



University of Colorado **Boulder**

2019 Program Review

Department of Integrative Physiology

Academic Review and Planning
Advisory Committee Report

Approved

DocuSigned by:

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Provost and Executive Vice Chancellor for Academic Affairs | Date

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Process Overview

The Academic Review and Planning Advisory Committee (ARPAC) review of the Department of Integrative Physiology was conducted in accordance with the 2019 program review guidelines. Self-study responses were prepared by the unit and checked by an internal review committee composed of two University of Colorado Boulder (CU Boulder) faculty members outside of the unit. The internal reviewers submitted a summary of findings derived from the self-study and from interviews and/or surveys with faculty, staff, and student unit members. An external review committee, consisting of three experts from outside of CU Boulder, visited the unit and submitted a report based upon review of relevant documents and interviews with faculty, staff, and student unit members and university administrators. Internal and external reviewer comments and recommendations are shared when relevant throughout this report.

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Unit Overview

The Office of Data Analytics (ODA) maintains a standardized description of the Department of Integrative Physiology [on its website](#). ODA updates the profile annually in the fall semester. This report cites data posted in October 2018, reflecting the state of the Department of Integrative Physiology as of the academic year (AY) 2017-2018.

Disciplinary context

The Department of Integrative Physiology (IPHY) is a relatively new unit that was established in 2003 with the consolidation of the departments of Environmental, Population and Organismic Biology (EPOB) and Kinesiology and Applied Physiology (KAPH). One year later, additional reorganization of the campus biological sciences resulted in some EPOB faculty moving over to Ecology and Evolutionary Biology (EBIO) while others remained in IPHY. As a result of this reorganization, most of the faculty members in IPHY had previously been members of KAPH, as related in the 2012 ARPAC report on IPHY. The unit's co-emphasis on biology in its curriculum sets IPHY's offerings apart from other physiology degree programs in Colorado that typically focus on some combination of topics in health and exercise studies. The National Research Council (NRC) ranked IPHY's PhD program in the top 10% of 63 such degree programs in the 2010 survey.

Research and scholarship

At the last review, IPHY described its mission as focusing on the study of life processes at the molecular, cellular, tissue, and organismic levels, and emphasizing the role of physical activity in human health across the lifespan. The unit's current hiring strategy projects its research expertise across four areas: cardiovascular/metabolic physiology, neuroscience, biomechanics, and sleep/circadian biology.

Faculty members whose research focuses on cardiovascular/metabolic physiology study metabolic change and morbidity associated with environmental factors,

epidemiology, substance abuse, and neurologic disorders. The neuroscience faculty study molecular signals of neurologic disorders and diseases such as amyotrophic lateral sclerosis, Alzheimer's disease, and stress-induced neurologic physiological or emotional changes. The biomechanics faculty study mechanisms and functional consequences of physical activity on human control of movement and locomotion including prosthetic assistance, and how these modulate with aging and disease. The sleep/circadian biology faculty study relations among stress, early human development, and brain function (emotion and cognition), and how these can impact conditions such as inflammation, chronobiology, and longevity. All of these areas attract continuing extramural funding from the National Institutes of Health and the National Science Foundation, with the number of awards rising from five in 2012 to 15 in 2017, for a total of more than \$8 million reported in the 2019 self-study; about \$384,000 per tenure-stream faculty member. The department's faculty members are also productive in terms of publications (roughly 5.5 published papers per member per year since 2012).

Collaborations

Integrative physiology research is by nature interdisciplinary and collaborative, and the usual practice is to publish with teams of other researchers. During the period 2012-2017, IPHY faculty reported 474 collaborations with researchers from US institutions, and 150 with researchers from international institutions across 22 nations. IPHY faculty members collaborate extensively with researchers at CU Denver, the CU Anschutz Medical Campus, and the Colorado School of Public Health, whose programs are themselves a collaboration among CU Anschutz, Colorado State University, and the University of Northern Colorado. The self-study records intra-campus collaborations between 2012-2017 for 13 of the 21 IPHY tenure-stream faculty members, including collaborations with faculty members from the departments of Anthropology,

Applied Mathematics, Chemical and Biological Engineering, Computer Science, Electrical, Computer and Energy Engineering, Ecology and Evolutionary Biology, Environmental Engineering Program, Molecular, Cellular and Developmental Biology, Psychology and Neuroscience, and Sociology; and from research institutes such as the Institute for Behavioral Genetics and the Institute of Behavioral Science.

National
and
international
context

The department is highly regarded at national and international levels. The self-study cites citation statistics (H-index) for peer-reviewed publications since the previous review of 43 (average) \pm 24 (standard deviation). IPHY faculty are extremely active in presenting at domestic and international conferences. The self-study lists 80 faculty conference presentations across IPHY's four research areas. IPHY instructors also present at many educational and scientific conferences, including the Human Anatomy and Physiology Society (HAPS) annual conference, Experimental Biology, and American Association for the Advancement of Science (AAAS) Vision and Change in Undergraduate Education. Instructors have published in peer-reviewed scientific journals during the last six years and collaborated in completing a lab manual (*Practice Anatomy Lab [PAL] 3.0 Lab Guide*), and an atlas (*A Photographic Atlas for Anatomy & Physiology*).

The department's success in securing external funding is another measure of its reputation and impact. Between 2012 and 2017, the number of faculty receiving awards tripled while the number of faculty increased by only 20%, although a table in the self-study shows that the average funding level (\$348,000 per faculty member) was nearly the same in 2012 as in 2017, following a sharp increase in 2016. The two metrics imply that faculty are submitting more proposals to a wider variety of funding vehicles. In terms of direct grant expenditures, the ODA unit profile shows IPHY first of eight biological and

environmental science departments per tenure-stream faculty member in AY 2017-18, and fifth of 39 ranked departments overall.

