

OSU-Marion Campus Strategic Planning Curriculum Proposal Biology B.S. (Pre-Health Professions Specialization)

We are living during what has been described as the “Century of Biology,” and it has been argued that biology is the ultimate 21st century degree. Important discoveries, especially in the fields of medical genomics and developmental biology, are being made at an astonishing rate. At the same time, the biological sciences encompass a strikingly broad realm of human endeavor, from the tightly focused, information-rich and highly technical genomics/proteomics and personalized medicine to more holistic, interdisciplinary, and field-based specialties such as ecology and conservation biology.

Accordingly, a biology degree program is likely to appeal to a substantial fraction of our incoming students. More importantly, and related to the extreme breadth and diversity of interests represented in the biological sciences, an exceptional student with a biology degree will be equipped with a skill set of great general value and interest to a variety of potential employers. Specifically, a graduate with a biology degree will have advanced quantitative skills, a good grounding in the pillars of methodological reasoning—chemistry and physics—and also be engaged with an area of nearly universal interest: life itself. Through their coursework, biology majors will have been tasked with assignments that draw heavily on reading comprehension, collaboration, and the communication of their science findings. In short, because skills and abilities are more transferable across disciplines than knowledge, a biology student receives an excellent liberal education that is also rigorous, contemporary, and individualized. Such a student will be equipped for success in a diverse array of occupations.

Assistant Director of Academic Services Chris Trapp and Career Services Coordinator Will Smith passed along information from several sources that depict a biology major as one that allows entry into occupations that are trending positive employment-wise. The web site www.ehow.com states “Majoring in biology is quite practical as a degree in the subject can be applied to a wide array of careers. Many of these careers, such as in the pharmaceuticals field, are high paying and offer a stable future. According to the American Institute of Biological Sciences, a report published by the US Bureau of Labor Statistics places the average starting salary for biology majors at \$60,000 per year, and this starting salary only increases with additional degrees and experience.” Trapp and Smith also indicated that additional, and more focused job outlook projections are available from the U.S. Department of Labor’s Bureau of Labor Statistics at www.bls.gov; these projections could prove useful in developing a more refined plan for a Biology degree program.

Augmented, but not wholly driven, by the relatively strong job prospects in biomedical fields, there is high interest among prospective college students in a biological science major. Our Director of Enrollment Management, Matt Moreau, provided statistics showing that of the approximately 3500 high school sophomores, juniors and seniors in our 7-county service area who indicated a preference (out of a total of just over 5000 students who were recently canvassed), 320 picked biology/biological science, 250 identified pre-medical or biomedical science *per se*, and a total of 228 showed in interest

in other preprofessional programs that are consonant with a biology degree (pre pharmacy, pre-veterinary, pre-dental, and pre-OT/PT).

The majors chosen by current OSU-Marion students show the same strong interest in biology and related disciplines. The various plans (majors) selected by our students that are either in the biological sciences, or are majors that require some of the same advanced courses as do the biology curricula (thus having the potential to act synergistically with a biology major to strengthen those course offerings) are shown below. Note that "BIOLOGY-BS" is the highest-indicated individual major (33 students enrolled), followed closely by HLTHPR-PRE (25 students) and HLTHPRF-AI (24 students). This is from a population of 1323 students enrolled during AU 2012 for whom MRN is their official campus. They are: 60 (4.5%) Graduate students; 21 (1.6%) Academy (PSEO) students; 584 (44.1%) Rank 1 freshmen (includes new and continuing freshmen); 283 (21.4%) Rank 2 sophomores; 177 (13.4%) Rank 3 juniors, and; 198 (15%) Rank 4 seniors. Moreau provided the following breakdown:

Undergraduate Majors with 10+ students in AU12 – Descending order

Early/Middle Childhood – 147
Business - Pre – 136
Engineering – all combined – 116
Psychology – 104
Health Professions – Pre – 49
Biology/Bio Sciences – 46
English – 44
Nursing – Pre – 39
Education – Undecided – 35
Criminology – 31
History – 30
Social Work – 27
Communications – 18
Animal Science – 17
Political Science – 13
Health Science – 12
Zoology – 11

Several of these popular majors, namely Pre-Health Professions (n=49), Biology/Bio Sciences (n=46), Animal Science (n=17), Health Science (n=12) and Zoology (n=11), with a total of 135 having selected them, are strongly allied to the biological sciences. Accordingly, it seems that a Biological Sciences (BS) degree program would allow them to fulfill their undergraduate educational objectives in whole or in very substantial part.

