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December 8, 2020

PROFESSOR KIT POGLIANO, Dean
Division of Biological Sciences

PROFESSOR JAMES WILHELM, Director of Undergraduate Education
Division of Biological Sciences

SUBJECT: Undergraduate Program Review for Biological Sciences

Dear Professor Pogliano and Professor Wilhelm,

At its November 13, 2020 meeting, the Undergraduate Council (UGC) discussed the Division of Biological Sciences' 2020 Undergraduate Program Review. The Council supports the findings and recommendations of the review committee and thanks the Division for their thoughtful response. Issues related instruction and faculty/TA teaching and mentorship were appropriately addressed. The Council's comments centered on the following curricular issues:

Space Constraints

- The Council recognizes the significant space and resource constraints under which the Division operates. These constraints are the most critical obstacle to the Division's undergraduate program, in terms of the impact it has as hands-on laboratory space, which is integral to student training.

Course Prerequisites and Student Preparation

- The Division noted that they hope to use data analytics to identify optimal course pathways, and to reexamine existing course prerequisites for two high DFW courses, molecular biology and metabolic biochemistry, to ensure that the material in the prerequisite courses is in alignment with the downstream courses. The Council looks forward to an update at the time of the follow-up review on the Division's progress and any outcomes available from the analysis.

Organic Chemistry Coursework

- The Council encourages the Division to reach out to the Department of Chemistry and Biochemistry to discuss options for aligning some of the content in its organic chemistry courses with biology applications. Collaborating with Chemistry and Biochemistry seems to be a more efficient use of faculty expertise and resources than developing an organic chemistry sequence within the Division.

- The Council also reviewed the four-year plans for Biology majors and noted that in majors that require organic chemistry, the organic chemistry lab is not included in the same year as the organic chemistry courses. The Council asks the Division to review its four-year plans and consider whether encouraging students to take the lab with the rest of the sequence would improve student learning outcomes.

The Council will conduct its follow-up review of the Division in Fall Quarter 2021. At that time, our goal is to learn about the Division's progress in implementing the recommendations of the program review committee and the Undergraduate Council. The Council extends its thanks to the Division for their engagement in this process and we look forward to the continued discussion.

Sincerely,

Jane Teranes, Chair
Undergraduate Council

Attachment
(1) Undergraduate Program Review Report and Response for Biological Sciences

cc: A. Booker
S. Constable
T. Javidi
J. Moore
R. Rodriguez
M. Sidney

2019-2020 Undergraduate Program Review:
UC San Diego Division of Biological Sciences

May 21, 2020

TO:

Professor Anthony Burr, Chair of Undergraduate Council, UC San Diego
Professor John Moore, Dean of Undergraduate Education, UC San Diego

FROM:

Professor Stacey Brydges, Department of Chemistry & Biochemistry, UC San Diego
Professor Christian Metallo, Department of Bioengineering, UC San Diego
Professor Karen Ottemann, Department of Microbiology & Environmental Toxicology, UC Santa Cruz.

Dear Professors Burr and Moore:

The Undergraduate Program Review for the Division of Biological Sciences was conducted on March 5-6, 2020, by Stacey Brydges (Program Review Chair; Chemistry and Biochemistry, UC San Diego), Christian Metallo (Bioengineering, UC San Diego) and Karen Ottemann (Microbiology and Environmental Toxicology, UC Santa Cruz).

In the following report, we provide an analysis of the operations of the Division, the curriculum, and the campus context of the undergraduate program. This analysis has been informed by the comprehensive self-study report and supplementary materials (e.g., 2018-29 SIS Annual Report) submitted by the Division, the data compiled by the Office of the Dean of Undergraduate Education, and our discussions with various stakeholders, including Divisional leadership, faculty, staff, and both and undergraduate students, though we met with very few of the latter (4 in total). We hope that our recommendations and feedback will help sustain and enhance their collective efforts moving forward.

I. Operation of Division: Strengths and Weaknesses

The Division of Biological Sciences is home to 128 faculty (13 of which are teaching professors, and not including 46 adjuncts) who are distributed amongst four department-like Academic Sections: Cell & Development Biology; Ecology, Behavior & Evolution; Molecular Biology; and Neurobiology. Academic leadership is provided by the Dean (Prof. Kit Pogliano), two Associate Deans (Profs. Andrew Chisholm and James Neigh), a Director of Undergraduate Education (Prof. Laurie Smith; Prof. Jim Wilheim incumbent) and a Director of Mentorship and Diversity (Prof. Gentry Patrick). Each of the Sections has a Chair and Vice-Chair, who interface with the Dean via the Council of Chairs. Administrative support, fiscal and human resources, computer services, and the undergraduate and graduate programs are governed at the Divisional level.