The external reviewers evaluate the unit's scholarship as excellent across all faculty at all tenure stream ranks, stating that "Collectively, this faculty is outstanding and attracts international attention to the research that occurs at the [university]." The external reviewers also call attention to the department's nearly four-fold rise in extramural funding since the previous review to \$8.52 million.

Campus context

IPHY plays an important role across CU Boulder units, with collaborative efforts in the biological sciences as well as the physical sciences and mathematics more generally. The self-study defines the department's teaching mission as integrating biology, anatomy, and physiology with physics, chemistry, and mathematics in an empirical approach that focuses on human and organism functions at levels ranging from genes to organs and systems.

Faculty and research personnel

According to the ODA unit profile for AY 2017-2018, IPHY employs 21 tenured and tenure-track faculty, nine instructor-track faculty, four lecturers and other instructional personnel, 44 teaching assistants/graduate part-time instructors/other student employees, 38 research faculty, and 12 student research assistants. The self-study reports one additional tenure-stream faculty member (newly appointed at the time of the ARPAC review), an equal number of instructors but two fewer lecturers in their self-count. The internal reviewers note that IPHY's senior instructors are highly committed, a number having been with the department for over 15 years.

The self-study points out a number of urgent challenges arising from the department's high ratio of 71 majors per tenure-stream

faculty member (the highest at CU Boulder), including an emphasis for hiring to better support teaching and mentoring activities and to provide faculty members sufficient bandwidth to address curricular and professional development needs. The external reviewers highlight a need to fill knowledge gaps in muscle physiology, immunology imaging, and sensory physiology. Hires in these specializations could expand IPHY's research collaborations with engineering and neuroscience researchers, as well as enrich its course offerings.

Five retirements, the conversion of a faculty line to a split appointment with the Department of Mechanical Engineering, and the appointment of two faculty members to administrative posts have reduced the department's tenure-stream faculty member strength by nearly six full-time positions. This shortfall has occurred at the same time that IPHY's undergraduate major count has more than doubled. Two assistant professor searches proved successful, but the self-study argues that additional hires in the above-mentioned areas would continue to strengthen the unit overall. According to the self-study, IPHY is working to develop a new faculty hiring plan.

Salaries for all IPHY faculty member ranks, including the senior instructor rank, either equal or exceed the CU Boulder average. And while average salaries are mixed, the standard deviations put them well within the range of the three other biological science departments (Ecology and Evolutionary Biology, Molecular, Cellular and Developmental Biology, and Psychology and Neuroscience). The ODA unit profile shows that average IPHY salaries by rank (\$85,716 for assistant professors, \$98,620 for associate professors, and \$169,603 for full professors) exceed Association of American Universities (AAU) peer salaries within the discipline (\$82,336, \$98,543, and \$140,892, respectively). The self-study interprets ODA's data differently, warning that low salaries diminish competitive hiring

and this indicates a need to increase starting salaries and startup packages. The ODA unit profile does not report AAU instructor salaries for peer disciplines, but it appears that the IPHY instructors achieve earnings commensurate or better than in cognate CU Boulder units.

Staff
and
infrastructure

According to the ODA AY 2017-2018 unit profile, IPHY employs seven exempt professional university staff members, four classified staff members, and 16 student hourly employees. The unit self-study reports eight staff (the equivalent of 7.2 full-time lines), dispersed across three business foci: program operations, finance and building, and academics. A staff administrator leads each grouping. The self-study comments that the chair is working to secure approval for a 0.75 FTE staff position to assist faculty with grant award logistics, and is expecting that to increase to a full-time position as IPHY hires additional research-active faculty. Notably, nine of the thirteen staff salaries are supported in whole or part by indirect cost recovery monies, which the self-study says ties up resources needed elsewhere.

Like IPHY faculty, the department's staff members are geographically dispersed. The drag imposed on business operations and departmental cohesion by having personnel distributed across three buildings (the Carlson Gymnasium, Clare Small, and Temporary Building 1) is called out by the unit's self-study and affirmed by the internal and external reviewers. In addition, the self-study reports that three staff members are scheduled to move into the Ramaley addition currently under construction. The combination of staff dispersal and subpar space is especially recognized as an impediment to undergraduate support, such as for advising.

Undergraduate
education

IPHY offers a Bachelor of Arts (BA) degree and a bachelor's-accelerated master's (BAM) degree, both in integrative

physiology. The undergraduate curriculum integrates learning from biology, anatomy, and physiology with physics, chemistry, and mathematics to teach students how humans and other organisms function at the level of genes, cells, tissues, organs and systems. Undergraduate majors gain a foundation in basic biology, anatomy, and physiology and are offered elective emphases in biomechanics, cell physiology, endocrinology, exercise physiology, immunology, and neurophysiology.

As previously noted, IPHY reported a total of 1,710 majors in 2017 (ODA reported a 2017 count of 1,743 IPHY majors). IPHY ranks second for majors in the College of Arts and Sciences, behind the Department of Psychology and Neuroscience. As noted earlier, the department has the highest student major to tenure-stream faculty member ratio (71:1) among biological science units at the university. The number of majors is stable relative to the previous ARPAC review (1,695 majors in 2012), but a decline from the 2014 peak of 1,984 majors. The internal and external reviewers concur with the unit's perspective that the establishment of the neuroscience major in the Department of Psychology and Neuroscience might have contributed to the decline. IPHY faculty members are working to revise their curriculum to make the major more appealing to students.

In 2017-2018, the unit awarded 295 bachelor's degrees, ranking second of the biological science departments, and fifth among 49 degree-granting units. Of these graduates, 1% earned a concurrent master's, 2% earned honors, and 4% earned the IPHY degree as a second major. ODA reports that the median time-to-degree completion is eight semesters (3.67 years), ranking IPHY first among the eight degree-granting units in the review year, and first among all units in 2018.

