UCC Program Review Committee summary of review

Program – Molecular and Cellular Biology

This program includes the following degrees, minors, and certificates:

- Ph.D.

Recommendation

This program is found to be viable, see report for commendations, concerns, and recommendations.

Date of last review – AY 2009

Date of this review – AY 2016

This review has been sent to the program director and his comment is included.

This review has been sent to college dean, his comment is included.

This review has been sent to graduate council, they have no comment to add to this report.
Ohio University Curriculum Committee

Academic Program Review

Interdisciplinary Graduate Program in Molecular and Cellular Biology

Ohio University – College of Arts & Sciences (Host College)

Dr. Brad Hillgartner, Department of Biochemistry, West Virginia University

Dr. Fuh-Cherng Jeng (OU Communication Sciences and Disorders)

Dr. Judith Millesen (OU Voinovich School)

Dr. Robert L. Williams II (OU Mechanical Engineering)

November 2015
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Introduction & Process Overview

The Interdisciplinary Graduate Program in Molecular and Cellular Biology (MCB) at Ohio University underwent an academic program review in November 2015. The Academic Program Review Committee was comprised of one external member, Dr. Brad Hillgartner, Director of the Biochemistry and Molecular Biology Graduate Program in the Department of Biochemistry at West Virginia University School of Medicine in Morgantown, West Virginia and three internal reviewers, Dr. Fuh-Cherng Jeng (Communication Sciences and Disorders), Dr. Judith Millesen (Voinovich School), and Dr. Robert L. Williams II (Mechanical Engineering).

Over the course of two days (11/9 and 11/10/2015), the team met with the Provost; the Dean of the College of Arts and Sciences; the MCB program director; the MCB Curriculum Chairs and Graduate Chair; MCB/CHEM faculty; MCB/PBIO faculty; MCB/BIOS faculty; HCOM Biomedical Sciences Faculty; EBI Research Faculty; the director of the Bioinformatics Certificate; and MCB PhD students. The team also had the opportunity to tour the Porter Hall facilities including the MCB office and the Genomics Lab, as well as the West Union Biochemistry Facility; LSB Facilities; the Academic & Research Center; and the Edison Biotechnology Institute.

Ohio University’s Interdisciplinary Graduate Program in Molecular and Cellular Biology struck us as a strong, viable program as evidenced by a dedicated faculty, engaged and strongly motivated students that are well-prepared for the post-graduate marketplace, high quality research publications generated by students and faculty, strong research support garnered from extramural sources, and state-of-the-art laboratories, equipment, and facilities.

This report is divided into four key sections. The first section provides an overview of the program including general information about the MCB program, a faculty profile, programmatic practices, research and productivity, and information about the graduate program. The second section identifies the major programmatic challenges. Specifically we address the need for dedicated faculty and maintaining high-quality enrollments. In section three we identify institutionally-related challenges that influence the overall operation of the program with special attention focused on how best to recognize interdisciplinary teaching. The review concludes with commendations and programmatic recommendations.

PROGRAM REVIEW

The Interdisciplinary Graduate Program in Molecular and Cellular Biology was established in 1983. The program offers a PhD and is housed within the College of Arts and Sciences. The founding faculty built the MCB graduate program on the strong foundation of established Ph.D. programs in Biological Sciences, Environmental and Plant Biology, and Chemistry and Biochemistry. Today, these three programs are reflected in the MCB program tracks: MCB/BIOS, MCB/PBIO, and MCB/CHEM. When students are admitted to the MCB graduate program they are also simultaneously admitted to one of these three “Home Departments.”
The MCB graduate program satisfies two primary missions: 1) train the highest quality Ph.D. students for careers in academia, biotechnology, and other science-related vocations, and 2) enhance and cultivate interdisciplinary interactions between faculty and students to augment research productivity and success in attracting extramural funding.