The Division offers 7 different undergraduate majors [Ecology, Behavior and Evolution (BI30), General Biology (BI31), Microbiology (BI32), Bioinformatics (BI34), Human Biology (BI35), Molecular and Cellular Biology (BI37), and Neurobiology (BI38)], a minor in General Biology, and a Contiguous BS/MS program. Oversight of the undergraduate education mission, including planning and staffing of lecture and laboratory courses, curriculum development, and student co-/extra-curricular activities (for example, via DO/Bio), is provided by the Director of Undergraduate Education, in consultation with the Education Committee. The latter, which has faculty representation from all four Sections, sets curricular priorities and makes teaching assignments. Faculty teaching loads are either 1.5 courses per year, (which includes a large, lower division lecture and a half of a smaller upper-division course or a graduate seminar) or 6 courses per year, in the case of teaching professors (who typically oversee laboratory classes).

Integral to the undergraduate program operations is the Student and Instructional Services (SIS) Office, which makes available academic services for students as well as instruction-based support for faculty. Also noteworthy is the well-designed and informative website for Undergraduate Studies, which includes tabs for the BioBulletin, VAC, Admissions, 'Finish in 4', Student Opportunities (like the Saltman Quarterly), Instructional Assistants (IAs), and more.

Strengths

The Division is to be commended for its design and delivery of a high-quality undergraduate program, which serves ~ 5,700 biology majors/minors and more than ~29,000 non-biology majors on an annual basis. Teaching professors are well integrated with research faculty in each academic Section, and a culture of shared teaching expertise and resources appears to be thriving both within and across Sections. In addition to tenure-track faculty, there are 17 engaged non-senate (Unit-18) lecturers (of full- and part-time status) and several highly competent undergraduate laboratories staff that support the undergraduate educational mission. The Education Committee provides a robust mechanism for ensuring that faculty teaching assignments are made in a fair and equitable manner. Lecture and laboratory instruction each year is aided by an impressive number of undergraduate and graduate Instructional Assistants, IAs (> 400 BS, ~ 200 MS, and ~ 150 PhD candidates), at an IA to student ratio of 1:33. IAs are introduced to effective classroom management and evidence-based instructional strategies through a model discipline-specific IA professional development course. And there are more than 50 Readers/year who serve as proctors, scribes, and occasional graders, and/or are part of a new Proctor Pool to support accommodation needs.

Under the direction of Dana Brehm, an SIS staff of close to 20 do an impressive job of coordinating undergraduate course scheduling and related IA support, advising students, and advancing co- and extra-curricular opportunities. SIS staff are encouraged to develop their competencies through regular training and are uniformly positive about their roles. Staff investment in the student experience is reflected in the productive partnership they've established with faculty and campus entities (such as Ed Technology services), and the creative array of student resources they've devised, including the website and remote advising sessions. With the current, increasing need for online resources driven by COVID-19, this early implementation of Zoom meetings by SIS is

a great (but certainly not isolated!) example of their outstanding vision and performance. As stated by one college dean, the Biological Sciences' SIS is "a model for how our other departments should perform."

Linking undergraduate education with the research and outreach missions of the Division, the Diversity Committee has achieved broad and frequent participation in diversity, equity and inclusion--related activities by members from all stakeholder groups (students, staff, faculty). The efforts of the committee are laudable, and we hope that their future strategic plans include the means and metrics by which they will measure how the needle is moving on diversity and inclusion in the Division (see below).

Opportunities for Improvement

While the operations of the Division are on the whole robust, there are a few areas which have the potential to be enhanced.

(1) As noted in the self-study and interviews, the student:faculty ratio in the Division is too high. Reasonable hiring targets have been set, and while it is already a consideration, it is important to highlight here the expressed desire from both faculty and students for increased faculty diversity. It was hinted that efforts to promote faculty diversity may first concentrate on those in the teaching track, given the larger teaching load and student reach of these instructors. Whatever strategies are employed, this is an area where the divisional Diversity Committee could assist.

(2) Also linked to faculty and divisional climate, many non-senate faculty expressed disappointment that they are not engaged in curricular decisions or well-integrated into other divisional activities. That Unit-18 lecturers may not always feel valued by their colleagues seems to stem from the way teaching assignments are made. On occasion, courses and associated materials they have invested significant time and energy in developing and refining have been re-assigned, without notice or discussion, to a tenure-track faculty. It seems that this situation can be easily remedied. The non-senate faculty are clearly committed to the Division's undergraduate educational mission, and appreciate the support and oversight provided by the Director of Undergraduate Education (Prof. Laurie Smith).

