Biology Program at the University of Wisconsin-Green Bay

Comprehensive Review
24 January 2021

Robert Howe, Professor and Chair

General and Overview

1. Describe your program's most significant opportunities and significant challenges.

The UW-Green Bay Biology Program oversees one of the institution's most popular and heavily enrolled majors. The curriculum comprises 8 areas of emphasis (+ 2 accelerated pre-graduate options), aimed at preparing students for careers in laboratory science (Cellular/Molecular Biology, Microbiology), field/organismal biology (Animal Biology, Ecology and Conservation, Aquatic Ecology and Fisheries), and professional/applied sciences (Biology for Educators, Pre-Veterinary, and Aquaculture). Several of these areas of emphasis are new, so current enrollment numbers are not necessarily indicative of their future status. Nevertheless, recent trends suggest that Biology majors represent diverse interests across this wide array of emphases. Two of the most general or flexible curriculum options (Animal Biology and Cell/Molecular Biology) continue to be the most popular.

Past success of the Biology Program can be linked with many of the same factors that portend its bright future. Spectacular advances in molecular genetics, cell physiology, and microbiology have opened or expanded exciting new careers ranging from forensic science to medical genetics. A crisis of biodiversity loss is now fully exposed, creating urgent needs for conservation biologists and applied ecologists. Climate change, global pandemics, and an aging human population all present challenges whose solutions will require (at least in part) trained biologists. In other words, growing socioeconomic challenges coupled with unprecedented technological advances have created demands for expertise in biology; students are following these career opportunities in large numbers, and the trend shows no signs of slowing.

With opportunity and innovation, however, come new educational challenges. To provide a meaningful curriculum for students today, faculty need to continuously incorporate new material into courses. New technology needs to be acquired for updating lab experiences. This places significant pressure on faculty and institutional budgets. An ongoing commitment of resources will be needed to maintain a competitive biology program, both in terms of dollars and workload support. Many of the program's future challenges are grounded in the need for recognizing critical needs and responding to them with creative, cost-effective commitments of funding and faculty/staff support.

Currently, the Biology Program is faced with a leadership challenge. Many senior Biology faculty are in other leadership positions: Draney is chair of NAS; Forsythe is Chair of the ES&P graduate program; Howe is current Biology Chair/Cofrin Center for Biodiversity Director but will be retiring in 2022; Merkel is Chair of Human Biology; Wolf and Marker have just completed multiple terms as department/unit chairs; Grubisha heads the new Applied Biotechnology Program; and Meinhardt was recently appointed as Curator of the Richter

Museum of Natural History. Given responsibilities for overseeing advising and curricular management in a program with nearly 250 majors and 8 areas of emphasis, the 3 credit workload reassignment for the Biology chair position is understandably unappealing. Talented and highly competent young faculty and strong Biology faculty additions from the Manitowoc, Marinette and Sheboygan campuses may eventually resolve this issue, but increased support for the Biology Chair position will help ensure that the program will continue to thrive. My experience as Chair during the past year attests to the high demand for advising and other issues. I suggest that the workload reassignment be increased to 6 credits, ideally split between two faculty members (e.g., one responsible for curriculum and meetings, the other for advising).

2. **What are some things that would help make your program and its students more successful? (Narrative)**

Facilities and capital equipment are essential for providing high impact experiences, which are so important for university science students today. New biotechnology is continuously appearing, so one of the first places to look for improving the Biology Program is to provide ways for students to experience these new technologies in laboratories and independent student research opportunities. A second improvement is to develop (or at least continue) seamless support of field trips, a signature feature of the UW-Green Bay's successful Biology program. On campus field trips, boat trips to the waters of Green Bay, and driving field trips to local natural areas all provide high impact experiences that separate UW-Green Bay's Biology program from many others. These experiences all help students build a competitive portfolio for their future careers. Finally, we need to adapt to the post-pandemic higher education environment where a combination of online and in-person learning will be demanded by students. Support for high quality online course content will be a key to expanding enrollment and delivering a modern curriculum for students in the 21st century. Fortunately, we have a head start, but faculty surely cannot simply return to the pre-pandemic array of course delivery options.

The introductory biology course sequences 201/202 and 203/204 set a critical academic foundation for upper-level courses as well as providing an opportunity for non-majors to fulfill the biological sciences general education requirement. In practice, these courses often are very challenging for students, and many require extra academic support. Biology faculty members Stahlheber, Kibbe, Draney, Pott, and Mueller addressed the high failure rate of students in Biology 201/202 and 203/204 with a trial peer mentoring program in 2017. Their Provost-funded project clearly supported the idea that extra student help can significantly increase student success in introductory biology courses. At the Manitowoc campus, Abler and Hein provide 1 credit discussion sections to help students in the introductory biology courses. In Abler's words: "We serve as an access point to students, including first-generation college students, many of whom need and want small class sizes with regular personal interactions during their early college careers." Furthermore, "remote learning has a role in allowing flexibility for student access to course materials (especially for working parents and others who are severely time-constrained), but face to face interactions are critical for recruitment and retention of most student in introductory courses." Uwe Pott, a lead instructor for Biology 201/202, suggests that we turn to the model used by the Chemistry Program for introductory courses: increase the course credits from 4 to 5 (lecture 3 credits, discussion 1 credit, and lab 1 credit). This, of course, would require additional personnel, either teaching assistants or faculty positions.