In 2018, IPHY generated 17,668 student credit hours, ranking third among biological and environmental science units and

17th among all CU Boulder units. The ODA report cites a somewhat higher number with IPHY generating 18,509 student credit hours in 2018. This is a 4% decrease over the past five years. The major requires 30 credits in biology, chemistry, physics, and mathematics, and 33 credits within the department. This split means that roughly half of the student course work leading to a bachelor's degree is credited to other units, and in this regard, IPHY is making significant contributions to the student credit hour statistics of those four departments. Tenure-stream faculty members teach only 31% of the student credit hours (a drop of 12% over five years), and instructors handle 52% (a roughly stable percentage over that time). Graduate part-time instructors and teaching assistants handle 9% of the student credit hours. IPHY is notable in offering a large number of student credit hours as one-on-one instruction (311 hours), which ranks first among all campus units. Faculty course questionnaire (FCQ) scores for the department are strong and have improved by 2% over the past five years. The unit is ranked first in course ratings among units in this review cycle, and tenth overall. Instructor ratings are higher than those of tenure-stream faculty members and have improved by 3%, ranking first and fourteenth, respectively.

A number of activities and initiatives are currently offered to improve the undergraduate experience, including three student-led clubs (IPHY Club, Biostatistics Club, and Nutrition Buffs). Undergraduates are also encouraged to participate in research supervised by tenure-stream faculty members and to gauge their personal interest in pursuing research in an industry or academic setting. By 2017, 16 IPHY laboratories had provided 458 undergraduates with formal research experience. A total of 97 undergraduates have co-authored research papers with faculty members or have papers in review or preparation. At present, the demand for additional research opportunities exceeds lab availability. One faculty member developed a

course-based undergraduate research experience (CURE) that was first taught in spring 2019 as a freshman-level pilot with a maximum of 18 students. In CURE, undergraduates are given the chance to conduct a research project in a laboratory setting, with one tenure-stream faculty member working with all 18 students as a group rather than one-on-one. Students can engage in volunteer activities both on and off campus, earning one internship credit for every 45 hours volunteered. Any IPHY faculty member can sponsor a volunteer. It is unclear if this work is counted as internship or independent study.

Undergraduates can also undertake several teaching activities for a number of campus pre-health programs (such as the Global Medical Brigade, the Global Dental Brigade, or the CU Pre dental Society). IPHY undergraduates can also find work as tutors, for example, to help fellow students succeed in the Human Anatomy Laboratory. In addition, IPHY offers two courses that help undergraduates develop and refine their teaching skills.

IPHY faculty members, and particularly instructor-line faculty, are proactive in campus communities that nurture research-based science, technology, engineering, and mathematics (STEM) teaching practices and that enhance their own pedagogical skills (e.g., the Faculty Teaching Excellence Program, the Arts and Sciences Support of Education Through Technology Program [ASSETT], the Center for STEM Learning, and the Transforming Education, Supporting Teaching and Learning Excellence Project [TRESTLE]). Since 2012, IPHY instructors have received a variety of campus awards recognizing their work; for example, the Best Should Teach Gold Award (one instructor), the Faculty Fellow Award (two instructors), the Marinus Smith Award (three instructors), the ASSETT Excellence in Teaching with Technology Award (one instructor), the TRESTLE Course Development Award (three instructors), and the Chancellor's Award for Excellence in STEM

Education (three instructors). Instructors have also revamped several laboratory courses, with the aim of having students gain skills through lab assignments that are inquiry-based, rather than textbook-style rote learning.

In 2011, IPHY faculty members worked with postdoctoral science teaching fellows as part of a CU Boulder science education initiative to develop new learning goals for four entry-level major courses and six upper-division electives. As a consequence of this work, IPHY was cited as a national role model for science education reform. However, the self-study reports that the department's curriculum has evolved with new faculty hires and the prior coherence has since eroded. In response, IPHY has created three instructor positions tasked with coordinating curricular realignment and assessment.

In 2012, a campus steering committee that included IPHY faculty representatives developed a certificate in public health. IPHY has been integral to the certificate's success and teaches one of the certificate's core courses each semester. As of December 2018, 402 students from 20 majors had completed the certificate, with 449 students still working towards completion.

Despite the certificate's success, IPHY wishes to expand students' perceptions of what its curriculum offers to more than just a "pre-health" major. Faculty members are working to eliminate second semester physics and calculus from the major's requirements, make the human anatomy laboratory an elective rather than a core requirement, and add four more course options for students fulfilling the major's core requirement. Majors will now be obligated to complete 15 credits from a final list of ten core courses.

A survey of IPHY seniors administered by ODA in 2016 attracted the participation of 149 students (a 37% response rate) and indicated that the seniors were generally satisfied with their experience, with 75% responding that the program met their educational goals, 77% that they were satisfied with the major as a whole, and 75% that they felt IPHY courses were effective in providing a good general education. A total of 61% of respondents felt that they were prepared for employment or graduate school. However, only 38% of students felt that career advising had been satisfactory, and only 49% felt positively about advising on course selection. This seems expected given the 71:1 student to tenure-stream faculty ratio, a situation that leaves little bandwidth for faculty members to interact with students outside of classroom or lab settings.

Graduate education

IPHY offers a Master of Science (MS), a Doctor of Philosophy (PhD), and the previously noted bachelor's/accelerated master's (BAM) degrees, all in integrative physiology. Master's students and BAM students can elect a non-thesis option. The self-study reports that, as of fall 2018, IPHY enrolled 32 MS and 24 PhD students. In 2017-2018, the unit awarded 22 MS and eight PhD degrees. This represents an increase of 57% for master's degrees since 2012, although MS degree production fluctuates between 14 and 25 over those seven years. The production of PhD degrees during that time period was relatively stable, with between six and eight degrees conferred each year. The ODA unit profile indicates a five-year 20% drop in master's students and a 13% drop in doctoral students, which appears to contradict the self-study statistics.

