



University of Colorado **Boulder**

2019 Program Review

Department of Ecology and
Evolutionary Biology

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 Ecology and Evolutionary Biology (EBIO) was conducted in accordance with the 2019 program review guidelines. EBIO completed a self-study report, which an internal review committee composed of two University of Colorado Boulder (CU Boulder) faculty members outside of EBIO evaluated for accuracy and completeness. The internal reviewers submitted a summary of findings derived from the self-study report and from interviews and/or surveys with faculty, staff, and student unit members. An external review committee, consisting of two experts from outside of CU Boulder, visited the unit and submitted a report based upon a 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.

Academic Review and Planning Advisory Committee (ARPAC)

Alaa Ahmed, Associate Professor, Department of Mechanical Engineering

Alison Boardman, Associate Professor, School of Education

Barbara Battenfield, Professor, Department of Geography

Paul Campos, Professor, University of Colorado School of Law

Paul Moeller, Associate Professor, University Libraries

Austin Okigbo, Associate Professor, College of Music

Judith Packer, Professor, Department of Mathematics

Teri Rueb, Professor, Department of Critical Media Practices

Kathleen Ryan, Associate Professor, Department of Journalism

Hanna Shell, Associate Professor, Department of Cinema Studies and Moving Image Arts

Tamara Sumner, Professor, Institute of Cognitive Science

Michael Stutzer, Professor, Leeds School of Business

Paul Youngquist, Professor, Department of English

Academic year 2019-20
voting members

Non-voting members

Bob Boswell, Vice Chancellor for Diversity, Equity, and Community Engagement and Professor of Molecular, Cellular, and Developmental Biology

Katherine Eggert, Senior Vice Provost and Associate Vice Chancellor for Academic Planning and Assessment and Professor of English

Mary Kraus, Vice Provost and Associate Vice Chancellor for Undergraduate Education and Professor of Geological Sciences

Michele Moses, Vice Provost and Associate Vice Chancellor for Faculty Affairs and Professor of Education

Ann Schmiesing, Executive Vice Provost for Academic Resource Management and Professor of Germanic and Slavic Languages and Literatures

Scott Adler, Dean of the Graduate School and Professor of Political Science

Staff

Andre Grothe, Office of Faculty Affairs

Emmanuel Melgoza Alfaro, Office of Faculty Affairs

Unit Overview

The Office of Data Analytics (ODA) maintains a standardized description of EBIO [on its website](#). ODA updates the profile annually in the fall semester. This report cites data produced on October 25, 2018, reflecting the state of EBIO as of the academic year (AY) 2017-2018.

Disciplinary context

Since its last program review in 2012, EBIO research has netted \$45.8 million in external funding. A recent evaluation by Shanghai Ranking of ecology programs found EBIO ninth best in the world based on its faculty members' publication and citation numbers, papers in top journals, international collaborations, and outside awards. In 2004, a reorganization of the biological sciences occurred, leading to the formation of EBIO, now one of three departments of biology on campus. Since 2004, EBIO has grown; the range and breadth of its research coverage, as well as the prestige and productivity of its faculty members, have flourished. The self-study report describes the subject areas that provide the department's focus as "a range of modern approaches to study the entire spectrum of life (microorganisms, fungi, algae, plants, and animals) covering multiple areas of research (genetics, systematics, anatomy, physiology, behavior, ecology, evolution, and education) from the molecular to global scales." The department also plays a central role in relation to a number of cutting-edge research institutes, museums, and teaching programs.

In terms of research and scholarship, EBIO is a world-class research department, as well as a dynamic space for interdisciplinary growth and collaboration. Areas of special strength include studies of global change, conservation biology, the spread of diseases, and revealing fundamental mechanisms underlying the structural and functional adaptations of organisms.

National
and
international
context

As noted above, total funding for research in EBIO was \$45.8 million over the review period, and EBIO was ranked 9th in the world in the recent rankings of ecology programs. The ranking was based on the following factors: i) number of publications and citations, ii) papers in top journals, iii) international collaborations, and iv) number of outside awards to faculty in the period of 2012 to 2016, according to figures cited in the self-study report.

Campus
context

Now one of three CU Boulder biology-focused departments, EBIO was originally established following a 1960 division of the Department of Biology (the Department of Molecular, Cellular and Developmental Biology also emerged from that split). In 2003, the Department of Integrative Physiology was formed and again reshaped the profile of CU Boulder's biology research programs.