3. **What are some program accomplishments worth highlighting? (Narrative)**

Accomplishments of faculty and students in the Biology program are many. Since 2015, faculty in the Biology Program have authored or co-authored at least 108 peer-reviewed articles, some in the world's most prestigious journals. This work has involved collaborations with undergraduate and graduate students and colleagues from around the world. Faculty and student research at UW-Green Bay includes several large, multi-institutional projects on Great Lakes ecology, forest dynamics, human physiology, biofuels, desert ecology in the Middle East, mycology, and arachnology. These research efforts have generated literally millions of dollars in external research grants, with no sign of slowing. In virtually all of these cases, UW-Green Bay students have benefitted by participating in these research projects under the guidance of Biology faculty. Biology faculty also have contributed significantly to UW-Green Bay outreach activities, including hundreds of public and professional presentations since 2015, appearances on science-related public radio broadcasts, and meaningful contributions to K-12 education in northeastern Wisconsin. Perhaps most significantly, the success of UW-Green Bay's Biology Program can be measured in the success of its graduates. While we do not systematically track the post-graduate careers of our students, we know from personal accounts that many graduates have achieved great success as medical and veterinary professionals, university professors, lab scientists, government agency biologists, conservation professionals in non-profit organizations, environmental consultants, K-12 teachers, and other scientific careers.

4. **Have there been any significant changes that have affected your program? (Narrative)**

Probably the most significant change affecting our program has been the elimination of the campus-wide requirement for an interdisciplinary program (major or minor). Since the Biology major was considered "disciplinary," students previously had to couple a Biology major with one of the designated interdisciplinary options (often Environmental Science or Human Biology minor). The result of this change has been a dramatic increase in Biology majors, beginning in about 2015. We have experienced nearly a 90% increase in the number of declared majors, levelling off at 230-240 declared majors since 2018. The merger of our four campuses also has changed the dynamics of the program, although the transition is still in progress. The addition of new biologists from Manitowoc, Marinette, and Sheboygan has added significant new capacity for the program. The transition itself has gone very smoothly, in large part because of the flexibility and cooperative nature of the people involved. We have not yet fulfilled the potential advantages of the merger, but the faculty themselves have become fully integrated into the Biology Program. Another important change has been the establishment of faculty curators for UW-Green Bay's two fine scientific collections, the Richter Museum and Fewless Herbarium. These curators are now better equipped to integrate the collections with the academic program and to generate larger numbers of quality, high impact experiences for UW-Green Bay students.

5. **Where do you want your program to be 5 to 7 years from now? (Narrative)**

My vision for successful progress during the next 5-7 years would be the accomplishment of these goals:

- Continued growth in enrollment; given the public demand for biologists in many sub-disciplines (biotechnology, health care, conservation biology, resource management, etc.), this is an area with high growth potential for UW-Green Bay in general. One area of growth is to better integrate the UW-Green Bay introductory courses with advanced high school course offerings.
- Elimination of enrollment bottlenecks by more efficient allocation of faculty resources and hiring of new faculty in critical areas (see below).
- Recruitment of a much higher diversity of students and faculty. The ethnic diversity of Biology majors currently is embarrassingly low. We can do much better, especially improving numbers of indigenous Americans students given nearby communities of Menominee, Oneida, Ho-Chunk, and Potawatomi people.
- Stronger integration of the Cofrin Center for Biodiversity (CCB) staff with the Biology curriculum. UW-Green Bay is fortunate to have truly outstanding field trip and research opportunities at 5 natural areas, the Richter Museum of Natural History, and Fewless Herbarium, in addition to teaching and research support from CCB staff. Some courses (e.g., Mammalogy, Ornithology) have a historical connection with these resources, but many other opportunities are underutilized. Students can gain important career skills and valuable academic experiences from these opportunities. Now that the CCB is on a solid structural foundation, modest additional support and creative planning can help integrate the CCB more effectively into the academic program.
- An innovative system to integrate faculty and classroom/lab resources at the Manitowoc, Marinette, and Sheboygan campuses with the Green Bay campus. Some combinations of online and in-person instruction coupled with strategic faculty assignments can help eliminate low enrollment course offerings and expand the ability of the Biology Program to accommodate increased student numbers.
- Strengthened support services for high impact student experiences in lab and field courses. This includes improvements in lab facilities (especially in molecular genetics) and a more efficient system for supporting field trips.

Demand

All data in this area is provided with the materials. (Graduates, majors, minors, etc.) This space is for any commentary you would like to apply to that material. (Narrative)

Internal

1. **Program goals (Mission, vision, learning outcomes; present as narrative/lists)**

The mission statement for UW-Green Bay's Biology Program was last revised in 2016. Due to university-wide changes in graduation requirements, parts of this mission statement are obsolete. Below I suggest updates that will make this mission statement consistent with the current academic environment. These recommendations haven't yet been approved, but they will be proposed to the Biology faculty during spring 2021.

The Biology Program at the University of Wisconsin-Green Bay provides a quality educational curriculum in the study of life and living systems, from the molecular level to the ecosystem level.

The disciplinary major and minor are core elements of UW-Green Bay's STEM curriculum, making strong contributions to other majors, particularly Human Biology, Environmental Science, the professional program in Education, and the graduate program in Environmental Science and Policy. The biology major prepares students for careers in ecology, organismal biology, physiology, genetics, cell and molecular biology, biotechnology, medicine and human health, veterinary science, wildlife management, education, agriculture, and science communication. Faculty and staff teach students to think critically and to solve complex problems scientifically by providing hands-on laboratory and field experiences as well as meaningful scientific research opportunities. The Biology Program contributes intellectual, cultural, and economic outreach activities and scientific research that enriches the quality of life for people in northeastern Wisconsin and elsewhere.