(3) Another area the Division intends to address is assessment of student learning. While insights on student success, critical course junctures, and DFW intervention effectiveness are sought, data analytics have thus far been limited by data access issues. The plan to hire an assessment expert for the Division is an encouraging move, and one that may be effectively leveraged given the existing strengths of the BioSci SIS.

(4) A last area of future growth is career development and placement, particularly for undergraduate majors whose interests fall outside the realms of health science and academic research. Providing sound career coaching and establishing a curated process for student internships may require additional staff and resources. Some mentioned the idea of a Student Success Center or some other centralized mechanism to promote student-student, student-

faculty and student-alumni interactions. We have no doubts that a creative solution is possible, given the demonstrated successes of SIS, the Career Center contributions and partnership, and the existing campus models (like the IDEA center or the Student Success Center in the Divisions of Engineering and Physical Sciences, respectively). That Faculty Advisors might adopt a larger, albeit more targeted, role in student advising should also be considered as it seems that one faculty per major is insufficient.

II. Curriculum: Strengths and Weakness

As mentioned above, the Division of Biological Sciences offers 7 undergraduate majors, a single minor, and a contiguous BS/MS degree program. Approximately 19% of all undergraduate degrees from UC San Diego are awarded in biology annually. The impact of the Division extends well beyond its ~ 5,400 BI majors (6 year average; ~75% incoming freshmen and ~25% transfer students) to the tens of thousands of students from other majors who enroll each year in at least one biology course. The undergraduate landscape in the Division is marked by a broad array of core, elective, and laboratory courses, with the latter comprising approximately 25% of the curriculum. Instruction is provided by a range of faculty, including world-class research professors, teaching professors, and Unit-18 lecturers, who are assisted by TAs and IAs.

Strengths

The Division has an established set of program/majors learning outcomes, and it is expected that the regular assessment of these will help to identify gaps and drive innovations in curriculum and pedagogy. To this end, a great variety of lecture and laboratory courses are offered by the Division on a quarterly basis (nearly 80 each Fall-Winter-Spring, and 40 in summer sessions), including senior seminars and other small enrollment classes. A flexible curriculum provides students the opportunity to take numerous electives across different sections of Biological Sciences. Some courses, such as BILD42 - Our Sustainable Future - provide career development insights through exposure to industry leaders (entrepreneurs, CEOs, *etc.*), while others address current topics of broad interest. Plans to expand on quantitative biology and biostatistics coursework (e.g. BILD 5 lab course) and to develop more discovery-based lab activities, including those that incorporate advanced techniques such as gene editing and sequencing data analysis, are exciting. The Division also coordinates and promotes a broad array of co-curricular activities, including undergraduate research experiences in the laboratories of faculty and many accessory units such as local hospitals and the Salk Institute.

From an administrative vantage, the Division pays earnest attention to the quality of undergraduate instruction it provides. It has made strategic hires of both research and teaching faculty with expertise in various curricular areas. It has designed and instituted exemplary models for: a curriculum pilot programming; shared instruction for new faculty; coordination and oversight of multiple offerings via a designated Lead Instructor; and, a 3-year curriculum review cycle by Course Coordination committees. Collectively, there is significant interest amongst faculty to stay current and ensure student access to emerging research and technologies. The quality of the

teaching enterprise extends to the many Unit-18 lecturers, who are clearly dedicated to the undergraduate student experience, and IAs, particularly undergraduates who value the opportunity to serve in this capacity and are generally seen to do an excellent job guiding their near-peers in the learning process.

Opportunities for Improvement

Curriculum Design: Several concerns regarding curriculum design were communicated to the review panel.

(5) The removal and/or reduction in biology course prerequisites, which has helped with time-to-degree, has added a 'remedial' element to advanced classes as students lack necessary foundational knowledge. To ensure the desired level of course rigor and inform any curricular updates, student learning outcomes should be assessed regularly and compared longitudinally. If it is indeed the case that students are no longer meeting course and program learning outcomes, the Division will need to determine how re-alignment will be achieved.

(6) The ineffective integration and perceived lack of usefulness of some physics, chemistry, and math prerequisites is another issue that was raised by students and faculty. To some extent, this is because these courses (and their course instructors) do not always tailor content to course participants, if only through providing relevant examples to emphasize context and motivate students. It is also a result of timing. Many BIO majors delay courses like organic chemistry lab (CHEM 43A) until later in their degree, when it no longer serves as foundational coursework and students have forgotten much of the material from the corresponding organic lecture series. To ensure that these courses are taken on time, new prerequisites for upper division BIO courses and labs should be implemented. Further, the Division should work with the Departments of Chemistry and Biochemistry, Physics, and possibly even Mathematics, to create lecture and lab courses specifically geared towards BIO students.