Faculty Profile
At present, there are a total of 47 participating faculty: 47% full professors; 40% associate professors; and 13% assistant professors. Across all three ranks, gender distribution is roughly the same – two-thirds male and one-third female. The number of MCB participating faculty in each home department/college has not changed significantly during the review period with new faculty members nearly balancing retirements/departures. Today there are 10 faculty from the Department of Biological Sciences; 8 from the Department of Chemistry and Biochemistry; 6 from the Department of Environmental and Plant Biology; and 23 participating faculty outside the College of Arts and Sciences. Faculty from the Biomedical Engineering and Bioinformatics program in the College of Engineering, the Heritage College of Osteopathic Medicine, the College of Health Sciences and Professions, and the Diabetes Institute have recently been added.

Programmatic Practices
Teaching and Advising. Teaching loads and expectations regarding advising are determined by the home department from which faculty are promoted and tenured. Even so, All MCB participating faculty are expected to be involved in graduate education and mentoring. Each student receives a high level of individualized faculty mentoring in the classroom and at the lab bench.

MCB graduate students are heavily involved in conducting the research projects of faculty in participating departments. Nearly all of the research publications generated by these departments include MCB graduate students as co-authors.

Participating Faculty. MCB faculty must have the Ph.D., M.D, D.O. or equivalent degree. Any OU faculty member meeting these criteria, wishing to participate in the MCB graduate program must submit a written request to the MCB Director, which should include a brief statement of research interests, an expressed commitment to graduate training and mentorship, and a current CV. The request is circulated among MCB participating faculty who then vote to accept or deny the application. The MCB Director, with approval of the MCB participating faculty, recommends acceptance to the Dean of the College of Arts and Sciences. Acceptance into the program is complete after approval by that Dean.

Admissions. The MCB graduate admissions committee is made up of at least one representative from each home department. Applicants are ranked independently by each member in five categories: academic preparation, GRE scores, recommendation letters, research experience, and personal statement. A final ranking for each applicant is generated as the average of each graduate committee member’s individual ranking. Offers are made top to bottom until the
available open slots are filled. Thus, the number of admits to each track, every year depends much more on the quality of the applicant pool than the number of applicants to specific tracks.

**Research and Creative Activity.** MCB participating faculty have broad and varied research interests, with many areas of overlap. Collaboration is common, encouraged, and productive. MCB faculty average 105 publications per year during the review period and many of these represent collaborative interdisciplinary research. In addition, MCB faculty are very successful in obtaining extramural funding averaging $3.4 million per year during the review period. A large portion of this extramural funding is based on preliminary and published data arising from collaborative and interdisciplinary efforts of MCB faculty.

**Service.** Service to the MCB graduate program by its participating faculty is voluntary and involves serving as Director or terms of service on the MCB curriculum and graduate committees. The goal is to have MCB participating faculty share equally in the service needs of the program.

**Interdisciplinary Work.** Interdisciplinary works are the cornerstone of the MCB program. As an interdisciplinary graduate program located within the College of Arts and Science but not in a single academic home, the MCB program includes 47 faculty from nine different programs in four different colleges across campus. The existence of the MCB graduate program has helped recruit new and retain exceptionally talented faculty in this area to further strengthen and sustain the quality of the MCB graduate program and strengthen the discipline based home departments from which faculty promotion and tenure is determined. The recent trend toward an increased emphasis in bioinformatics and diabetes research are two good examples of how the MCB graduate program naturally responds to other programmatic initiatives at OU and works synergistically with existing and new program initiatives to strengthen and enhance interdisciplinary graduate student education and research excellence.

**Diversity of Faculty/Students.** The current demographic profile of faculty in the MCB program consists of 47 tenure track faculty approximated two-thirds of whom are male and one-third female, which is comparable to similar programs in the United States. Biological Sciences and Biomedical Sciences constitute about 60% of the MCB participating faculty. The overall total participating faculty in MCB has remained constant over the review period. Also, the numbers of faculty in each home department/discipline has remained relatively constant. New faculty members have been added during this period, but recent retirements have roughly balanced the new faculty memberships.