We also revised our learning outcomes for the 2016 Academic Program Review. I believe that these learning outcomes are still relevant:

- *Describe the organization and diversity of life at levels of complexity from subcellular to ecosystem.*
- *Demonstrate an understanding of genetic information, hereditary processes, and their relevance to evolutionary change as a product of mutation and natural selection*
- *Explain the important processes and pathways that sustain living organisms including functional systems for exchange of energy and matter*
- *Solve problems by applying a scientific process of inquiry, including the effective use of appropriate techniques, instrumentation, and data analysis*
- *Identify and interpret findings of scientists and communicate results of scientific work to others in the scientific community and the general public.*

2. Curriculum development (Lists, brief narrative if appropriate)

In addition to changes in lists of elective courses and other minor changes to the Biology curriculum, several major changes have occurred during the past 5 years. Two new areas of emphasis were added during 2020 (Aquaculture and Aquatic Ecology and Fisheries) to strengthen our already strong program in fish biology. Two years earlier, two "accelerated" programs were added (in 2018) to help students in the Animal Biology and Ecology and Conservation areas of emphasis to gain a head start for the UW-Green Bay graduate program in Environmental Science and Policy. This option essentially permits students to take select upper-level Biology courses as graduate courses, eventually enabling them to complete their Master's degree coursework in a single year after their baccalaureate graduation. Few students have chosen these options, but they are in place and we hope that they will become more attractive as they are more widely advertised. Finally, two very important areas of emphasis were added in 2016: Microbiology and Pre-veterinary Science. Numbers of students choosing these options has grown steadily since then. The previously established areas of emphasis have been remarkably stable and successful during the last decade. Unlike the conclusions of several previous Biology program reviews, no serious gaps are apparent in the curriculum. Our challenge today is to maintain and expand the numbers of sections in our current course array rather than adding new courses. One exception might be the addition of discussion sections in our core introductory

course sequences (BIOLOGY 201/202 and BIOLOGY 203/204) to help students build a stronger foundation for upper level courses in the program.

3. **Connections to other programs (Lists, brief narrative if appropriate)**

The Biology Program is strongly linked to two majors (Environmental Science and Human Biology) and the Master's degree graduate program in Environmental Science and Policy. Because Biology is not a budgetary unit, faculty members in the program are also members of either the Department of Natural and Applied Sciences (NAS) or Department of Human Biology (HUB). Numerous Biology courses are listed as requirements and electives for other majors in NAS and HUB (e.g., BIOLOGY 201/203); likewise, majors in the two budgetary units (e.g., Environmental Science and Human Biology) provide required supporting courses for most of the Biology areas of emphasis (Table 2). Other STEM programs including Mathematics (MATH 260), Chemistry (CHEM 211/213), and Physics (PHYSICS 201/03) also provide supporting courses for Biology majors.

Two introductory courses (BIOLOGY 201 and BIOLOGY 203) can be used to satisfy the UW-Green Bay biological sciences general education requirements for the biological sciences.

4. **Number of courses offered (Overall number provided in materials. <u>Chairs</u>: short commentary if appropriate. Provide a sub-grouping of various modalities by percentage. For example, what percentage of your program is available online, hybrid, etc.?)**

The Biology Program currently offers 47 courses (plus one inactive course), listed below (Table 1) in 8 areas of emphasis with two accelerated alternatives (Table 2). Most Biology courses attract near-capacity enrollments and can be grouped into one of the following categories:

Introductory lecture course:	2
Introductory lab course:	2
Introductory discussion course:	1
First Year Seminar:	1
Upper level lecture course only:	9
Upper level standalone lab course:	5
Upper level lecture/laboratory course:	3
Upper level lecture/lab/field course:	16
Individualized learning course/travel:	7
Capstone Seminar:	1

Due to the 2020-21 pandemic, virtually all Biology courses have been offered at least partly online. The future of online instruction in these courses is yet to be determined, but lab and field courses inevitably will return to a mostly in-person modality. At least some sections of the non-lab courses, however (and probably even some components of the lab/field courses) are likely to be offered as hybrid alternatives or fully online.

Table 1. Annotated list of Biology courses.

1. BIOLOGY 198. First Year Seminar. 3 Credits.
Topics vary. Reserved for New Incoming Freshman

2. BIOLOGY 200. Principles of Biology Discussion: Cellular and Molecular Processes. 1 Credit.
Discussion course supplementing BIOLOGY 201.Currently offered at the Manitowoc campus only.

3. BIOLOGY 201. Principles of Biology: Cellular and Molecular Processes. 3 Credits.
Core introductory Biology course focusing on cellular structure and function, metabolism, genetics, evolution, and development. Intended mainly for science majors. Prerequisites being reviewed by a Biology faculty subcommittee. Addition of discussion sections has been suggested by faculty to increase student success.

4. BIOLOGY 202. Principles of Biology Lab: Cellular and Molecular Processes. 1 Credit.
Lab course that complements BIOLOGY 201. Labs often taught by graduate teaching assistants.

5. BIOLOGY 203. Principles of Biology: Organisms, Ecology, and Evolution. 3 Credits.
Core introductory Biology course focusing on evolution and diversity of life, with focus on general biological principles, anatomy and physiology, and consideration of interactions from the cellular to organismal level. No prerequisites, so often taken to fulfill Gen Ed biological science requirement. Addition of discussion sections has been suggested by faculty to increase student success.

6. BIOLOGY 204. Principles of Biology Lab: Organisms, Ecology, and Evolution. 1 Credit.
Lab course that complements BIOLOGY 203. Labs often taught by graduate teaching assistants.

7. BIOLOGY 298. Independent Study. 1-4 Credits.
Faculty-mentored research for freshmen and sophomores with GPA ≥2.50 or others with GPA ≥2.00

8. BIOLOGY 299. Travel Course. 1-6 Credits.
Freshman/Sophomore credits for travel courses.

9. BIOLOGY 303. Genetics. 3 Credits.
Core upper level requirement for all areas of emphasis. A "bottleneck" course that often fills to capacity (45).

10. BIOLOGY 304. Genetics Laboratory. 1 Credit.
Lab complement to BIOLOGY 303. Can be taken separately; only offered in fall.

11. BIOLOGY 307. Cell Biology. 3 Credits.
Core upper level requirement for 5 of 8 areas of emphasis. (Upper level elective for most others.)

12. BIOLOGY 308. Cell Biology Laboratory. 1 Credit.
Lab complement to BIOLOGY 307.

13. BIOLOGY 309. Evolutionary Biology. 3 Credits.
Core upper level requirement for all areas of emphasis except Aquaculture. Potentially a bottleneck course.

14. BIOLOGY 310. Plant Biodiversity. 4 Credits.
Upper level elective. Important course for students in resource management career paths. Spring even years.