IPHY master's students complete their degrees on average in two to three years and PhD students in four to seven years, according to the self-study. However, the ODA unit profile shows that many IPHY PhD students take longer: 79% of PhD students who do not finish in four years actually take up to ten

years to complete their degrees. The ODA report suggests that students completing within four years are continuing from the master's degree, or receiving joint PhDs in neuroscience or cognitive science. It's unclear what portion of the remainder of doctoral students take longer to graduate, and what portion of those students leave the program. The department's students appear to place well. MS graduates are recruited to doctoral programs or professional schools and PhDs graduates are recruited into post-doctoral positions, gain tenure-stream faculty appointments, or take jobs in private industry.

The department describes low graduate student stipends as a challenge that hinders successful recruitments, saying that CU's stipend offers fall below those of peer institutions, especially considering Boulder's high living costs. Some faculty members "top up" teaching assistant stipends with research funding from their grants. The self-study reports that doctoral students are typically awarded a 50% teaching assistantship or research assistantship, while MS and BAM students are offered 30%-50% appointments as department funds allow. The stated intention is to provide every student two years of support in the form of teaching positions, with roughly 40 teaching assistantships available each semester. Doctoral students typically move from teaching assistantships into research assistantships or research fellowships. The internal reviewers report that in practice, IPHY offers more than two years of funding in the form of teaching appointments when needed.

A 2010 NRC ranking of physiology doctoral programs ranked IPHY sixth overall in comparison with over 60 other graduate programs. One of several criteria used in this ranking is the number of graduate publications. IPHY graduate students publish at high rates in first-tier refereed outlets. The self-study estimates that its graduate students published 337 scientific articles in the five years previous to the self-study's writing, and

170 of these with the IPHY student as first author. The self-study also reports that in the same time period, graduate students gave 227 presentations at conferences in biomechanics, heart and vascular research, sports physiology, sleep science, and neurological mechanics. Students are offered up to \$600 to defray costs of conference participation.

The graduate curriculum includes a required statistics and research methods course, a colloquium seminar, and an experimental design course that includes training in proposal development and publication. A total of 30 graduate level credits are needed to complete either the MS or PhD, and students can include courses offered outside the department. Such flexibility permits students to tailor their education to individual interests and skills. The self-study makes a special note of IPHY doctoral students' pursuing a joint degree in neuroscience, but does not offer data on how many students take this option.

The self-study reports that the department sometimes has to cancel graduate courses due to low enrollments, which may be connected to the dissatisfaction about limited course offerings registered by the internal reviewers in their survey of graduate students. The self-study says that the specialized nature of graduate work, and an enrollment base of six students, contributes to this problem. Graduate students also note a lack of interaction with faculty members, a circumstance that the self-study attributes to the unit's physical dispersion across several campus buildings. The department tries to remedy this with a weekly colloquium, but attendance is not required, and students tend to interact more with others in their advisor's laboratory. A new colloquium series where graduate students present their own research is also elective and not well-attended. According to the self-study, IPHY has taken steps to improve graduate student satisfaction, including by

administering a climate survey, establishing a graduate listserv, and hiring a lead graduate teacher to train teaching assistants and coordinate graduate student participation in the Graduate Teacher Program's teaching certification. Future planned strategies to enhance graduate student cohesion include offering student-organized socials, and opening dissertation defenses to faculty members and students from other laboratories.

Postdoctoral
training

The ODA unit profile showed IPHY employing five postdoctoral fellows in the fall of 2017. The self-study does not allude to them as a group, beyond mentioning that a new staff hire will be assigned to track current and former postdoctoral researchers for use in future training grant submissions. Neither the self-study nor the bylaws address postdoctoral fellows, leaving this review with little to assess about this important population, including the organization of support resources or mentoring.

Space and
infrastructure

The department's lack of contiguous space and a deteriorating infrastructure appear to be its two most pressing problems. Given IPHY's research productivity, national ranking, and volume of undergraduate instruction (and therefore tuition dollars), these shortfalls were especially noteworthy to the internal and external reviewers. According to the self-study, IPHY occupies 29,000 square feet of space dispersed across six buildings. An anticipated 2020 renovation of the Ramaley Building will allow IPHY faculty and staff members currently working in the Carlson Gymnasium to move into modern laboratories and offices. The renovation will also open space for two new faculty hires, and provide a large conference room for department community activities. However, it will not remedy space or infrastructure shortfalls for a majority of IPHY faculty.

The department's frustrations also relate to the location of some faculty members and graduate teaching assistants on the East Campus or on Wilderness Place, far removed from the department's personnel in Clare Small, Temporary Building 1, and Ramaley. The distances involved impose logistical difficulties for holding office hours and serving undergraduate needs effectively. Staff members are also suboptimally located to address the advising needs of 1,700+ majors in a coordinated way. Both the internal and external reviewers call the lack of centralized space an impediment to departmental cohesion and community, and the student surveys back up this assessment.

Support
needs

The IPHY self-study suggests that the unit's most pressing support need is for improved and more frequent transportation between Main Campus, East Campus, and Wilderness Place. This is a recurring need across multiple units split across campus sites.

Governance

IPHY revised its bylaws in January 2018, and they were approved by a faculty member vote one month later. The bylaws articulate roles and responsibilities of an elected chair and two associate chairs. They also describe the responsibilities of five standing committees and three ad hoc committees, one of which handles grievances. The bylaws describe voting eligibility and procedures, and protocols related to hiring and promotion, curricular affairs, and resource allocations. The chair, in conjunction with an executive committee oversee the administration of the department by following regent and campus policies. The committee consists of the associate chairs for faculty affairs and undergraduate affairs and two other tenure-stream faculty members or senior instructors elected by a simple majority vote.