The Biology major is supported by The Center for Life Sciences Education (CLSE), an interdepartmental program administered by the College of Arts and Sciences. CLSE also develops, teaches, and provides administrative support for a small number of heavily-enrolled core Biology courses, most notably the two two-course sets of general introductory biology courses that includes, for majors, the Biology1113 and Biology 1114 sequence, and for non-majors, two separate standalone courses, Biology 1101 and Biology 1102. Additionally of note, they offer Biology 3401 (Integrative Biology), which

is listed as a "core course" for all three specialization areas (Forensic Biology, Life Sciences Education, or Pre-Health Professions).

Most of the biological science course requirements for the Biology degree are drawn from offerings of other biology-related Departments, which vary depending upon the specialization area of the Biology Major. Accordingly, courses from Evolution, Ecology and Organismal Biology (EEOB), Molecular Genetics, Chemistry and Biochemistry, Microbiology, Entomology, and Anthropology may be required for the Biology degree. According to the CLSE Mission Statement, the biology major is "designed to ensure exposure to a broad base of biological knowledge, to provide depth of experience in advanced topics, and to develop competence in scientific disciplines that are supportive of biological endeavors (mathematics, data analysis, physics, and chemistry)." They also note that the major "provides a good background for graduate study (MS, PhD, MD/PhD) and is readily adaptable to meeting professional school requirements (medicine, dentistry, pharmacy, veterinary medicine, allied medicine, optometry, etc.), while also allowing freedom to take courses that satisfy secondary interests or alternative goals."

Owing to the high student interest in a biology major and the related disciplines for which this major could serve as a gateway, as well as the strong and varied skill set that such a degree program would provide, we respectfully request that the OSU-Marion Academic Affairs Committee assess the advisability of having our campus effect a change from a 2-year program to a 4-year Biology degree program at Ohio State Marion, and to recommend that to Dean/Director Rose.

Benefits

Offering a Biology major will give an opportunity to area students to come to Marion and complete a science degree in biology. Presently, a substantial number of students with an interest in the sciences leave the area to enroll in neighboring universities because we don't offer a science degree. Guidance and career counselors at local high schools would likely have enthusiasm for this option, and recommend it to suitable students.

It would also be possible also to incorporate a Biology minor. Because of its very different subject matter and career trajectory, few students from our other majors such as Psychology, Education, English, and Business are likely to pursue this. (Criminology may be an exception, as there is interest in forensics.) On the other hand, Biology majors may elect to minor in other areas in which we offer a B.S. degree. Because we already have major programs in Humanities, Social Sciences, Business, Social Work, and Engineering, the addition of Biology --a natural science --will sharply increase the comprehensiveness of our campus. The course work can thereby be expected to enhance the existing programs and attract more students to our campus. Moreover, it will enable students to choose biology as their degree program for a pre-med curriculum, a major that, alongside Chemistry, is one of the most-chosen paths to becoming a physician.

While there are, as mentioned above, several specialization areas within the Biology major administered by CLSE, as well as two potentially applicable majors programs

within EEOB (Evolution & Ecology Major; Zoology Major), for assessment purposes and also because it is likely the best option, the Pre-Health Professions specialization area of the Biology B.S. program is herewith described in detail, paying particular attention to the course requirements and our capacity to meet them using existing and potentially-proposed additional faculty (new hires).

Program Description: Biology Major –Pre-Health Professions Specialization

I. Supporting Courses (required for BS in any specialization area)

Biology 1113 (Biological Sciences: Energy Transfer and Development; 4 units, lab required)

Biology 1114 (Biological Sciences: Form, Function, Diversity, and Ecology; 4 units, lab required)

Chemistry 1210 (General Chemistry I; 5 units, lab required) or 1610 (General Chemistry for Majors I; 5 units, lab required) or 1910H (Honors General Chemistry I; 5 units, lab required)

Chemistry 1220 (General Chemistry II; 5 units, lab required) or 1620 (General Chemistry for Majors II; 5 units, lab required) or 1920H (Honors General Chemistry II; 5 units; lab required)

Chemistry 2510 (Organic Chemistry I; 4 units) or 2610 (Organic Chemistry for Majors I; 4 units) or 2910H (Honors Organic Chemistry I; 4 units)

Chemistry 2520 (Organic Chemistry II; 4 units) or 2620 (Organic Chemistry for Majors II; 4 units) or 2920H (Honors Organic Chemistry II; 4 units)

Chemistry 2540 (Organic Chemistry Laboratory I; 2 units) or 2940H (Honors Organic Chemistry Laboratory I; 2 units)

Chemistry 2550 (Organic Chemistry Laboratory II; 2 units) or 2950H (Honors Organic Chemistry Laboratory II; 2 units)

Math 1156 (Calculus for the Biological Sciences; 5 units)

Math 1157 (Mathematical Modeling for the Biological Sciences; 5 units) or Stat 2480 (Statistics for the Life Sciences; 3 units)