The enrolled student population and demographics result naturally from admitting only the highest qualified applicants each year. Overall, there are roughly an equal number of male and female students enrolled each year – generally females just outnumber the males. The majority of enrolled students are international (average = 77% during the review period). The majority of the international students are from China or India. Although the number of domestic students has increased recently, this is not the result of any intentional efforts on the part of the MCB program and most likely reflects normal year to year variations.
Research, Scholarship, & Creative Activity

All MCB participating faculty are evaluated for promotion and tenure by their home departments. There is an important synergistic relationship between the home departments and the MCB graduate program working both to assure that high quality graduate faculty are available to mentor MCB graduate students and the MCB graduate program exists to help advance the research and scholarly activity of its students and participating faculty.

All MCB participating faculty must meet or exceed the expectations of their discipline based home department for research and scholarly activity, teaching and service, as defined in each department’s workload and promotion and tenure documents. MCB participating faculty are successful and have an impressive publication rate (average 105 publications/year, during the review period) and are consistently successful at obtaining extramural grant funding ($3.4 million/year, of which an average of $656,000/year is interdisciplinary research funding).

Resources

Staffing. The program has one half-time administrative assistant. Although it has not worked out as anticipated (due to scheduling and academic considerations) one work-study student was assigned to the program this year and is supervised by the administrative assistant.

Physical Facilities & Technology. The interdisciplinary design of the MCB program means that research labs and student computer labs are in different buildings across campus, often in close proximity to the faculty member’s home department. Shared equipment and resources are efficient from a financial perspective, yet the physical separation does serve as a challenge to interdisciplinary activity. In spite of any challenges that may exist related to the physical location of labs, MCB faculty are committed to interdisciplinary research activity and work hard to make this happen.

The PhD Program Review

Curriculum. Students enrolled in the MCB doctoral program are required to take a rigorous curriculum in molecular and cellular biology with course offerings in MCB, Biological Sciences, Chemistry and Biochemistry, and Environmental and Plant Biology. The core course requirements along with a written comprehensive exam and oral defense of a research proposal are required for Ph.D. candidacy. A final written research thesis is presented publically and an oral defense before the student’s doctoral advisory committee are the final graduation requirement. Course offerings and requirements have evolved over time in response to student needs. For example, a few MCB students have elected to add the Bioinformatics Certificate.

Students. For the period between Fall 2007 and Fall 2014 although the total number of applications have decreased, particularly among international applicants, there has been no effect on the overall numbers of students admitted to each home department, the median GRE percentile score, the mean TOEFL score, or the demographic profile (including nationality, ethnicity, and gender) of applicants. Over time, there has been a shift in the proportion of applicants to the three degree tracks. MCB/BIOS now contributes the majority of applications, with MCB/PBIO and MCB/CHEM significantly lower.
The headcount for students admitted to the MCB graduate program ranged from a low of 2 (2014) to a high of 12 (2012). The number of admissions each year is determined primarily by the number of available graduate assistantships. The program enrolls a fairly diverse group with slightly more female than male students as well as international students of various ethnicities, although enrolled international students are predominantly from China and India.

The majority of MCB students are supported by teaching assistantships, institutional fellowships, or research grants. Teaching assistantships require teaching in the student’s home department (approximately 20 hours per week). All MCB students achieve high academic performance with an overall GPA close to 3.8 and are making steady progress toward graduation; the majority advance to candidacy after 2.5 years and complete their PhD in just over 5 years. Over the review period, the program had a 91% graduation rate with only three students departing the program without the degree.

Scholarly Activity. MCB graduate students are expected to write competitive grant proposals, attend meetings and present research findings to national and international audiences, and publish abstracts and journal articles in high quality journals. MCB graduate students have an impressive level of research and scholarly activity. MCB students consistently receive research awards (total averaged $10,000/year during review period), are perennial winners at the OU Research and Creative Activity Expo, attend national and international scientific meetings and present research data (total averaged 26 conference presentations/year during review period), and publish research articles in top-rated journals (total averaged 14/year during review period).