EBIO is notable for its expansive collaborations. The department's faculty members play a central role in cutting-edge research at the CU Museum of Natural History (including the campus herbarium), the Institute of Behavioral Genetics (IBG); the Environmental Studies Program (ENVS); the Cooperative Institute for Research in Environmental Science (CIRES); and the Institute for Arctic and Alpine Research (INSTAAR). Other notable collaborators include the Niwot Ridge Long-Term Ecological Research Program; the McMurdo Dry Valleys Long Term Ecological Research Project; the BioFrontiers Institute; the Renewable and Sustainable Energy Institute (RASEI), and the Critical Zone Observatory.

The department is also deeply committed to interdisciplinary education and to developing new teaching tools and assessment models. EBIO rightfully celebrates its place as a “nexus” or “hub” among various departments. In particular, the

undergraduate teaching it accomplishes supports students in a wide array of majors.

Faculty
and
research
personnel

The ODA EBIO profile shows the unit employing 30 tenured and tenure-track faculty members, four instructor-track faculty members, 51 teaching assistants (TAs), graduate part-time instructors (GPTIs), lecturers, other student employees, other instructional personnel, and 22 research faculty. The department anticipated gaining a tenure-track faculty member in AY 2019-2020, lifting the tenure-track personnel count to 31, which would bring EBIO to the size it had been at the time of the last review in 2012. The self-study report also notes that EBIO employs over 30 postdoctoral and research associates funded through sponsored projects.

According to ODA, EBIO full professors earn on average 93% of what their peers make elsewhere within the Association of American Universities (AAU), while EBIO associate professors earn 96% of the average, and EBIO assistant professors, 99%. Across all ranks, EBIO tenure-track faculty members earn about 95% of the AAU average. Average instructor salaries are approximately \$57,000, as compared with a national average for Biology instructors or \$50,000 (2017-2018, The College and University Professional Association for Human Resources).

EBIO has pressing needs for additional faculty lines, following multiple recent retirements, and growth in its undergraduate and graduate degree programs. The department makes the case for a tenure-track animal behavior specialist as its top hiring priority. EBIO's second priority would be to make a new hire in ecological or evolutionary physiology, and in biology teaching and educational innovation. As its third priority, the department seeks to hire an applied biology faculty member as well, to enhance its current status as a world leader in the area of environmental change biology. This hire could potentially

focus on urban ecology, agroecology, conservation biology, or assisted evolution.

Staff ODA shows that EBIO employs three state classified and 11 university staff members (previously called exempt professionals), seven of which were listed as “temporary.” EBIO also employs 75 student hourly employees. The unit has requested permission to hire a facilities and shared spaces manager to continue a pilot CU Green Labs initiative that was set up to explore ways to increase energy and space-use efficiency and to promote campus interdisciplinary research. EBIO has also requested permission to hire an undergraduate program coordinator and a grants manager to aid EBIO faculty members with preparing and submitting grants. Staff numbers appear to have remained relatively constant since the last review.

The department’s request for more staff support parallels a recognition within the College of Arts and Sciences Strategic Plan that additional staff hiring is needed to ensure that staff-to-faculty and staff-to-student ratios within the college become more consistent with those in other colleges at CU Boulder. The plan also calls out the fact that its staff members are paid less on average than staff in other colleges at CU Boulder.

EBIO plays an important and growing role in undergraduate education at CU Boulder. Students in the department’s degree programs may earn a BA in ecology and evolutionary biology, a minor in ecology and evolutionary biology, or an EBIO concurrent degree (C-EBIO).

Over the academic year 2018-2019, EBIO awarded 215 bachelor’s degrees, a 30% increase over the last five years. Of these graduates, 9% achieved honors in the major, representing a five year 156% increase. The department's total

number of undergraduate majors was 742, a five-year 7% increase. Notably, with a median time-to-degree of 3.67 years, EBIO majors have the shortest time-to-degree among all CU Boulder students (first out of 46 degree-granting units)..

While EBIO's number of majors increased, its total undergraduate student credit hours taught decreased by 4% over a five-year period. Fifty-three percent of these credit hours were taught by tenure-track faculty members (a five-year 18% drop), 12% by instructors (a 37% drop), and 11% by TAs/GPTIs (a 209% increase). Despite these shifts, the ratio of credit hours taught by EBIO tenure-track faculty members remains the second highest among the life and environmental science units.