15. BIOLOGY 311. Plant Physiology. 4 Credits.
One of two choices for upper level physiology requirement. Fall only.

16. BIOLOGY 312. Mycology. 4 Credits.

Upper level elective for 5 areas of emphasis. Fall odd years.

17. BIOLOGY 317. Structure of Seed Plants. 3 Credits.
Has not been taught for many years. Could be removed from catalog.

18. BIOLOGY 320. Field Botany. 4 Credits.
Upper level elective. Important course for students resource management career paths. Fall even years.

19. BIOLOGY 322. Environmental Microbiology. 4 Credits.
One of two options for upper level requirement in 4 of 8 areas of emphasis. Spring.

20. BIOLOGY 323. Principles of Microbiology. 3 Credits.
One of two options for upper level requirement in 6 of 8 areas of emphasis. Taught every semester.

21. BIOLOGY 324. Principles of Microbiology Laboratory. 1 Credit.
Upper level requirement or option for 5 of 8 areas of emphasis. Some sections taught by graduate teaching assistants. A critical "bottleneck course." Multiple sections taught every semester.

22. BIOLOGY 340. Comparative Anatomy of Vertebrates. 4 Credits.
Upper level elective for 3 areas of emphasis. Fall only.

23. BIOLOGY 341. Ichthyology. 4 Credits.
Upper level requirement (one of two options in one case) for 2 areas of emphasis. Spring even years.

24. BIOLOGY 342. Ornithology. 4 Credits.
Upper level elective for 4 of 8 areas of emphasis. Field course, nearly always fills. Spring even years.

25. BIOLOGY 343. Mammalogy. 4 Credits.
Upper level elective for 3 of 8 areas of emphasis. Popular, high enrollment lecture course. Spring odd years.

26. BIOLOGY 345. Animal Behavior. 3 Credits.
Upper level elective for 4 of 8 areas of emphasis. Field course, nearly always fills. Spring even years.

27. BIOLOGY 346. Comparative Physiology. 3 Credits.
One of 2 choices for upper level physiology requirement. Often fills to capacity. A "bottleneck" course. Spring.

28. BIOLOGY 355. Entomology. 4 Credits.
Upper level elective for 3 of 8 areas of emphasis. Important course for field biologists. Fall odd years.

29. BIOLOGY 357. Marine Biology. 4 Credits.
Upper level elective for 3 of 8 areas of emphasis. Formerly Invertebrate Biology. Popular course for field biology students. Spring odd years.

30. BIOLOGY 361. Introduction to Aquaculture. 3 Credits.
New course added in 2020 as upper level requirement for the Aquaculture area of emphasis. Fall even years.

31. BIOLOGY 365. Aquatic Invertebrates. 3 Credits.
New course added in 2020. Upper level elective for Aquatic Ecology and Fisheries area of emphasis; should be upper level elective for Animal Biology and Ecology and Conservation areas of emphasis. Spring odd years.

32. BIOLOGY 370. Fisheries Research and Management. 3 Credits.
New course in 2020. Upper level elective (1 of 2 options) for Aquatic Ecology and Fisheries area of emphasis; could be upper level elective for Animal Biology and Ecology/Conservation areas of emphasis. Fall odd years.

33. BIOLOGY 375. Conservation Genetics. 3 Credits.
New course added in 2020 with Aquaculture and Aquatic Ecology and Fishes areas of emphasis. Not listed as an elective or requirement for either curriculum, however. This needs to be addressed. Could be appropriate elective for the Ecology and Conservation area of emphasis. Has not been offered yet. Spring even years.

34. BIOLOGY 401. Fish and Wildlife Population Dynamics. 4 Credits.
New course. Upper level elective (1 of 2 options) for Aquatic Ecology/Fisheries area of emphasis; could be upper level elective for Animal Biology and Ecology/Conservation areas of emphasis. Spring odd years.

35. BIOLOGY 402. Advanced Microbiology. 4 Credits.
Upper level requirement for Microbiology area of emphasis and upper level elective for 2 other areas of emphasis. Fall only.

36. BIOLOGY 407. Molecular Biology. 3 Credits.
Upper level elective for 2 areas of emphasis; upper level requirement for Cell/Molecular Biology area of emphasis. Spring odd years.

37. BIOLOGY 408. Molecular Biology Laboratory. 1 Credit.
Lab complement for BIOLOGY 407; Upper level elective for 3 of 8 areas of emphasis. Spring odd years.

38. BIOLOGY 410. Developmental Biology. 3 Credits.
Upper level elective for Animal Biology and Cell/Molecular areas of emphasis. Spring.

39. BIOLOGY 411. Developmental Biology Laboratory. 1 Credit.
Lab complement for BIOLOGY 410; Upper level elective for 3 of 8 areas of emphasis. Spring.

40. BIOLOGY 449. Wetland Ecology. 3 Credits.
Formerly graduate only. Now upper level elective for Animal Biology and Ecology/Conservation Biology areas of emphasis and upper level requirement for Aquatic Ecology/Fisheries area of emphasis. Spring.

41. BIOLOGY 450. Ecological Restoration. 3 Credits.
Recently established as permanent course; formerly special topics course. Should be added as an upper level elective for Ecology and Conservation Biology area of emphasis. Spring even years.

42. BIOLOGY 461. Advanced Aquaculture. 3 Credits.
Upper level requirement for Aquaculture area of emphasis. Spring odd years.

43. BIOLOGY 478. Honors in the Major. 3 Credits.
Independent research opportunity for exceptional students with min 3.50 GPA for courses in major and min GPA 3.75 for all required major courses. Fall and Spring.

44. BIOLOGY 490. Biology Seminar. 1 Credit.
Capstone experience; upper level requirement for all Biology majors. Fall and Spring.

45. BIOLOGY 495. Research in Biology. 1-5 Credits.
Research experience under guidance of faculty member.

46. BIOLOGY 497. Internship. 1-12 Credits.
Supervised practical experience with guidance from faculty member. Available for students with at least junior standing. Fall and Spring.

