1. **Reporting Institution** Eastern Illinois University

2. **Program Reviewed** M.S. Biological Sciences

3. **Date** January 01, 2019

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5. Overview

The M.S. in Biological Sciences is a selective program offered through the Department of Biological Sciences. The program offers students the opportunity to pursue advanced training in many areas of modern biology leading to the Master of Science in Biological Sciences. One of the goals of the program is to recruit and academically prepare a diverse group of top students, including domestic and international students, for further graduate work and/or rewarding careers after graduation. The MS program has three options:

1. Thesis option – Total 30 semester hours (sh)

- BIO 5900 - Research (6 sh)
- BIO 5950 - Thesis (3 sh)
- BIO 5150 - Seminar (1 or 2 sh)
- Graduate course work determined by thesis committee (19-20 sh)
- Thesis, oral thesis defense, and oral comprehensive examination.

2. Internship option – Total 32 sh

- BIO 5980 - Internship (6 sh)
- BIO 5150 - Seminar (1 or 2 sh)
- Graduate Course work determined by internship committee (24-25 sh)
- Internship report, and oral comprehensive examination.

3. Non-Thesis option – Total 32 sh

- BIO 5150 - Seminar (1 or 2 sh)
- BIO 5990 – Independent Study (3 sh)
- Graduate course work determined by committee/coordinator (27-28 sh)

Currently the graduate program has a total of 62 students (Thesis option-28, Non-thesis-33, and Internship-1). The size of the program facilitates close contact between students and graduate faculty in the Department. Experiences provided by the graduate faculty in formal

courses, research laboratories, and in diverse field situations are the basis not only for degree requirements but also for continuation of their postgraduate education and placement in a career in the biological sciences. The department includes faculty from a wide variety of sub-disciplines in the Biological Sciences and students are free to work with any graduate faculty member. The graduate program does not have a "core" curriculum, but rather is designed to support a wide range of student interests. We offer courses in experimental design and data analysis and seminars appropriate for all students, but they are free to design a study plan from discipline or technique-specific offerings suited for their unique educational goal. We strive to support top students financially through assistantships and research support. Graduate faculty in the department received $0.8-1.2 million dollars per year in external grants over the last 5 years to support their research and provide research assistantships to graduate students. Students in the program successfully pursue support through the university and external agencies as well, earning over 42 research awards and 52 travel grants to support their own research. Faculty and students actively present their research, with over 100 publications in refereed journals and over 200 presentations at professional meetings from 2014-2018 alone, many of these with students as co-authors. Students are recognized for their outstanding work at the university and at regional and national levels. Graduates are prepared for a wide range of options in Biology, including PhD programs, state agencies, medical schools, as well as community college and high school teaching.

6. Major Findings and Recommendations

6.a. Description and assessment of any major changes in the program [e.g., (a) changes in the overall discipline or field; (b) student demand; (c) societal needs; (d) institutional context for offering the degree; and (e) other elements appropriate to the discipline in question.

6.a.1. Changes in the discipline

The field of Biology has changed in several ways in the last decade. The area of cellular and molecular biology especially has benefited from computational and technological advancements. For instance, it is now possible to quickly sequence entire genomes and modify genes to express them in whole organisms. These technologies are now being further developed for diagnosis and treatment of disease as well as basic science. The importance of these areas is reflected in the department's recent hires that include a molecular physiologist and a plant physiologist/geneticist. Presently, we are in the process of hiring a microbiologist with expertise in cutting edge genomics-based analysis. Organismal/field biology has long been a strength of the department and it has also benefited from advances in computer technology and molecular biology. The increased use of computational modeling, including Geographic Information System (GIS) technology, has allowed for larger, ecosystem-scale, studies in ecology. Application of sequencing technologies has allowed for previously intractable studies of population genetics and evolutionary change. Another recent hire, an ichthyologist, recognized our commitment to students in this group and bolstered contacts with state agencies for support.

6.a.2. Student demand and success

The graduate program in Biological Sciences continues to bring in large numbers of qualified students, from over 30 undergraduate institutions and 6 foreign countries in recent years. The size of the program has increased from 34 students in 2014 to 62 students in 2018. Recent graduates of the program were accepted into medical professional programs, matriculated into PhD programs, and began careers with industry or state agencies. Of 79 graduates tracked over the period 2014 – Fall 2018, more than 90% were working in-field or continuing their graduate education. For example, our long-standing tradition of training field biologists, coupled with renewed contacts in the fisheries agencies, affords our graduates excellent success in governmental agencies (i.e. US Fish and Wildlife, state Departments of Natural Resources) as well as private environmental-based consulting firms.

6.a.3. Societal needs

The demand for biologists, especially in medical and biotechnology fields, is projected to grow much faster than the average (up to 21% in the decade beginning in 2008) and many of these positions require graduate training (Occupational Outlook Handbook, 2010-11 Edition). Beginning in 2015, we recommended the MS non-thesis option to students interested in pursuing professional degree in health-related fields or in obtaining a job immediately after completion of their MS degree. Presently, we have 33 students in the non-thesis MS option.