EBIO offers its students the chance to participate in research and internships, but demand often exceeds the department's capacity. Among the options available to EBIO students are the Undergraduate Research Opportunities Program (UROP), the Summer Multicultural Access to Research Training (SMART) program, the Biological Sciences Initiative, the National Science Foundation's Research Experiences for Undergraduates (REU) program, Science Discovery, as well as the Beckman Scholars Program, and the Jacob Van Ek Scholars Award in Arts and Sciences. EBIO also offers students course credit for independent study projects.

Since its last review in 2012, EBIO has implemented curricular changes designed to give students an understanding of ecology and evolutionary biology's broad scope and to teach science process skills as core competencies. To accomplish this, EBIO faculty members have redesigned and reframed classes to emphasize evidence-based approaches. The department has also begun to implement a three-dimensional learning assessment protocol (3D-LAP) intended to provide faculty members with a clearer measure of their teaching

effectiveness. The department developed two sets of learning goals for its majors, aimed at advancing students' critical and scientific thinking abilities. The first set focuses on science process skills and the second set focuses on preparing students to understand the broad scope and real-world significance of ecology and evolutionary biology.

Measures of student satisfaction at the undergraduate level are generally high, with an exception being student evaluations of the department's approach to counseling and advising about employment and/or graduate study opportunities. ODA data from the spring 2016 senior survey and the analysis of the internal and external reviewers all converge here to suggest a need for improvement. To their credit, the department has already undertaken steps to remedy the shortfall, writing in their self-study report: "Our plan going forward is to discuss the creation of a capstone senior seminar focused on specific knowledge, skills, and abilities that are needed in transitioning from campus to the job market. We will increase exposure of our majors to the array of career options open to them through career workshops and a requirement that all EBIO majors do an internship in a possible career area culminating in a well-referenced academic analysis of the experience (or an Honors thesis) for which they receive independent study credit. A significant fraction of EBIO Honors theses are based on just such internship experiences, and we will broaden this exposure to include all of our majors."

Graduate
education

EBIO offers one PhD and two MA degrees (one with and one without a significant research project in ecology and evolutionary biology). Also offered is the EBiology-Concurrent Degree through which students can earn a concurrent BA and MA. Over 2018-2019, EBIO awarded five MA and four PhD degrees. Compared to five years ago, this is the same number of MA degrees awarded and a 64% decline in PhD degrees. As

of 2018-2019, EBIO had a total of 78 graduate students, of which 70 (90%) were pursuing PhDs. In their report, the internal reviewers note that EBIO graduate students expressed a desire for more graduate-level courses, including more advanced courses, more spring semester courses, and specific needs in the topic areas of statistics and quantitative biology. EBIO graduate students also want courses that go deeper into advanced material than is generally achieved in combined 4000/5000-level classes, which appear to dominate EBIO graduate course offerings.

Postdoctoral training	While the review materials provide few details of the nature of EBIO's postdoctoral training, the impressive productivity and interdisciplinarity of the department's research labs do suggest that postdoctoral fellows thrive there.
Budget	The self-study report describes the department's budget in detail, the bulk of which comes from an annual College of Arts and Sciences operating budget allocation. Other sources discussed in the self-study include departmental administered indirect cost recovery (DA-ICR) monies generated by EBIO's sponsored projects and instructional fees. The elimination of instructional fees as part of the "Be Boulder Pact" means that the College of Arts and Sciences will need to allocate an equivalent amount to EBIO. At the time of the 2012 review, the department had expressed concern about budgetary fluctuation, but this has ceased. However, the department did express worry that its expected funding will prove insufficient for making competitive startup offers and commitments to new faculty in the coming years with what will hopefully be several important faculty hires.