47. BIOLOGY 498. Independent Study. 1-4 Credits.
Independent study project for freshmen/sophomores with GPA ≥ 2.50; or junior/senior with GPA ≥ 2.00.

48. BIOLOGY 499. Travel Course. 1-6 Credits. Faculty led travel course offered periodically.

Table 2. Distribution of Biology courses among 8 areas of emphasis. Supporting courses from other programs are also included.

Course #	Animal Biology	Aquaculture	Aquatic Ecol. Fisheries	Biology for Educators	Cell Molecular Biology	Ecology and Conservation	Microbiology	Pre-veterinary
CHEM 211/213	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
CHEM 212/214	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
CHEM 207	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
MATH 260	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
MATH/GIS	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
Writing Options	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
CHEM 300/301		UpperReq.			*UpperReq.*			
CHEM 302/204					*UpperReq.*			
BIOLOGY 198								
BIOLOGY 200								
BIOLOGY 201	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
BIOLOGY 202	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
BIOLOGY 203	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
BIOLOGY 204	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting	Supporting
BIOLOGY 298								
BIOLOGY 299								
BIOLOGY 303	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.
BIOLOGY 304	UpperElect.			*UpperElect.*	*UpperElect.*			*UpperElect.*
BIOLOGY 307	*UpperReq.*	*UpperElect.*		*UpperReq.*	UpperReq.	*UpperReq.*	*UpperElect.*	*UpperReq.*
BIOLOGY 308	*UpperReq.*	*UpperElect.*		*UpperReq.*	UpperReq.	*UpperReq.*	*UpperElect.*	*UpperReq.*
BIOLOGY 309	UpperReq.	*UpperElect.*	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.
BIOLOGY 310	UpperElect.					*UpperElect.*		
BIOLOGY 311	*UpperReq.*			*UpperReq.*	*UpperReq.*	*UpperReq.*	*UpperReq.*	
BIOLOGY 312				*UpperElect.*	*UpperElect.*	*UpperElect.*	*UpperElect.*	
BIOLOGY 317								
BIOLOGY 320	UpperElect.					*UpperElect.*		
BIOLOGY 322	*UpperReq.*	*UpperElect.*	UpperReq.		*UpperElect.*	*UpperReq.*	*UpperReq.*	
BIOLOGY 323	*UpperReq.*	*UpperElect.*		*UpperReq.*	UpperReq.	*UpperReq.*	*UpperReq.*	*UpperReq.*
BIOLOGY 324	*UpperElect.*	*UpperElect.*		*UpperReq.*	UpperReq.	*UpperReq.*	*UpperReq.*	*UpperReq.*
BIOLOGY 340	*UpperElect.*			*UpperElect.*				*UpperElect.*
BIOLOGY 341	*UpperElect.*	UpperReq.	*UpperReq..*					
BIOLOGY 342	*UpperElect.*			*UpperElect.*		*UpperElect.*		*UpperElect.*
BIOLOGY 343	*UpperElect.*			*UpperElect.*		*UpperElect.*		*UpperElect.*
BIOLOGY 345	*UpperElect.*			*UpperElect.*				*UpperElect.*
BIOLOGY 346	*UpperReq.*	*UpperElect.*	UpperReq.	*UpperReq.*	*UpperReq.*	*UpperReq.*	*UpperReq.*	UpperReq.
BIOLOGY 355	*UpperElect.*			*UpperElect.*		*UpperElect.*		
BIOLOGY 357	*UpperElect.*			*UpperElect.*		*UpperElect.*		
BIOLOGY 360		UpperReq.	UpperReq.					
BIOLOGY 361		UpperReq.						
BIOLOGY 365			*UpperElect.*					
BIOLOGY 370			*UpperElect.*					
BIOLOGY 375								
BIOLOGY 401	*UpperElect.*		*UpperElect.*			*UpperElect.*		
BIOLOGY 402				*UpperElect.*	*UpperElect.*		UpperReq.	
BIOLOGY 407				*UpperElect.*	UpperReq.		*UpperElect.*	
BIOLOGY 408				*UpperElect.*	*UpperElect.*		*UpperElect.*	
BIOLOGY 410	*UpperElect.*				*UpperElect.*			
BIOLOGY 411	*UpperElect.*				*UpperElect.*			*UpperElect.*
BIOLOGY 449	*UpperElect.*		UpperReq.			*UpperElect.*		
BIOLOGY 450								
BIOLOGY 461		UpperReq.						
BIOLOGY 478								
BIOLOGY 490	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	
BIOLOGY 495								
BIOLOGY 497							*UpperElect.*	
BIOLOGY 498								
BIOLOGY 499								
ENV SCI 302	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.	UpperReq.
ENV SCI 337	*UpperElect.*					*UpperElect.*		
ENV SCI 401	*UpperElect.*					*UpperElect.*		
ENV SCI 403	*UpperElect.*					*UpperElect.*		
ENV SCI 467				*UpperElect.*		*UpperElect.*		
ENV SCI 469				*UpperElect.*		UpperReq.		
ENV SCI 499				*UpperElect.*		*UpperElect.*		
CHEM 302/304							*UpperReq.*	UpperReq.
CHEM 303/305							*UpperReq.*	UpperReq.
CHEM 330				*UpperElect.*	*UpperElect.*		*UpperReq.*	UpperReq.
CHEM 331				*UpperElect.*	*UpperElect.*		*UpperReq.*	
HUM BIOL 402	*UpperElect.*							
HUM BIOL 403	*UpperElect.*							
HUM BIOL 413	*UpperElect.*							
HUM BIOL 422	*UpperElect.*			*UpperElect.*	*UpperElect.*		*UpperElect.*	*UpperElect.*
HUM BIOL 423	*UpperElect.*			*UpperElect.*	*UpperElect.*		*UpperElect.*	*UpperElect.*
HUM BIOL 444	*UpperElect.*			*UpperElect.*	*UpperElect.*			
HUM BIOL 449	*UpperElect.*							
PHYSICS 103/104								*UpperReq.*
PHYSICS 201/202								*UpperReq.*
Supporting	25-29	25-29	25-29	25-29	26-29	25-29	26-29	26-29
Upper Required	17-18	30	30	17-18	24-25	21-22	28-29	39
Upper Elective	12-14	6	6	12-14	9	8	8	8
Biology Seminar	1	1	1	1	1	1	1	1
Total	**55-61**	**62-65**	**62-65**	**55-61**	**59-64**	**55-60**	**62-67**	**74-77**