6.a.4. Institutional context

Our graduate program interacts with other programs including chemistry and geography. Students include faculty from these departments on their thesis committees and many take courses in other departments as part of their individualized study plans. The recently developed interdisciplinary MS in Biochemistry and Biotechnology program especially, has been particularly well populated by the lab technique–oriented biology graduate students. The Biological Sciences graduate program leads the university in the areas of competitive awards for students, numbers of theses produced, number of distinguished theses, number of faculty mentor awards, and in grant money received. In 2011, our graduate program received the “First- Choice” designation. According to the EIU Graduate School website “Graduate programs achieving the distinction of "First Choice" have applied for and been subjected to rigorous review from EIU's Council on Graduate Studies — with oversight from The Graduate School — to ensure they meet the highest standards of scholarly excellence as evidenced through sustained achievement of criteria developed and adopted by the council”. In 2015, we renewed the First-Choice status by undergoing a rigorous renewal process to provide evidence that the program has sustained achievement of the criteria and is eligible for an additional five-year designation period.

6.b. Description of major findings and recommendations, including evidence of learning outcomes and identification of opportunities for program improvement.

6.b.1. Assessment

The department uses a number of internal assessment methods, at the departmental and the graduate school levels, as well as external assessment. The department requires GRE scores for thesis and internship options, individual statements of interest and letters of reference in the application process to evaluate student preparedness upon entering the program. Students in the thesis option are required to develop individual study plans, in cooperation with their graduate committee members, and performance in these courses is used as one measure of learning. In addition, students in thesis and internship options are required to publish a thesis or write a final report of their internship, which are used to evaluate written communication skills, scientific design, and their ability to synthesize information. A final oral presentation and test of comprehensive knowledge are also part of the capstone experience for the graduate degree for students in the thesis and internship options. These are used to assess oral communication skills as well as content knowledge in the field. No student finishes the degree without meeting acceptable levels in all stages. Students that fail to meet these standards are given additional directives to address weaknesses. There is no universal exit exam or board exam in the field. Student success, relative to other programs, is assessed through grants and awards, publications, and presentations at university level and professional meetings. The number of awards and publications, as described in the overview, lead the university in many categories. Assessment data are used to improve student learning, to guide improvements to the curriculum, and to achieve academic excellence. In 2018, the graduate program attained level 2 or 3 in all assessment categories, and reached "the mature" assessment stage.

6.b.2. Changes due to assessment

We have instituted a course rotation of graduate courses to better ensure that all students will have access to needed classes and facilitate development of their study plans. Although the assessment techniques used in the department are doing a good job of maintaining program quality, they do not allow for direct comparisons between students or years. To address this, we are developing rubrics to be used at the assessment points (thesis, oral, comprehensive knowledge). This will generate quantitative data, which can better enable us to track improvements or problems.

6.c. Description of actions taken since the last review, including instructional resources and practices, and curricular changes.

6.c.1. Faculty hires

There were a number of new and replacement hires in the Biological Sciences department since the last review (see 6.1), and all of these hires have been assimilated into the graduate faculty. Replacing the fisheries biologist and botanists strengthened our ties to government agencies and retained our strong tradition of organismal biology, and we are currently conducting searches for a microbiologist to add to this strength. Our new molecular physiologist and plant physiologist/geneticist expanded our coverage of modern biological disciplines, and will provide excellent interdisciplinary opportunities for the department and our students. Hires with molecular interests, including cell biologists and a plant geneticist, provide expertise and offerings in this critical area.

6.c.2. Instructional resources and practices

All classrooms have been equipped with computers and projectors for lectures. The computer lab in our building has been updated with computers containing software used for GIS and statistical courses commonly taken by graduate students. Research is a critical component of graduate education, and all faculty have designated research space in the building. Start up funds and grant monies have been used by individual faculty to establish research labs in microbiology, microtechniques, ecotoxicology, and fisheries biology. Graduate students work in the labs of their faculty mentors. All graduate students with assistantships are provided with a designated space, either in their lab or in a central graduate student office suite, to use as an office.

6.c.3. Curricular changes

The curriculum remains flexible. The minimal required core of seminar and research allows students to develop their own unique study plan. The seminar is a critical resource that allows individual faculty to address unique special topics of interest to pools of students or evaluate the need for new courses. The statistical courses have been completely revamped to use the software R, which will allow students to continue using it after graduation as it is a freeware package. Recent hires have allowed for the development of new graduate courses in Plant Biotechnology, Advanced Cell Biology, Advanced Neurobiology, Neurobiology of Diseases, and Bioenergy and Bioresources, and the reinstatement and modernization of courses in fisheries management, systematics, herpetology, and ecotoxicology. The course rotation and Graduate Teaching Assistant Program (see sec 7.d) were significant curricular changes.

6.d. Description of actions to be taken as a result of this review, including instructional resources and practices, and curricular changes.

We continue to monitor course availability via the course rotation plan to support graduate students in both field and bench sciences. Balancing these offerings by graduate faculty who also teach undergraduate courses is an ongoing concern.

8. Outcome

8.1. Decision

__X__ Program in Good Standing

_____ Program flagged for Priority Review

_____ Program Enrollment Suspended

8.2. Explanation

On behalf of the office of Academic Affairs, I appreciate the faculty and program's continued commitment to the First Choice graduate program designation. Additionally, they are to be commended for the refinement of assessment objectives as they relate to academic excellence and student success.

Dean's Comments

This is a highly successful program that has witnessed much growth in recent years. The non-thesis option has provided greater access to graduate study and indeed currently leads the program in number of students enrolled. Biology faculty members continue to attract outside grant funding to help underwrite the graduate programs by providing student support and enhancing opportunities for experiential learning. Recent curricular changes and strategic hiring have positioned the program for success in the future. Seeking the means for a thorough renovation of the aging Life Sciences building remains a priority for the College of Liberal Arts and Sciences as Eastern Illinois University works to recover from the recent budget impasse.