Post-Graduation Employment. MCB graduates are highly qualified and prepared for employment after graduating, land jobs as post-doctoral researchers, teachers, or industrial positions immediately after graduation, and eventually find permanent employment and excel in their career field. The survey of graduating MCB alumni (88 of 137 responding), indicated that all of these graduates are employed – 80% in academia and 20% in industry. Many are excelling and leaders in these areas.

PROGRAMMATIC CHALLENGES

Challenge #1: Dedicated Faculty
The MCB founding faculty were able to obtain a State of Ohio Academic Challenge grant (approximately $2M) which among other things was used to establish two group I (tenure track) faculty positions. These positions were recruited and the successful hires went to the home department that best suited the new hire’s research and academic background. These were originally located in Plant Biology (this position continues to the present) and Chemistry and Biochemistry. The Chemistry position departed and the new hire went to Biological Sciences and then migrated to Biomedical Sciences when that department was formed. This faculty member recently retired (partial retirement). The Biomedical Sciences position has not been restored at present.
The most pressing curricular need at the moment is the uncertain long term status of the MCB 7600 Advanced Cell Biology course. This is a required course in the MCB graduate program curriculum, and a fundamental building block of the knowledge base of all MCB graduate students. The course’s future since the partial retirement of Dr. Horodyski is uncertain. At present, an agreement between the MCB graduate program and the department of Biomedical Sciences has assured the quality and high standards of the course until the full retirement of Dr. Horodyski occurs. Prior to Dr. Horodyski’s full retirement a solution will need to be worked out to assure the continued delivery of a high quality advanced graduate course in cell biology. This will be a focus of the curriculum committee in the coming years.

Challenge #2: Maintaining High Quality Enrollments
The total number of applications to the MCB program has declined substantially during the review period (from 68 applications in 2007 down to 30 applications in 2014). This decline brings in concerns. Although the MCB program is still capable of maintaining high quality enrollments at present time, strategic plans shall be devised to further enhance the visibility of the MCB program and to attract more high quality students to apply, both domestically and internationally.

The visibility of the MCB program shall be enhanced through various strategies. Marketing the MCB program at local, national, and international conferences is an important strategy to utilize. According to the review committee’s informal conversations with the currently enrolled MCB students, a majority of them are recruited through face-to-face communications at a conference meeting, scientific workshop, or through a collaborative research project. Students are recruited because they have made personal contacts with a MCB faculty and get to know more about the benefits and advantages of the one-on-one mentorship, interdisciplinary curriculum and research collaboration, and the advanced technologies and entrepreneurship opportunities that are available in the MCB program.

Another important strategy to enhance the visibility of the MCB program and to attract more high quality students to apply is to improve web designs. At present time, the MCB program is only accessible through a single portal from the Ohio University homepage (under Academics, Schools and Departments, Molecular and Cellular Biology). If a prospective student goes to Ohio University homepage and clicks on Biology, for example, it will be quite very difficult for this student to identify the presence of the MCB program. Multiple portals shall be made available so that prospective students who are interested in Biological Sciences, Environmental and Plant Biology, Chemistry and Biochemistry, Biomedical Sciences, Bioinformatics, Genomics, and related fields can find the MCB program easily online. That way, both domestic and international students can have equal opportunities to recognize the presence and greatness of the MCB program at Ohio University.
INSTITUTIONAL CHALLENGES

Challenge #1: Maintaining Support for Interdisciplinary Work
MCB faculty felt strongly that the various participating departments and colleges as well as the University identify an incentive structure that would formally recognize and support interdisciplinary teaching and research efforts. The faculty recognize that there are competing demands for resources across campus. However, the benefits to interdisciplinary teaching and learning for the students, the faculty, and resulting research points to the need to reconcile these concerns. Additionally, the program is curious about how the university policy of Responsibility Centered Management (RCM), which ties, more so than in the past, the distribution of revenues to departments to the amount of revenue they bring in for the college as well as the number of undergraduate students enrolled will affect resource distribution in the future. Given that the MCB program is an interdisciplinary graduate program with no single departmental home and only one dedicated faculty line, RCM is likely to present unique fiscal challenges.