5. **Diversity of students, faculty, and curriculum (Overall number provided in materials. Chairs: short commentary if appropriate; provide examples from curriculum if appropriate.)**

Ethnic diversity in the Biology Program is embarrassingly low. Currently (2020-21) the percentage of non-white students in the major is only 15.45%, a modest increase from 11-13% between 2013-2017. The faculty is entirely white (12 men, 9 women). We need to do better in both hiring faculty and recruiting students from non-white populations.

6. **Gen Ed, FYS/GPS, CCIHS (Lists)**

Introductory Biology courses (BIOLOGY 201 and 203) fulfill the UW-Green Bay general education requirement in the biological sciences. No Biology courses are listed as First Year Seminars, although Biology faculty such as Dr. Karen Stahlheber have taught FYS sections through the Environmental Science program. The most recent offering, entitled "Tending Nature: Restoring Ecosystems in an Era of Change" is focused on activities at UW-Green Bay natural areas managed by the Cofrin Center for Biodiversity. Currently, no College Credit in High School course is administered by the UW-Green Bay Biology program. Given the development of online lectures by virtually all faculty, however, future opportunities for collaborating with high school teachers should be considered. For example, recorded lectures by UW-Green Bay faculty in Biology 201 or 203 might be augmented by discussion sections led by high school teachers. Likewise, online introductory materials might enable high school instructors to teach laboratory classes that would fulfill the lab sections of our introductory courses (BIOLOGY 202 and 204).

7. **Program support and staffing (Chairs: History, trends, and future needs. Depending on program, could be connected to accreditation.)**

The Biology Program is led by 21 PhD-level faculty: 5 Full Professors, 6 Associate Professors, 5 Assistant Professors, and 5 Lecturers or project-funded research scientists. Two laboratory technicians, 2 academic staff in the Cofrin Center for Biodiversity, and numerous graduate assistants also contribute significantly to the program. Professor Mathew Dornbush, Dean of the Cofrin School of Business, is a member of the Biology Faculty but is not currently teaching courses in the Biology Program. Because the Biology Program is not a budgetary unit, all faculty are members of either the Department of Natural and Applied Sciences or Department of Human Biology. The number of staff grew significantly in 2019 with the addition of 6 faculty members from the Marinette, Manitowoc, and Sheboygan campuses. Transition of these faculty into the Biology Program has gone remarkably smoothly. Currently we are working to fully integrate the curriculum and course offerings among the 4 campuses. I believe that significant potential exists for expanding the Biology Program as a result of the merger. Despite this potential, however, expanding the number of Biology majors will require strategic new hires or reassignments to

Table 3. Current faculty members in the UW-Green Bay Biology Department.

Faculty member	Rank	Area
Rebecca Abler	Professor	Microbiology, Water Quality
Michael Draney	Professor	Field Biology, Invertebrate Systematics/Ecology
Richard Hein	Professor	Physiology, Aquatic/Marine Ecology
Robert Howe	Professor (Chair)	Vertebrate Ecology, Population Dynamics
Amy Wolf	Professor	Field Ecology, Conservation Biology
Patrick Forsythe	Associate Professor*	Field Biology, Fisheries Population Biology
Lisa Grubisha	Associate Professor	Microbiology, Mycology, Population Genetics
James Marker	Associate Professor	Human Physiology, Exercise Science
Daniel Meinhardt	Associate Professor	Field Biology, Evolutionary Biology
Brian Merkel	Associate Professor	Microbiology, Toxicology
Uwe Pott	Associate Professor	Genetics, Oncology
Carly Kibbe	Assistant Professor	Cell Biology, Endocrinology, Reproductive Biology
Paul Mueller	Assistant Professor	Cell/Molecular Biology, Developmental Biology
Renee Richer	Assistant Professor*	Plant Biology, Desert Ecology, Cyanobacteria
Karen Stahlheber	Assistant Professor*	Plant Community Ecology, Plant Physiology
Keir Wefferling	Assistant Professor	Field Botany, Plant Evolution/Biogeography
Stephanie Evenson	Senior Lecturer	Veterinary Science, Microbiology, Physiology
Christopher Houghton	Assistant Scientist	Fish Ecology, GIS, Aquatic Ecology
Tracy Smith Leiker	Senior Lecturer	Developmental Biology
Jessica Warwick	Lecturer	Invertebrate Ecology, Stream Ecology
Kenneth Webb	Associate Researcher	Aquaculture, Animal Physiology

* Under consideration for promotion during 2020-21

8. Cost per credit hour (TBD)

External

1. Outreach: student/faculty partnerships, collaborations, participation with organizations or individually (Lists)

A complete list of outreach activities and partnerships is too long for this review. Below is a sample of outreach activities led by Biology faculty.

- Michael Draney is a regular contributor to Wisconsin Public Radio programs on topics involving insects, spiders, and conservation. During the past 5 years he has made 65 media appearances and participated in approximately 70 outreach activities since 2015.
- Rebecca Abler and Richard Hein at the Manitowoc campus are engaged in active partnerships with the Lakeshore Natural Resource Partnership, Friends of Hika Bay, Manitowoc County Lakes Association, Wisconsin Sea Grant, and Southeastern WI Watershed Trust (Sweet Water).
- Carly Kibbe is working with local educators on the Serious About STEM "SAS" Program (Fall 2018 – present), which provides high school girls with female mentors in STEM fields.
- Amy Wolf gives many community presentations on native bees and pollinators and works with Wisconsin DNR biologists on bee conservation in the state. She also helps

lead a Green Bay pollinator conservation committee tasked with promoting pollinator-friendly landscaping in the city.