Space and infrastructure	<p>The self-study and internal and external review reports all indicate pressing space and infrastructure needs. In particular, the department requests renovations to facilitate pedagogical innovations through “student-centered learning spaces.” The internal reviewers comment that EBIO spaces have not grown commensurately with the department’s needs. The self-study puts it well, stating that EBIO has “no space left to expand as a department, despite the increasing demand for our major and the increasing importance of our work to regional and global issues of importance to society.”</p>
Governance	<p>The unit last revised its bylaws in 2016. The bylaws clearly delineate faculty member voting rights, hiring, reappointment, promotion and tenure procedures, merit review, as well as grievance procedures for faculty members and students.</p> <p>The department is led by a chair, elected for one or more three-year terms. The chair is assisted by two associate chairs, one each for its undergraduate and graduate programs. EBIO also has an executive committee and a merit committee, along with various ad hoc committees that advise the chair on departmental matters.</p>
Inclusive excellence	<p>The EBIO self-study clearly and thoughtfully describes the unit's commitment to further its diversity. According to the ODA AY 2018-2019 data, 43% of EBIO tenure-track faculty members identify as women and none as belonging to an underrepresented minority (URM) population. Among EBIO undergraduates, 59% identify as women and 19% as belonging to a URM group. Women comprise 59% of EBIO MA and PhD students and 13% of the graduate students identify as URM. Given the student percentages, the relative lack of minority faculty members is striking. Notably, URM identification among EBIO graduate students increased 142% over the preceding five years, bringing it up to the highest position among life and</p>

environmental science units. Over those same five years, EBIO undergraduate student minority identification increased 66%.

Climate
and
culture

EBIO faculty members have sought to promote a welcoming environment for students, one where interactions between faculty and students are effective and comfortable. However, as is noted by the internal reviewers: “there was relatively strong sentiment that at times the relationship of teaching staff with tenure-track staff was not ideal. In particular, there were expressions of discontent with a hierarchical structure of decision-making in which some people felt marginalized or not included.”

Past Reviews

ARPAC last reviewed EBIO in 2012. That review noted departmental strengths while providing suggestions for improvement, including asking the department to produce a strategic plan. EBIO took this up, producing a strategic vision in 2013 that included a three-year ecology-focused faculty hiring plan.

The 2012 review also raised questions about possible introductory course redundancies across the life science departments (including EBIO, MCDB and IPHY). ARPAC asked the units to jointly consider curricular streamlining to avoid replication. This idea was not taken up. EBIO did change its introductory biology class, including to introduce new assessment methods, as previously described. After 2012, EBIO worked to make its Biology Club and Honors Club exemplary spaces of collegiality, collaboration, and inclusivity. As it does again this year, the 2012 ARPAC review called out EBIO undergraduate career advising as a concern.

Analysis

Having doubled its undergraduate student population in 12 years, EBIO has a strong case to make for increased faculty and staffing support. The department also has a convincing vision to make the most of such investments.

In its self-study report, the department defines a three-pillar strategy for capitalizing on its recent success:

1. Reinforce EBIO's expertise in ecology and evolutionary biology with breadth and depth across the diversity of living organisms, biological scales, and by using approaches from basic through applied research;
2. Increase EBIO's role in both understanding how biological systems respond to environmental change as well as discovering solutions to environmental challenges;
3. Transform EBIO teaching to further integrate research and teaching while building best practices to engage diverse learning styles.

Supporting student success, driving teaching and research innovation, and positively impacting society and the environment through these pursuits are at the heart of EBIO's mission; and the unit is to be commended for its work in the area of biology education.

An important area of growth for the department relates to diversity in hiring, especially for its faculty. Although EBIO was able to hire a Chancellor's Postdoctoral Fellow, the department needs to work to hire a critical mass of faculty of color in order to meet its research and teaching goals. In addition, diverse new hires could help energize a revised graduate curriculum that emphasizes graduate-only courses, discussed below.

To realize its strategic vision, the department needs two new staff lines, one for grant support and the other to serve as an undergraduate curriculum coordinator. Students would welcome a renewed focus on career advising. And while a dedicated career advisor is not included in the position requests described in the self-study, ARPAC recommends the department make the most of the undergraduate curriculum coordinator position by including in its responsibilities some attention to career advising. The undergraduate course offerings and student climate are strong.

In terms of space and infrastructure issues, the best path forward would seem to be, first and foremost, working towards pursuing “swing space” and “shared space” opportunities. Moving equipment from individual labs to shared spaces might serve to create space economies, as well as cost savings. Shared equipment and resources seem like they would be a positive step forward and should be incentivized in addition to being enabled; this could increase energy and space-use efficiency and promote interdisciplinary research.