The bylaws include procedures and criteria for reappointment, promotion, and tenure, for faculty searches, and for voting rights. They do not include annual merit evaluation procedures, and the reappointment and promotion procedures do not address the promotion of instructor-rank faculty (for example, from instructor to senior instructor or from senior instructor to teaching professor). The self-study describes plans to codify reappointment and promotion procedures separately from the bylaws and to outline new annual merit evaluation procedures that will resolve faculty dissatisfaction with current annual merit evaluation methods.

Inclusive
excellence

The fall 2017 ODA IPHY profile shows seven (of 21) tenure-stream faculty members (30%) who identify as women, four (17%) who identify as people of color, and three (13%) who are members of underrepresented minority groups. These percentages place IPHY sixth, fourth, and first among the biological and environmental science units for diversity in these respective categories.

Of IPHY's 1,743 undergraduate majors in fall 2017, the ODA unit profile reports that 74% are Colorado state residents and 2% are international students. Undergraduate majors include 68% who identify as women (ranking IPHY second of the eight departments in the review cycle), 30% identifying as Asian American, African American, Latinx, or indigenous (Native American or Pacific Islander) (second of the eight departments), and 19% who are members of underrepresented minority groups (third of the eight departments).

The ODA unit profile reports fall 2017 demographics of 61 graduate students, including 35 master's (including BAM) and 26 PhD students. Of these, 84% were Colorado residents, 3% were international students, 46% identified as women (ranking IPHY seventh of the eight departments in the review cycle),

18% identified as people of color (third of the eight departments), and 11% identified as belonging to an underrepresented minority population (third of the eight departments).

The self-study highlights the department's participation in several campus programs intended to improve recruitment of underrepresented students into science, technology, engineering, and mathematics-based PhD programs. These include the Colorado Advantage Program, the Colorado Diversity Initiative's Graduate Preview Weekend, and the CU SMART Program, which offers an opportunity for potential recruits to do summer work with a faculty mentor while also attending communication-focused workshops.

The internal reviewers say: "We view the diversity issue as an ongoing challenge given the lack of articulation of specifics for how diversity is addressed in the self-study, and comments from those we spoke to such as the colloquium series being 'very white and very male.' "

The internal reviewers also note a self-study comment that the IPHY diversity committee was disbanded. They requested examples of how the department considers inclusive excellence, above and beyond the mandatory discussion of hiring diversity. IPHY's response struck the internal reviewers as vague and non-committal: "The Diversity Committee that previously existed was not active, and philosophically the IPHY leadership strongly believes that diversity and inclusiveness should be part of our 'moral fabric,' rather than being relegated to a 'committee task.' This is a recent change, and for the time being the Executive Committee will provide umbrella oversight for diversity and inclusiveness on issues pertaining to undergraduate and graduate student recruitment and retention."

Climate
and
Culture

The unit's overall climate appears to be positive, according to the results of a March 2018 climate survey addressed to IPHY faculty and staff members and to graduate student appointees. The overwhelming majority of faculty members and graduate students reported feeling respected and valued by their colleagues. However, a few items of concern remain; notably the lack of a sense of community by staff, consensus among faculty members and graduate students that they feel excluded from informal networks, and a dearth of departmental cohesion, likely exacerbated by the department's previously noted physical dispersion.

Past Reviews

ARPAC last reviewed the Department of Integrative Physiology in 2012. The committee made recommendations to the unit and to university administrators regarding steps it considered advisable to strengthen IPHY. This section describes how the major recommendations were acted on in the intervening seven years.

In 2012, ARPAC signaled its support for hiring to fortify the department's strengths and suggested that IPHY undertake steps to improve faculty mentoring. By 2014, IPHY had recruited faculty members with expertise in cell physiology and in imaging. In 2015, IPHY was authorized to hire two additional faculty members. At a 2016 retreat, the department made plans to add to existing strengths in sleep physiology and epidemiology. IPHY also participated in a cluster hire focused on the practice of science, technology, engineering, and mathematics-based education.

Efforts to improve mentoring practices as per the 2012 ARPAC recommendations proved less straightforward. At first, IPHY responded that associate professors have access to full professors as a source of knowledge and mentoring. This response was a serious deflection that completely ignored the needs of pre-tenure faculty members and instructors. Moreover, it placed the onus to seek advice upon those in more vulnerable ranks, and kept the unit in ignorance about its responsibility to mentor all ranks of unit personnel. In 2016, the problem was mediated in a positive manner, when the new IPHY chair implemented a formal mentoring structure for junior faculty members and instructors, and provided regular access and opportunity for associate professors to approach the chair for advice.

As previously noted, IPHY completed a cycle of bylaw revisions in 2018 that added clear references to advancement and

promotion and opened department leadership roles (such as membership on the executive committee) to instructors. At the time of the 2012 review, ARPAC called out a number of opportunities for the unit to modify its educational programs to better serve students. To aid undergraduates, ARPAC suggested that IPHY expand and regularize its course offerings. Following ARPAC's suggestion, IPHY explored the possibility of offering summer courses, but did not find sufficient student demand to make the expansion sustainable. By 2016, the department offered additional sections of high-demand courses during the regular academic year. A valid concern voiced by IPHY in several documents is that the sheer number of undergraduate majors makes it difficult to serve students' interests in more specific ways, such as to offer each student an individual research opportunity. That said, in spring 2019, IPHY offered its first-year students a course-based undergraduate research experience (CURE).

The ARPAC recommendation that IPHY, along with the departments of Ecology and Evolutionary Biology (EBIO), and Molecular, Cellular and Developmental (MCDB), coordinate their lower division general biology course offerings, was not taken up. In its 2014 review update, IPHY indicated that neither EBIO nor MCDB was willing to cooperate; the College of Arts and Sciences did not intercede.

ARPAC's 2012 recommendations regarding graduate education included a request to IPHY to develop more graduate-level courses and to strengthen its core requirements for MS and PhD students. IPHY did not feel a need to expand core requirements, and when additional graduate electives were added, enrollments were not high enough to sustain the courses. The committee also asked IPHY to reconsider the requirement that PhD applicants obtain the sponsorship of a faculty mentor before applying. IPHY responded that, without a

sponsor, an applicant would not have alternate funding sources within the unit. Finally, in response to a prompt that IPHY better define the role and mission of the MS degree program, the department said that the degree's stated mission is unchanged.