- Daniel Meinhardt leads a variety of outreach activities through his role as Curator of the Richter Museum of Natural History, including host for Lawton Gallery art exhibit entitled "Museum of Natural Inspiration; support for art summer camps; and numerous visits to the museum by school groups and community groups like the Brown County Federation of History Organizations.
- Uwe Pott and others serve as question writers and judges for the Green Bay Academic Competition for local high schools.
- Renee Richer has recently given many presentations in Wisconsin and Qatar on topics ranging from sustainable development to water quality to multiculturalism.
- Patrick Forsythe and Kenneth Webb have led a sustainable food initiative centered on aquaculture at "The Farmory" in Green Bay. Like others, Forsythe and Webb have given numerous public presentations on fisheries and freshwater ecosystems.
- Karen Stahlheber, Lisa Grubisha, and Amy Wolf (with others) lead an annual heirloom plant sale for the Green Bay community, a project that raised awareness about plant genetic diversity and raises funds for graduate research activities. With Stahlheber and Grubisha also lead a "Girl Scout Water Badge Day" aimed at helping Girl Scouts learn about aquaponics and gardening.
- Robert Howe and staff of the Cofrin Center for Biodiversity have recently worked with other government agencies, the Northeast Wisconsin Land Trust, and the Town of Scott to acquire a new natural area along Wequiock Creek in Brown County, Wisconsin. The CCB also manages hunting programs and recreational opportunities for thousands of visitors to UW-Green Bay natural areas.

Virtually all Biology faculty contribute meaningfully to science learning and the application of science in northeast Wisconsin and elsewhere, in some cases internationally. Our faculty are engaged in many community science projects that contribute to conservation, the arts and humanities, K-12 education, public recreation, and other valuable community resources.

2. Contributions to regional infrastructure (Lists)

Local, regional, and state (and in some cases federal) agencies benefit from applied scientific research and expertise from UW-Green Bay Biology faculty and staff. Again, the list of contributions (below) is not complete, but it demonstrates the breadth of activities during a typical year.

- Patrick Forsythe, Chris Houghton, and students led fisheries research on northern pike, lake sturgeon, and other species with biologists from the Wisconsin DNR and US Fish and Wildlife Service. Results help guide fisheries policies and habitat restoration in the Lower Green Bay and Fox River ecosystem.
- Amy Wolf, Robert Howe, and Erin Giese (CCB Senior Research Specialist) led a strategic assessment of fish and wildlife resources in the Lower Green Bay and Fox River Area of Concern (AOC) from 2015-2020. Results will be used by the US Environmental Protection Agency and Wisconsin DNR to restore fish and wildlife populations and

habitats in the AOC during the next decade. Wolf, Howe, Giese, and others also have been involved with planning for maintenance of the Cat Island Restoration Project in lower Green Bay, one of the biggest environmental restoration projects in the Laurentian (North American) Great Lakes.

- UW-Green Bay Biology faculty have been major contributors to watershed planning and conservation in northeast Wisconsin. Rebecca Abler and Richard Hein are members of the Northeast Lakeshore Total Maximum Daily Load Technical Team (2017-present) consisting of WDNR staff, county and municipality governments, Wisconsin Forage Council, UW Cooperative Extension, citizen lakes associations, Lakeshore Natural Resource Partnership, and Discovery Farms. We provide input on water quality monitoring (including data reports), and logistical planning. The goal of this team is to establish a EPA 9 Key Element plan and a TMDL plan for the Lakeshore watershed region (Kewaunee, Calumet, Manitowoc, Sheboygan counties).
- Draney serves as a local expert in insect and spider identification for northeastern Wisconsin and (for spiders) the entire state. Since 2015 he has made 837 consultations or species identifications for agencies, businesses, and the general public.
- Wolf and Howe are leaders of biodiversity research in northern Wisconsin. They oversee studies at the Wabikon Forest Dynamics Plot in the Chequamegon-Nicolet National Forest, one of 72 standardized research plots in 27 countries as part of the Smithsonian Institution's ForestGEO Program.
- Lisa Grubisha, Howe, and Bobbie Webster (CCB Natural Areas Ecologist) completed a study and local mapping of treatment history of the invasive grass, Phragmites australis in lower Green Bay with funding from the WDNR Aquatic Invasive Species program.
- Wolf, Webster, Howe, NAS academic staff Paul Baumgart, Julia Noordyk of UW Sea Grant, and students collaborated on monitoring and assessment of the "Green Bay East Shore Watersheds", which include Wequiock Creek and Mahon Creek. As a result of this work, a draft EPA 9 Key Element plan and accompanying Habitat Restoration plan were completed in late 2020.
- Several Biology faculty are leaders in their respective professional organizations. For example, Grubisha was program chair for the 2020 annual meeting of the Mycological Society of America and Draney (along with Vicki Medland) hosted the annual meeting of the American Arachnological Society at UW-Green Bay in 2012. In 2021, Erin Giese (Senior Research Scientist if the CCB) was on the steering committee for the 2019 annual meeting and will be a new member of the Board of Directors for the National Audubon Society.
- Biology faculty, staff, and students are leaders in the Great Lakes Coastal Wetland Monitoring Program, a multi-million dollar EPA-sponsored monitoring program covering all of the Great Lakes. Fourteen other universities and agencies in the U.S. and Canada are collaborators on this project.