The review committee was impressed that every participating faculty group mentioned that they essentially volunteer their time in doing MCB teaching, that is, such teaching is not part of their recognized workload in their home departments. Some chairs even bluntly told them not to do MCB teaching since that is not counted. However, most faculty we talked to considered their involvement in MCB to be well-worth their time investments despite these prevailing negative aspects of workload.

Interestingly, when the site visit team met with the Dean, he explained that faculty workload policy is determined at the departmental level. It may be beneficial for the MCB faculty to develop an acceptable workload policy and collectively present the proposal to each of the home departments. This may also be an opportunity for the University to put forth a formal position statement that acknowledges, incentivizes, and rewards interdisciplinary teaching and research. As it stands right now, faculty are frustrated and feel that University systems actually hinder interdisciplinary work.

COMMENDATIONS

1. Faculty Dedication and Commitment. The committee was impressed with the high-level of engagement and dedication of the faculty who essentially volunteer their time to assure positive student outcomes and productive research agendas. Particularly notable was the commitment by individual faculty (namely, John Kopchick) in providing scholarships for MCB students and faculty awards for excellence in MCB-related research. This level of commitment demonstrated by faculty is unprecedented and demonstrates the importance of the MCB interdisciplinary program in the development of Ohio University.
2. **Responsiveness to Students.** MCB students spoke very highly about the ability to work in an interdisciplinary environment. They were very positive about the quality of instruction and the one-on-one mentorship. Students were also appreciative of the availability of travel grants, the ability to select a lab that allowed them to pursue individual research interests, and the one-on-one mentorship and guidance they receive from faculty.

3. **Curricular Improvements.** When the University transitioned to semesters, MCB faculty revised the curriculum in ways that reflected trends in the field and were responsive to student expectations. Specifically, they added a writing class that prepares students for all phases of scientific writing (e.g., grants, academic manuscripts, scientific reports) and a teaching seminar where students learn how to give a seminar. Although the number of required courses exceed the national average for similar programs, these kinds of course are essential for success after graduation. These courses and the success they have had in preparing students for the kind of writing and presenting they will be doing once they enter the field could serve as a model for the field.

4. **Student Organized Research Symposium.** The committee was impressed with the initiative taken by the MCB students to organize a research symposium that brings together students from four universities in Appalachia including Ohio University, Marshall University, West Virginia University, and University of Kentucky.

**RECOMMENDATIONS**

We find the interdisciplinary Ph.D. program in Molecular and Cellular Biology to be viable and successful. MCB graduate students are receiving outstanding research training and teaching experience. They are provided with excellent opportunities to present their research at local and national conferences. Here, we provide recommendations to further improve the quality of the MCB program and to enhance the impact of the MCB program on the research and educational mission of the University.

**Recommendation #1: Expand the MCB Interdisciplinary Research Model at OU**

The interdisciplinary MCB program has proven to be a highly successful model to promote and stimulate research at OU. We recommend that mechanisms be developed to expand this interdisciplinary model at OU. Currently, the MCB program is administered by the College of Arts and Sciences. A large component of the MCB faculty is housed in the College of Arts and Sciences, and one faculty position in the College (i.e. Dr. Alan Showalter) is dedicated to MCB research, teaching, and service. There are 23 participating MCB faculty outside of the College of Arts and Sciences. These individuals are located in the Heritage College of Osteopathic Medicine, the Russ College of Engineering (the Biomedical Engineering and Bioinformatics Program), and the College of Health Sciences and Professions. One idea is to establish a dedicated MCB faculty position in each of these colleges. Dedicated MCB positions in the
Heritage College of Osteopathic Medicine, Russ College of Engineering, College of Health Sciences and Professions, and the College of Arts and Sciences would be jointly supported by each of these OU colleges. This arrangement would formally expand the interdisciplinary breadth of the MCB program and would provide needed teaching and administrative support for the MCB program to continue to flourish.