Student frustrations with undergraduate advising were a major focus of ARPAC recommendations in 2012. IPHY began working with the Arts and Sciences Academic Advising Center in 2014 and continued to do so after the consolidation of biological sciences advising in 2016. A student survey that year found general satisfaction with advising among IPHY undergraduates. The committee also suggested that IPHY supplement general undergraduate academic advising with advising for career and research opportunities provided by faculty members. By 2016, IPHY had seen an increase in the number of undergraduates who were pursuing research sponsored by individual faculty members, a development that opened a pathway for more individualized and professionally-focused advising. Following the 2012 review, the department also initiated planning discussions for assessing the educational outcomes of its degree programs. These discussions evolved into a collaboration with MCDB in 2016, and the initiation of a pilot assessment instrument distributed to students completing upper-division courses. These efforts have seen positive results.

In 2012, ARPAC suggested that IPHY take steps to strengthen the sense of departmental collegiality, especially among graduate students. While IPHY was hopeful that the creation of a graduate colloquium seminar was sufficient, the internal and external reviewers in the current review continued to report student concerns that the department deprioritizes the sorts of associations most meaningful to them, especially interactions with a broader array of faculty members. In 2016, the faculty asked the IPHY Club to make suggestions about improving

departmental cohesion; surveying members to ask if an informal August social event might help, and supporting a continuation of the graduate colloquium seminar mentioned above. This tactic appeared to place the burden for community-building efforts on students (e.g., for the students to form graduate panels and organize seminars, or initiate career discussions with undergraduate students). Today, there remains little involvement by faculty members in brainstorming or interacting with students outside of individual labs.

ARPAC recommendations addressed to the dean of the College of Arts and Sciences in 2012 met with mixed success. Among other challenges, the department's acute lack of space continues mostly unabated and hinders the department's ability to recruit personnel and students. IPHY also reported that an ARPAC request for the college to increase its allocation of teaching assistantships went unanswered. However, the college did permit IPHY to reclassify two staff members in 2014 and 2016 and provided funds to hire a part-time administrative assistant to coordinate the public health certificate, along with a part-time student assistant for its main office. Also, the college hired an advancement liaison in 2016 to work with selected IPHY faculty members to raise research funding.

A number of recommendations that ARPAC addressed to the provost concerning IPHY in 2012 gained traction, including a recommendation for the campus to upgrade and consolidate its animal facilities; a development that forestalled the potential withdrawal of extramural funding by outside granting agencies. Also, the department's urgent space needs described previously saw steps in a useful direction with the renovation of the Ramaley Building. While the renovation is an initial first step towards a more meaningful consolidation of the department's core operations, it still leaves many needs unmet. The department's 2016 progress update refers to plans for a

possible campus life sciences complex that as of this review remain only under discussion.

Analysis

The Department of Integrative Physiology is clearly positioned as a strong unit, with a faculty of nationally and internationally recognized scholars, and the second largest number of majors in the College of Arts and Sciences. Yet challenges to continued growth and vitality must be confronted, including better undergraduate and graduate student advising and mentoring, improved unit cohesion despite a lack of centralized meeting space, and the dispersal of personnel across multiple campus sites. A 71:1 ratio of undergraduate students to tenure stream faculty members precludes offering the high levels of interaction that students indicate they desire. It is difficult to envision how the undergraduate program could grow—or even be maintained—at current levels. Moreover, the unit’s challenges are stacked: without additional lab and research space, additional faculty member hiring may be constrained. And without additional faculty members, it is hard to gain the graduate student teaching assistantships, and additional post-doctoral researchers that help to support undergraduate and graduate mentoring.

Strategic vision and planning

As part of a strategic planning exercise in 2018, IPHY evaluated and modified its undergraduate curriculum to reduce the number of student credit hours required for the major outside the department and to increase students’ core course options. That exercise also resulted in the establishment of an associate chair for faculty affairs and proposed steps to address salary inequities, improve junior faculty and instructor mentoring, realign the faculty hiring plan toward existing unit strengths, and broaden faculty input into unit policies and procedures. ARPAC sees all of these actions as positive steps toward actual change for the unit.

ARPAC believes that as part of its strategic planning, IPHY should consider expanding its outreach to other units for shared projects and interests, including sharing research

equipment and promoting additional collaborations; for example, to move forward on ARPAC's repeated request that IPHY join forces with Ecology and Evolutionary Biology (EBIO), and Molecular, Cellular and Developmental Biology (MCDB) on lower-division biology instruction. Given the current shortage of tenure-stream faculty members in IPHY and the common goal of involving tenure-stream faculty in lower-division teaching as much as it is possible, this type of collaboration seems an obvious win-win strategy.

As previously noted, the department has lost five faculty members to retirements and two to administrative appointments in recent years, and another took up a split appointment with the Department of Mechanical Engineering. Replacement hiring has left the number of faculty essentially unchanged from seven years ago, a period that saw a 250% increase in IPHY's undergraduate majors. A reduction of the student-faculty ratio is dependent upon making more hires. Such hires will also help the unit to expand its extramural funding. ARPAC finds persuasive IPHY's claims that its hiring seems less attractive to candidates due to relatively low starting salaries and inadequate lab space. It appears that additional support from the college and the provost will be required to facilitate the department's growth.

The IPHY major attracts many students who want to pursue advanced degrees or health-related professional careers. The aforementioned student-faculty access challenge requires that IPHY envision and pursue creative ways of teaching undergraduates; for example, by team-teaching or collaborating with other units on introductory courses. The undergraduate public health certificate clearly serves not just the department majors but students across campus, and should be prioritized by the college and campus for support and expansion.