(7) The existence of specific curricular gaps, including regular formal instruction in information literacy and process/professional skills (for example, in writing and speaking), and the lack of courses in human anatomy or physiology (which leads many pre-medical students to take these classes at community colleges) has been noted. With existing campus expertise and literature resources and models (e.g., http://elipss.com), it should be possible to incorporate information literacy and process skills in an intentional, scaffolded fashion across the curriculum so that BIO majors benefit from these critical competencies.

(8) The BS/MS program has a strong influence on undergraduate education (though not discussed in detail during the review) as well as student's time-to-degree, given their desire to shorten the MS timeline by taking contiguous 199 credit. It is recommended that the Division examine the issue of research credits in terms of the BS/MS program setup.

Instruction and Mentorship: While the Division has in place effective instructional models (i.e. Lead Instructors and Co-Instructors), there are three teaching areas that could benefit from attention.

(9) In terms of formal instruction, a broader engagement of faculty with evidence-based instructional practices (EBIP) is needed. Of course, this is tied to space (vide infra) and professional development opportunities. Faculty themselves expressed interest in a short "Teach 101" course on writing learning objectives, developing assessments, and using EBIPs. Other faculty support requests were made for: a more formal archiving system of teaching materials (especially for new faculty); assistance with managing burgeoning student health issues; and guidelines for interacting with TAs. These requests can be met through a variety of mechanisms, including partnerships with the Teaching and Learning Commons Engaged Teaching hub, which already offers the Course Design Studio and a plethora of short teaching workshops, as well as Graduate Division, which has joined with the Commons to co-sponsor the Teaching/IA Faculty Advisor group.

(10) Although undergraduate TAs were acknowledged for their (generally) outstanding efforts, there was concern that some Ph.D.-level Instructional Assistants are poorly engaged (and therefore, off-putting to students) and/or assigned to advanced courses for which they lack the specialized content knowledge. The tracking and regular review of TA/IA performance should provide the data necessary to make informed changes in IA appointments and teaching responsibilities. There was also an expressed desire by faculty to give IAs the opportunity to repeat their teaching assignments, as all parties (course instructors, IAs, and students) could benefit from the graduate student's developing expertise. Given the teaching requirements of Ph.D. candidates, it would seem that such requests could be easily fulfilled.

(11) Lastly, students expressed interest in having more formal mentorship structures with faculty and senior peers so that they can establish the type of authentic relationships that help with academic, career, and personal advancement. Given the faculty-student ratio this will be a challenge to achieve, but perhaps such activities could be expanded to include graduate students and postdoctoral fellows, and linked to existing student groups and career development initiatives. For example, the Division might take better advantage of some of the high value student experiences, e.g. the Saltman Quarterly, to promote more student-faculty connections. Moreover, the Division might consider the approach of some departments, which have developed a discipline-specific "First Year Experience"-type course that fosters community early in students' academic careers.

III. Division in the Context of Campus and University Policies

Given the size and reach of its students, staff, and faculty, the Division of Biological Sciences holds a prominent and influential campus role, especially in terms of education policies, funding, facilities, and other resource allocation.

Strengths

The integration and communication of SIS and faculty, particularly those in the teaching track, with the 7 Colleges and other campus units is one of the most visible and positive ways in which the Division of Biological Sciences impacts the institution at large. Many aspects of SIS, including its staff training model, are emulated by other departments and divisions. Biological Sciences also leads the way in terms of its curriculum reform efforts. For example, it offers the only DEI-approved STEM course, BILD 60, for undergraduate students. The division's commitment to and campus leadership in inclusive excellence extends more broadly to the strategic engagement of its Diversity Committee with the Graduate Division and the Office for Equity, Diversity, and Inclusion.

Opportunities for Improvement

The largest, most pressing issue of the Division is the need for additional resources in support of student instruction and advising.

(12) The ability to offer a modern laboratory curriculum that infuses group-based learning and computing infrastructure is hindered by outdated teaching laboratories in York Hall. Capital Improvement Project submissions to renovate such spaces have thus far been unsuccessful. There is also concern that the Division is reaching wet lab instructional capacity. And as noted across campus, the limited availability of active learning classrooms hampers the adoption of evidence-based instructional practices by faculty and IAs.

(13) Space constraints extend to the work of SIS staff, who report a lack of closed-door areas suitable for confidential conversations with students during advising sessions.

(14) Relatedly, divisional leadership expressed concerns about the higher workload and lower salaries of their staff (relative to other departments on campus).

We are optimistic that the Division will continue to work closely with campus administration to find creative and satisfactory solutions to each of these matters as it endeavors to maintain and expand its high-quality and innovative undergraduate program.