3. Scholarly activity of faculty (Lists that are not all-inclusive; maybe seek to highlight the different areas/types of activity)

The Biology faculty includes accomplished scholars with international reputations and collaborations. Their publications have appeared many of the world's most prestigious academic

journals including Science, Nature, Ecology, Molecular Ecology, Conservation Biology, Journal of Great Lakes Research, American Journal of Botany, Frontiers in Genetics, Global Ecology and Biogeography, Journal of Biological Chemistry, Nature Ecology and Evolution, Systematic Botany, PLOS One, and others. Examples of publications (and citations) can be seen in Google Scholar profiles for senior faculty such as Howe, Wolf, Draney, Forsythe, and Grubisha, as well as younger scholars such as Stahlheber, Kibbe, Richer, and Wefferling. Since 2015, Biology faculty have collectively authored or co-authored about 20 peer-reviewed articles each year. Biology faculty members collectively receive hundreds of thousands of dollars in external research grants every year, making this program one the most (if not the most) productive programs at UW-Green Bay. During 2020 alone, for example, Biology faculty were awarded more than $530,000 in external funding through 17 grant projects. This total dollar amount excludes funds that extend to other years (i.e., a 2 year award was split, with only ½ the amount included in the 2020 total) and it does not include more than $235,000 in annual gifts to the Cofrin Center for Biodiversity from private foundations.

Student Success

1. **High-impact practices and individualized-learning opportunities (Some data provided; lists and/or brief narrative)**

The Biology faculty's many research activities and engagement in grant-funded science initiatives all provide opportunities for high-impact student experiences. In almost every example described above, students have been part of the research, often as paid assistants or even as co-authors of publications and presentations. Several opportunities for funding undergraduate research are available for Biology students, including Cofrin Student Research Assistantships (about $10,000 awarded annually) and several biology-related awards through the NAS scholarship program. The annual Cofrin Student Research Symposium and Academic Excellence Symposium provide opportunities for students to present their independent research publicly. Biology faculty also work with students to present their findings at professional meetings at the regional, state, and national or international scale. Since 2015, for example, 29 students at the UW-Manitowoc campus alone have presented papers at professional meetings or symposia under the guidance of Hein and Abler. The CCB, along with Biology faculty collaborators, hires 25-40 students every year to work on various projects and activities, including collections management (Meinhardt, Wefferling), ecological restoration (Wolf, Stahlheber), natural areas management (Webster), biological monitoring (Howe, Wolf, Giese), and other field research. Aquatic biology research projects led by Forsythe, Houghton, and Webb employ an equivalent number of students for studies in Green Bay and the Fox River. Molecular biology labs developed by Kibbe, Grubisha, Pott, Mueller, Wefferling, and others are growing and provide high impact extracurricular opportunities for students in laboratory sub-disciplines. Biology faculty also lead an annual January trip to Panama to field stations of the Smithsonian Tropical Research Institute. Hein offers and annual trip to the Marine Lab in Key Largo, Florida, to study the biology of the Florida Keys. Occasional international trips to other countries also have been organized by Biology faculty during the past decade.

2. **Retention (TBD. Note: if program-level data is not provided, maybe list some things your program does that you believe aid in retention.)**

The initiative by Stahlheber, Kibbe, Draney, Mueller, and Pott (funded by CSET one-time funds) to improve success of students in the introductory biology series (Biology 201/202 and 203/204) has been a major step in improving retention of students at the critical first stage of the Biology Program curriculum. The most effective investments to retain biology students at subsequent stages are linked to high impact experiences in laboratories and independent research projects. The most positive comments on course evaluations often are related to lab or field experiences, so by making these experiences better, we are essentially improving retention of students in the Biology program. A corollary to this idea is the assertion that more students will be retained in the program if quality high impact experiences can be offered earlier in the curriculum. This is a challenge that we should address in the future. Currently, many students do not enroll in high impact lab courses (other than the introductory labs) until their junior year. Some of this delay is due to limited course capacity, a problem that should be addressed. Another mechanism for building enthusiasm in the Biology and related science programs would be to develop a new high impact lab or field experience specifically for freshman or sophomores (e.g., a one-time field trip to ecologically and economically significant areas in lower Green Bay and Lake Michigan). Recruitment and retention will be critical for UWGB's future. The Biology Program can be a key to succeeding in both areas.

Mission Relevant

1. **Relevance to mission (Narrative or lists as appropriate)**

The Biology Program helps fulfill many elements of the UW-Green Bay Select and Core Mission statements. The heavy emphasis on lab courses clearly makes the Biology Program "problem focused." Like the UW-Green Bay Select Mission, the program helps promote "environmental sustainability" through several of the areas of emphasis as well as extracurricular programs like the Cofrin Center for Biodiversity. The Pre-Veterinary and laboratory-based areas of emphasis (Cell/Molecular Biology, Microbiology) help train students for "specialized professional/technical degrees," a goal mentioned in the Core Mission. The strong faculty research record and many collaborations with community agencies and organizations also fulfills specific elements of the mission statement (""community-based partnerships" and "collaborative faculty scholarship and innovation."

2. **Cultural enrichment (Narrative or lists as appropriate)**

Cofrin Center for Biodiversity staff are currently working with the UW-Green Bay First Nations Program and tribal leaders on a project (at the new Wequiock Creek Natural Area) to incorporate cultural values and education into natural areas management. This can be expanded to other areas. Cultural enrichment is already part of several resource management courses (Field Botany, Weltand Ecology, Ecological Restoration, etc.), and we should commit to increasing cultural awareness further in these and other courses.

3. **Access (Does the program have any agreements with other institutions? For example, a transfer agreement with a technical college.)**

We have a specific course transfer agreement with Northeast Wisconsin Technical College. Generic course transfer lists also are in place for other institutions where standard introductory courses like BIOLOGY 201/203 and core upper level supporting courses like BIOLOGY 303, 307, 309, etc. have widely used names such as Principles of Biology, Genetic, Evolutionary Biology, Comparative Anatomy, etc. The most challenging transfer issue involves earned credits for widely offered introductory or lab courses. Some institutions have introductory biology courses with only 3 credits and no lab, for example. Separation of lab sections from the main lecture component has helped eliminate some of the transfer issues, but we can improve the articulation of transfer credit policies. In my opinion, erring on the side of the student, even if this means accepting fewer credits for introductory and core courses, is a desirable policy, since these students will then end up taking more upper level courses, where general principles are taught again but in a more focused context.