The self-study describes the integrative physiology undergraduate degree as a major contributor to future graduate education and as a vehicle for preparing students for healthcare careers. Interestingly, the 2016 ODA survey of graduating IPHY seniors showed that 64% (129 of 295) of the respondents planned to seek private sector employment, and only 20% were considering graduate school. One conclusion might be that the unit is not serving its undergraduates adequately in terms of offering them the research experience that would open up graduate study as a prospect. A different interpretation, however, is that not all undergraduates seek an academic career path, and if this is the case, not all IPHY majors might be in need of research opportunities, contrary to the position stated in the self-study. Further surveying of upper-division undergraduate majors might provide more insight into how undergraduate course and out-of-classroom learning options might serve students' career exploration and post-graduation planning.

ARPAC believes that IPHY and the other biology departments, MCDB and EBIO, should revisit the committee's 2012 recommendation to consolidate introductory biology classes and/or their teaching in some fashion that would serve the needs of all units' majors and maximize teaching resources. For IPHY, this practice could improve the student credit hours allotted to tenure-stream faculty members teaching in IPHY. This could be arranged as a rotation by which tenure-stream faculty members in two units could co-teach each semester, thus offering students an opportunity to work with tenure-stream faculty members from multiple units.

IPHY has a strong research-based graduate program for all three degrees (BAM, MS, and PhD). Graduate students are generally satisfied with their training, but express concern about the lack of departmental community. While graduate student

stipends are lower than what might be ideal, proposals and current practices to “top up” stipends from research grants must align with university policies. Specifically, IPHY must seek clarity on whether the practice of augmenting graduate TA lines from extramural grants is aligned with university policy that no student funded on a 50% teaching assistantship or research assistantship is allowed to accept additional employment on or off campus. If a student stipend is drawn from research funding, is the student expected to perform research for that additional stipend? If not, then the IPHY faculty members must offer that augmentation as an honorarium, but the exact mechanism of this practice is not clear in the self-study.

The maintenance of established training grants, and the attainment of new grants, will necessarily confer more attention to graduate advising, mentoring, and placement. But implementing better graduate student support and the concurrent need for better reporting on outcomes warrants a request to the college for additional resources, such as to transform the current graduate and postdoctoral affairs coordinator position into an additional associate chair.

Amplified graduate student enrollments could augment existing support for IPHY undergraduate teaching and mentoring, as well as boost faculty research productivity. An expanded graduate student population will require additional teaching assistantships. Meanwhile, postdoctoral researchers should be able to contribute to their own support by participating in and/or leading their own research proposals and submissions. The department’s request to gain a staff position to aid with grant processing should be taken up by the college as it helps to better support this critical campus constituency in IPHY. Since many funding agencies (such as the National Institutes of Health) do not accept proposals from postdoctoral researchers, increasing grant success among postdoctoral researchers

would necessitate their being reclassified as research associates—a common campus practice, but one that must be undertaken in full awareness of the camouflage that such reclassification imposes and how this can complicate identifying (and supporting) postdocs.

Budget The practice of applying indirect cost recovery monies to support staff positions reduces resources that could go toward other departmental needs such as communal activities, curriculum development, or additional student teaching or research positions.

Space, infrastructure, and support needs Important department objectives like gaining a greater sense of community, improving the quality of undergraduate advising, and promoting collaborations and interactions are stymied by IPHY's dispersion across multiple buildings. Important features, such as adequate communal space and office space to advise students privately are missing. Moreover, laboratory space allocated to the unit is insufficient and hinders faculty and graduate student recruitment. Poor transportation between various IPHY locations intensifies these problems, and while it may be impossible to assign a single location for the labs and classrooms and offices at present, it should definitely be possible to improve and regularize campus transportation between sites or, at a minimum, to offer parking flexibility. The campus is harming its overall productivity by failing to remedy transportation issues in a comprehensive manner.

Governance and mentoring Greater decision-making transparency, and the inclusion of more faculty and instructors in unit decision-making, including for resource allocations, has improved unit morale in important ways since the last ARPAC review. We commend the department for the courage and perseverance to have already undertaken significant adjustments in a short time, and we encourage further such efforts.

ARPAC especially sees the need for governance and departmental practice to change in regard to faculty and postdoc mentoring and evaluation. For example, the unit needs to develop tenure-stream and instructor-track promotion policies and to update its annual merit evaluation procedures. The self-study describes many of these aspects in detail and this can serve as a useful start. For example, the instructor development template could add material similar to Item 5 in the development plans of tenure-stream faculty members (see “Planning to Move to the Next Step”), focused on guiding the faculty member being mentored to make key contacts, develop a CV, and undertake other actions that facilitate reappointment and promotion. Additionally, the role of the graduate and postdoctoral affairs coordinator should be expanded to support mentoring responsibilities for those populations.

Changes like these might necessitate updates to the IPHY bylaws. They also will require patience, constructive visioning, and in some cases, hard work, all of which take time away from teaching and research. Faculty who head these efforts should be rewarded for their work in annual merit evaluations.

Inclusive
excellence

ARPAC appreciates the advances that IPHY has made in increasing faculty diversity but agrees with the internal and external reviewers that the departmental commitment to inclusive excellence is not well articulated or an obvious priority. Like the internal reviewers, ARPAC wonders why the IPHY diversity committee was disbanded and believes the department should express and sharpen its vision of what inclusive excellence means within the unit’s culture and practice. The self-study alludes to the department’s inclusive excellence document, but does not express that document’s tenor or goals. As already quoted, the department’s response to the internal reviewers conveys only that “the IPHY leadership

strongly believes that diversity and inclusiveness should be part of our 'moral fabric,' rather than being relegated to a 'committee task.'" ARPAC joins the internal reviewers in questioning whether the executive committee can provide the focus necessary for "umbrella oversight for diversity and inclusiveness on issues pertaining to undergraduate and graduate student recruitment and retention."

