations at that time allowed students to repeatedly withdraw from a given course between the fifth and ninth weeks (earning a "W" designation on their transcripts, but having no effect on GPA). Also, some students repeated a given course multiple times with a grade of D or less, often with no effect on their GPA. The committee was pleased to learn that since that time, with urging from the Biology Division, a new regulation (Academic Senate Regulation 500(F)) has been introduced, limiting the number of "W" grades for a given course to one, and Academic Senate Regulation 505D, limiting to two the number of repetitions by a student of a given course with grades of D, F, NP or U, has had enforcement strengthened. These steps have resulted in campus-wide strengthening of academic standards. In addition, the Biology Division has introduced minimum grade requirements in prerequisites for Biology courses.

Suggestions for improvement

(9) There was a general feeling amongst Biology faculty, which we believe is shared by other campus faculty, that there is a sore need for appropriate assessment of teaching beyond student CAPE evaluations. In this direction, the committee was pleased to learn that the Biology

Division plans to develop a comprehensive teaching evaluation system in collaboration with the new Center for Engaged Teaching (CET) which is adaptive to different learning modalities and will help faculty improve their teaching skills. The committee also recommends that junior faculty be provided instructional mentoring during their first instructional experiences. More senior faculty with strong instructional expertise should attend a lecture (or two) of a less experienced faculty member to evaluate their teaching effectiveness, and to provide constructive criticism. Such comments would also provide additional evidence of teaching effectiveness required during the merit/promotion evaluation process.

(10) Over the past five years, on average, nearly 19% of enrolled Biology majors have been transfer students. While the Biology Division makes substantial efforts to ensure a smooth transition for their transfer students, a significant ongoing issue is the fact that the vast majority of transfer students admitted to UCSD as Biology majors arrive without having completed necessary prerequisite lower-division courses in chemistry, mathematics, physics and biology. This has a significant effect on time-to-degree for these students which has averaged 2.7 years over the past 5 years.

To address transfer time-to-degree, efforts have been initiated by the Division to partner with the UCSD Admissions Committee to establish a Biology-specific eligibility requirement for transfer students entering the Biology major. The committee feels that this is a very important requirement to put in place as soon as possible. We recommend that the Division also reach out to community colleges, to partner with them to ensure that prospective Biology majors obtain appropriate prerequisite training before reaching UCSD.

(11) An ongoing issue is the TA allocation formula which disadvantages the Divisions of Biological and Physical Sciences compared with the Engineering School. The Biology curriculum is constantly evolving as it adapts to developments in the field and changes in the needs of its students. The Division is to be especially commended for its development of innovative new courses, such as BILD 4 and BIMM 171/A, that involve students at an early stage in lab experiences and which serve to motivate their studies in Biology and related fields. The Division also exhibits a positive, cooperative attitude towards partnering with faculty from other disciplines in developing and adapting courses related to emerging quantitative needs in biology. However, all of these developments, especially new lab courses and interdisciplinary efforts, put substantial additional stresses on instructional resources. It would be helpful if the campus-wide TA allocation formula would recognize the additional needs of lab courses and provided incentives for innovative projects, especially in Biology and the Physical Sciences which presently receive a less favorable treatment from the TA support formula than does Engineering.

(12) The committee heard strong testimony from students about the importance of continued support for the Bioscholars Program through offering the Bioscholars Seminar, BISP 170 (from Bench to Bedside and Beyond) and providing related funding and advising activities for Bioscholars. The committee felt this was a very valuable program and believes that the Division shares that view.

(13) Teaching professors (formerly called LPSOEs, LSOEs) are well appreciated for their contribution to the instructional program of the Division and especially for their teaching in lab courses. While expectations of those in the Teaching Professor series with regard to "scholarship" have been clarified somewhat since the previous review, there is still some concern amongst those in the series regarding the vagueness of this requirement. Concern was also expressed by teaching professors about how to balance teaching with the need to also engage in scholarship. The high LSOE teaching load (6 courses, vs. research faculty's load of 1.5) is further exacerbated by the fact that many LSOEs teach lab courses, which entail a greater time commitment than lecture courses. Therefore, we recommend greater university-level commitment to clarifying the requirements and expectations for the Teaching Professor series.

(14) Cheating is a campus-wide challenge and, in recent years, a new Academic Integrity Office has raised the profile of the importance of academic honesty for students and centralized the handling of cases of academic dishonesty. Some Biology faculty reported imperfect experiences with this office, while others felt there was an overemphasis on prosecution rather than prevention. It is apparent that Biology faculty make significant efforts to deter cheating. Efforts to deter cheating could be helped by providing a service for scanning exams as is already done at UC Irvine. This could be a campus-wide resource. Also, the committee heard many ideas on how individual faculty deter cheating. Providing an explicit mechanism or forum for Biology faculty to share these ideas could be especially helpful. The numbering of seats in auditoriums which has been done recently may be one new addition that will help faculty in this regard.