Recommendation #2: Improve Career Counseling of Graduate Students
One weakness of the MCB program is the availability of early career counseling for the graduate students. The MCB program has begun to address this issue by starting an alumni mentoring program where MCB alumni are paired one on one with MCB graduate students. This is an excellent approach to provide assistance in career counseling but its success is dependent on the willingness of alumni to participate in the program. Another approach that has been shown to be effective in guiding career development is the incorporation of an Individual Development Plan (IDP) into the student’s plan of study. IDPs for science careers are available online free of charge (see: http://myidp.sciencecareers.org/). They are useful in assessing the student’s strengths and weaknesses in guiding career choices. The student’s mentor aids in the IDP process. We recommend that the MCB program encourage or require students to initiate and maintain an IDP as part of their annual progress report to their Doctoral Advisory Committee. IDPs are currently required in the training plan of several predoctoral fellowship applications (e.g. NIH).

Recommendation #3: Develop a Bioinformatics Track in the MCB Curriculum
During the past five years, there has been explosion of molecular and cell biology research guided by computational genomics and the analysis of large libraries of biological data. The MCB curriculum committee has recognized this trend and lists bioinformatics courses taught by Dr. Lonnie Welch in the Department of Computer Science as possible MCB electives. We recommend that the MCB program work with Dr. Welch to tailor these course offerings to the needs of MCB students. Dr. Welch is very amenable to modify his teaching to suit the needs of individual students. The review committee also recommends that the MCB program establish a MCB track in bioinformatics for students wishing to obtain in-depth training in all aspects (statistics, computer programming, data mining) of bioinformatics. Currently, a graduate certificate program in bioinformatics is offered through the Russ College of Engineering. This program is available to all OU students. A formal MCB track in bioinformatics would strengthen the MCB curriculum and could be used as a marketing tool to enhance the recruitment of talented students into the MCB program.

Recommendation #4: Use MCB to Market Undergraduate Research Opportunities
The MCB program plays an important role in fostering undergraduate research at OU. Many MCB faculty take OU undergraduates into their laboratories and introduce them to the fascinating world of molecular and cell biology research. The commitment of the MCB program to undergraduate research is highlighted by annual awards provided by the The John J. Kopchick Molecular and Cellular Biology Undergraduate Student Support Fund. The review committee feels that the MCB program should be employed as a marketing tool to recruit high quality
undergraduates into science, engineering, health care, and biotechnology majors at OU. Currently, MCB research opportunities are not directed at undergraduate students (see: https://www.ohio.edu/cas/undergrad/research.cfm).
Hi David,

I have a copy of the review, sent by Judith – I assume it would be the same version sent to Dean Frank, etc.

I sent this to the MCB faculty, we were pleased with the overall review and felt the “pulse” of the program was captured accurately. Thus, we have no further comments or corrections to make.

Bob

David C. Ingram (ingram@ohio.edu)
Program Review Committee Chair, UCC
Ohio University
Athens, Ohio 45701-2979
David Ingram  
Chair, UCC Program Review Committee  

Dear David:  

I am writing in response to receipt of the program review report for Molecular and Cellular Biology. The review committee did a commendable job in its report, capturing the current value of the program to the university along with the challenges of supporting cross-college, interdisciplinary research. Although the current structure presents some problems, the faculty have been able to overcome them and provide a quality educational experience for their students. However, current balance is delicate, and future budget pressures may create significant barriers to future success. The program faculty should act now, as suggested in the report, to set workload expectations and resource needs that can then serve as a starting point for conversations with the participating departments and colleges. In my view, such a proactive approach is essential. Please let me know if you have additional questions or concerns.  

Sincerely yours,  

[Signature]  

Robert A. Frank, Ph.D.  
Dean, College of Arts and Sciences  
Professor of Psychology