Physics 1200 (Mechanics, Kinematics, Fluids, Waves; 5 units, lab required) or 1250 (Mechanics, Thermal Physics, Waves; 5 units, lab required)

Physics 1201 (E&M, Optics, Modern Physics –algebra based; 5 units, lab required) or 1251 (E&M, Optics, Modern Physics –calculus based; 5 units, lab required)

II. Core Course (required for Pre-Health Professions specialization)

Biology 3401 (Integrated Biology; 4 units)

III. Required Course (required for Pre-Health Professions specialization)

Molecular Genetics 4500 (General Genetics; 3 units) or 4606 (Molecular Genetics; 4 units)

IV. Additional Coursework (At least 4 must be chosen. Of the 32 semester units, 25 units must be courses in Biochemistry, Biology, EEOB, Microbiology, or Molecular Genetics.)

Biochemistry 4511 (Introduction to Biological Chemistry, 4 units) or 5613 (Biochemistry and Molecular Biology I, 3 units) and 5614 (Biochemistry and Molecular Biology II; 3 units)

EEOB 3310 (Evolution; 4 units)

Microbiology 4000 (Basic and Practical Microbiology; 4 units, lab required) or 4100 (General Microbiology; 5 units, lab required)

EEOB 3510 (Cellular and Developmental Biology; 3 units) or MolGen 5607 (Cell Biology; 3 units)

EEOB 3520 (Microscopic Anatomy; 3 units, lab required)

Anatomy 2300.01 (Human Anatomy; 4 units, lab required) or Anatomy 3300 (Advanced Human

Anatomy for Undergraduates; 5 units, lab required), or EEOB 2510 (Human Anatomy; 3 units, lab required)

EEOB 4510 (Comparative Vertebrate Anatomy; 3 units, lab required)

PhysioCB 3101 (Human Physiology I; 3 units) and PhysioCB 3102 (Human Physiology II; 3 units) – or EEOB 2520 (Human Physiology; 3 units) or EEOB 4520 (Comparative Physiology; 3 units)

Coursework already offered, and need for Additional Faculty. Note that OSU Marion already offers all of the “Supporting Courses” listed above. There are some areas that would need to be filled among the “Core,” “Required,” and “Additional” courses. Currently, we have two regular EEOB faculty members, Bob Klips and Susan Gershman, who are principally evolutionary biologists within EEOB specializing in plant and animal reproductive ecology, respectively. Our strengths are in the areas of evolution (one class

required for the Pre-Health Professions specialization) and various aspects of organismal diversity (not required for the Pre-Health Professions specialization). There are a few courses that may or may not be feasible for our current faculty to teach, such as the ones in genetics, molecular genetics, microscopic anatomy, and cell biology; more information is needed about the course content and the policies of the offering Departments to fully assess our capacity to offer them with our present staff. During most semesters, OSU-Marion employs two auxiliary faculty teaching introductory biology courses and/or EEOB 2510 (Human Anatomy) and EEOB 2520 (Human Physiology). Given the emphases on vertebrate anatomy, vertebrate physiology, and microbiology, it is apparent that adoption of this biology major program would necessitate hiring one or two new faculty members with strength(s) in those areas.

Collaboration. At least one subject area, Microbiology, requires lab facilities and possibly teaching expertise that we presently lack and which may be difficult to develop right away, and which apparently is being addressed by our co-located campus, Marion Technical College. This may be an area in which the two campuses can collaborate. Also, it will provide an opportunity for students trying to enter into MTC nursing programs, by enabling them to take some of our courses while awaiting admission.

Precedent and Permission. Because B.S. programs in Biology and Health Science are presently offered on OSU's Lima campus and are enrolling well CLSE and/or other departments will likely be amenable to our offering this degree on our campus. To date, the Center has provided indispensable teaching guidance to our faculty and lab support staff. EEOB has been very helpful supporting and providing research space for our faculty members in that Department.

Synergy with other Programs. Although we don't have a great number of Engineering students specializing in in bio-mechanics or bio-engineering, having a B.S. in Biology will provide that opportunity for any such students completing their Engineering degree here. Our math, physics, and chemistry classes would experience enrollment increases. Overall, a Biology degree program would likely complement, rather than compete with, our existing programs.

Community Involvement. The recent acquisition of Smith Clinic by OhioHealth, and the continuing strong presence of Marion General Hospital are elements of a positive trend in health professions locally. With opportunities in this area increasing, it will be of benefit to this sector to have a program whereby people can complete a science degree on our campus. Nurses with a 2-year degree may opt to complete their 4-year program in Biology, and our students could engage in internships locally.

Thank you very much for consideration of this request. Please do not hesitate to ask for clarification or additional information.

Bob Klips
Susan Gershman
April 1, 2013