Climate
and
culture

The popularity of the major attests to the positive attitude of undergraduates. The previously described March 2018 climate survey suggest that IPHY employees feel respected, but share a general concern about the lack of a community. Solutions proposed by the unit do not seem cognizant of the fact that being siloed within one's own laboratory could be a big impediment to unit cohesion. The department's decision to disband its diversity committee communicates the opposite of what was intended as a statement of deeply ingrained support for inclusivity across all existing department practices. Students share a concern that tenure-stream faculty members do not spend enough time interacting with them. Additionally, some faculty members and students indicate that they feel excluded from informal networks. There was also an indication in the climate survey that staff feel disrespected, with some 40% responding that they "agree" or "strongly agree" that faculty incivility toward them is a concern, and 60% "agreeing" or "strongly agreeing" that this incivility affects department functioning. Unit attention to community, inclusion, and mutual respect is warranted and will pay dividends in terms of student, faculty, and staff satisfaction and a general sense of belonging.

Recommendations

The members of the Academic Review and Planning Advisory Committee address the following recommendations to the Department of Integrative Physiology and to the offices of responsible administrators:

To the Unit:

1. Create clear standards defining the reappointment and promotion of instructor-track faculty (instructor to senior instructor or senior instructor to teaching professor). Instructors must not be disadvantaged by the absence of such policies.
2. Update annual merit evaluation procedures, consulting with the divisional dean for natural sciences and with the Office of Faculty Affairs on models and best practices.
3. Elevate the graduate and postdoctoral affairs coordinator position to that of an associate chair, in order to support mentoring activities, and especially to provide greater attention to graduate students. Provide this position with rights and privileges identical to those of the two other associate chairs.
4. Revise the bylaws or create a separate document to define mentoring and promotion systems for tenure-stream and instructor-track faculty and for postdoctoral personnel. Define the duties of mentors and outline recommended steps and resources for preparing for the reappointment or promotion process and for improving one's portfolio.
5. Given the department's high student-to-faculty ratio, seek out all opportunities to hire additional faculty members. Do not avoid such opportunities because the unit lacks sufficient space, since the act of hiring can by itself increase the unit's share of office, research and laboratory space.

Consider hires of instructor-track faculty to address needs for undergraduate teaching.

6. Consult with the Research and Innovation Office (RIO) and the Graduate School to make sure that current arrangements for graduate student stipends, in which research funds are used as stipend supplements, are in compliance with university policies regarding graduate student workloads and the use of research funds.
7. Develop strategies to provide space on Main Campus for faculty currently working on the East Campus or on Wilderness Place to hold office hours, to prepare for courses, and to engage in formal and informal interactions with students, staff and other faculty members. This might take the form of making swing-space available in Carlson Gymnasium, Clare Small or Temporary Building 1.
8. Reconsider the opportunity to collaboratively teach lower-division biology courses with the Departments of Ecology and Evolutionary Biology and Molecular, Cellular and Developmental Biology.
9. Attend to practices and policies that further unit diversity and inclusivity:
 - a. Add language to the bylaws and departmental procedural documents that actively protect and advance diversity and inclusivity values and practices.
 - b. Immediately address staff concerns about faculty incivility and take steps to stop such behavior.
 - c. Reconstitute the diversity committee.
 - d. Focus on diversity in faculty hiring. Work with the Department of Human Resources to implement best practices in recruiting applicants who identify as women

or as belonging to an underrepresented minority population, as well as best practices to conduct faculty searches.

- e. Work with the Office of Faculty Affairs and the Office of Diversity, Equity and Community Engagement to implement best practices for retaining faculty members from diverse populations.
- f. Make a copy of the IPHY inclusive excellence document alluded to in the self-study report publicly accessible on the department's website.

10. Work with other units and the college to raise the visibility of the public health certificate to increase student demand for the certificate and to secure additional instructional support resources.

11. Consider working with the college to increase the 0.75 FTE grant processing staff position to 1.0 FTE.

12. Publicize the unit's record of PhD placements; one possible resource is the T-32 data.

13. Establish an undergraduate colloquium devoted to planning and strategizing for a variety of post-graduation health careers; including in this effort the participation of public and private agencies.

To the Dean of the
College of Arts and
Sciences:

14. Support IPHY in elevating the graduate and postdoctoral affairs coordinator position to an associate chairship.

15. Create incentives to reform and consolidate first-year biology courses offered by the departments of Integrative Physiology, Ecology and Evolutionary Biology, and Molecular, Cellular and Developmental Biology.

16. Work with IPHY to clarify plans for restoring the tenure-stream faculty lines lost to retirements and moves.

17. Consider IPHY's proposal to increase the 0.75 FTE grant processing staff position to 1.0 FTE.

To the Dean of the
Graduate School:

18. Think creatively about ways to increase the number of IPHY graduate fellowships, or their dollar amounts.

To the Vice Chancellor for
Infrastructure and
Sustainability:

19. Improve and regularize transportation and parking options between off-campus sites and main campus to ease commuting. This could take the form of more frequent bus and shuttle transportation, or of offering multi-site parking permits.

To the Provost:

20. Support renovations to the Clare Small building to remedy a deteriorating infrastructure, including the HVAC system. Such renovations are especially important in laboratories containing specialized equipment, animal experiments, and for the general health and safety of university students and employees.

Required Follow-Up

The chair of the Department of Integrative Physiology shall report annually on the first of April for a period of three years following the year of the receipt of this report (i.e., April 1st of 2022, 2023, and 2024) to the divisional dean for natural sciences and the dean of the College of Arts and Sciences and to the provost on the implementation of these recommendations. Likewise, the dean of the College of Arts and Sciences shall report annually on the first of May to the provost on the implementation of recommendations addressed to the program. The provost, as part of the review reforms, has agreed to respond annually to all outstanding matters under their purview arising from this review year. All official responses will be posted online.