As already noted, in 2012, ARPAC recommended a consolidation of introductory biology courses across the life science departments, including EBIO, IPHY, and MCDB. This did not occur. These departments could still do more to coordinate curricula to minimize inconveniences for students who switch majors between departments early on in their college careers. For example, it might be possible to develop a 2000-level course specifically geared to switching students, say from MCDB to EBIO.

At the graduate level, EBIO is to be commended for its efforts to create a more welcoming climate. The department has refined its grievance procedures to address graduate student concerns about unclear expectations and procedures. If and

when EBIO is able to make additional faculty hires, the department should focus energy on offering more graduate student courses, rather than the combined courses that attempt to accommodate both graduate students and upper-level undergraduates.

The internal reviewers commend the department for its impressive work to promote diversity and a culture of inclusivity. They cite the responses of EBIO undergraduate and graduate students to a survey that asked “what has been the best part of your experience so far?” The EBIO community received high praise, especially from graduate students. The MA and PhD students also directed praise toward EBIO faculty members in general, and their individual advisors in particular. The department’s efforts to intentionally foster a graduate student community “appear to be paying off,” the internal reviewers note.

That EBIO undergraduates and graduates appear to widely agree in the spring 2018 climate survey that the department promotes a welcoming environment is an indication of how thoughtfully EBIO has integrated an emphasis on mentoring, collaboration, and inclusion throughout its community. Although students crave more diverse representation among faculty members, which hopefully can be addressed by upcoming hires, the students' comments suggest something significant is already happening in EBIO that might be a model for the campus. In this regard, EBIO's weekly diversity and inclusion seminar, which students, postdoctoral fellows, faculty and staff members attend, merits particular praise. As does the fact that EBIO recently decided to drop the GRE requirement in graduate admissions on the grounds that the test requirement may discourage some applicants from underrepresented minority populations, including first generation students. ARPAC congratulates EBIO for these efforts.

Recommendations

The members of the Academic Review and Planning Advisory Committee address the following recommendations to the Department of Ecology and Evolutionary Biology and to the offices of responsible administrators:

To the Unit:

1. Consider integrating career advising responsibilities into the duties of an existing or planned position, such as into the proposed undergraduate curriculum coordinator's role.
2. Assess whether a new "career advisor" position is warranted, or if these duties could be inscribed in some way into those of the proposed undergraduate curriculum coordinator.
3. Continue to coordinate introductory course offerings with those offered by MCDB and IPHY in order to facilitate easier changes of major where students do not have to take two different introductory course offerings. Consider possible solutions for students who change their majors to EBIO after their first year by introducing students to EBIO with a single 2000-level course or a modular (e.g., one-credit) add-on course introducing key EBIO concepts not covered by 1000-level MCDB and IPHY courses.
4. Address a relative lack of graduate-only classes by attempting to decouple 4000- from 5000-level courses when possible, differentiate the graduate curriculum in the combined courses, or offer more specialized electives for graduate students only.
5. Consider additional ways to promote mentoring and community between graduate students and faculty early in the graduate students' careers.

6. Advocate to the dean for making proposed new hires, and clearly prioritize unit needs based on teaching and research coverage.
7. As the unit makes a case for hiring additional faculty, build into the proposal ways the faculty would teach across the curriculum.
8. Continue efforts to hire and retain diverse faculty members. Continue with mentoring efforts, with a particular focus on improved diversity and inclusion.
9. Advocate for further investment in and cooperate in the evaluation of the Green Labs program in EBIO and across campus.
10. Assess possible ways to collaborate with physically adjacent departments and/or cognate units so as to further refine/advocate for swing spaces and/or the maintenance of shared lab space.
11. Consider EBIO's proposals for new faculty hires.
12. Consider EBIO's requests for new staff positions.
13. Consider partially allocating a College of Arts and Sciences career advisor to EBIO.
14. Consider hiring a grant administrator whose duties, in part, would include assisting EBIO faculty, especially those without other designated grant support (as is available to those faculty affiliated with institutes or museums in addition to EBIO).

To the Dean of the
College of Arts and
Sciences:

15. Create incentives to reform and consolidate first-year biology courses in Ecology and Evolutionary Biology, Integrative Physiology, and Molecular, Cellular and Developmental Biology.

To the Vice Chancellor of
Infrastructure and
Sustainability:

16. Assess the impact of the Green Labs Program on costs and environmental benefits and continue and/or expand funding if warranted.

Required Follow-Up

The chair of the Department of Ecology and Evolutionary Biology 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.