

Self-Study Undergraduate Major in Biology 2010-2011

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I. Executive Summary

1) Goals and History - The non-departmental, inter-college Biology Major began in 1999 to provide students in CALS and L&S with a broad, interdisciplinary and rigorous major in the biological sciences that utilized the multitude of curricular choices available on campus. The Major is also home to two Options, one in Neurobiology and the other in Evolution, for students with more specialized interests.

2) Demographics- The Major has been hugely successful, growing to become the second-largest major on campus. On average, students perform well in the Biology Major, and finish their degrees in a timely fashion.

3) Assessment- The Biology Major has used a variety of assessment tools to measure our students' satisfaction with aspects of the Major's curriculum and advising. Most students are satisfied that the Biology Major's curriculum helps them meet their goals. There is less (although still substantial) satisfaction with advising in the Major. The Major is developing a new tool to allow more rigorous, quantifiable assessments of the Major's goals.

4) Administration- The Biology Major is governed by an Executive Committee, co-chaired by faculty from CALS and L&S. The Major's administrative and advising staff is hired by, and housed within, ICBE; the staff also serves the Molecular Biology and BAC Majors. With a few exceptions, this arrangement has worked well. Current concerns include a) the mechanism for electing the Co-Chairs; b) the compensation for Co-Chairs, which may be lapsing, and 3) the lack of a formal administrative structure governing the relationship between the Executive Committee, the Biology Major staff, and ICBE.

5) Curriculum- The curriculum of the Biology Major provides a strong background in science, a breadth of exposure to biological sciences, and "hands-on" experiences for students with lab courses and faculty-mentored research. The faculty-mentored research has proved to be particularly valuable and popular. The Major has no physical or monetary resources for curricular changes, but controls quality through the review of courses, and has been strongly engaged with campus-wide discussions of curricular innovation.

6) Advising- Advising in the Biology Major is performed by faculty advisors, staff advisors, and a CALS Peer Advising Program. The explosive growth in the number of students enrolled by the major has not been matched by similar increases in the number of advisors. This has placed a great deal of strain on the advising system, and caused the temporary abeyance of the CALS Peer Advising Program. This strain likely accounts for the lower quality of advising reported by some students. We propose formalizing the method of recruiting faculty advisors, changing the roles of faculty vs. staff advising, and submitting proposals to increase the number of staff advisors.

7) Community- Although its students are largely satisfied with the Biology Major, the inter-college, non-departmental nature of the Biology Major, as well as its large size, make it difficult to provide a unified community for its students. We have been more successful building community in the smaller Neurobiology and Evolutionary Options, and the approaches used by the Options may provide models for future community building within the Major. The Major is also hurt by its lack of physical and monetary resources. The Major has no mechanism for fund-raising; this needs to be rectified.

II. History and Goals of the Major

“The Biology Major is designed for students who are interested in a broad exposure to the concepts and methodologies of the biological sciences, as well as those interested in a more specific sub-discipline. The focus of the student’s program is determined by the student with a biology advisor of the student’s choosing. This major is appropriate for students interested in post-graduate careers in any biological science or health profession. It is also appropriate for students who think that a good knowledge of biology and the scientific process will help them in a non-biological career.”- The Biology Major Web Page (http://www.biology.wisc.edu/Academic_Programs/Biology/).

The Biology Major was initiated in 1999 to provide a major for undergraduates with broad interests in the biological sciences, and was intended especially to: 1) prepare undergraduates for graduate studies in diverse areas of biology; 2) prepare certain pre-professional students (e.g. medicine, veterinary medicine, dentistry) for advanced study in the health professions; and, 3) provide a broad exposure to biology for students who want a general science education as biologists.

Prior to creation of the Biology Major, the campus lacked a broad, interdisciplinary biology major that was similar to those found at most liberal arts colleges and many other large public universities. Instead, students with interests in the biological sciences had to pick one of the many specialized departmental biological majors found on the UW campus. It was felt that students were often confused by the absence of a broad biology major, and by the choice between so many specialized options. This confusion may have discouraged students from choosing a major until late in their undergraduate careers, in turn delaying the students’ access to advising in the biosciences. Moreover, the sometimes restricted course requirements of the specialized majors made it more difficult for students to access the huge variety of biological coursework available on the UW campus, while still completing the coursework for their major. The need for a major in biology was identified in the [1991 report of the Biological Sciences Review Committee](#) (chaired by John Hearn) and the report of the Undergraduate Biology Education Committee entitled ["Issues and Recommendations for Undergraduate Instruction in the Biological Sciences at UW-Madison"](#), issued in 1995.

The Biology Major provides a broad, interdisciplinary biology education for undergraduates in both the College of Letters and Science (L&S) and the College of Agricultural and Life Sciences (CALS), which contain the great majority of biology

students on campus. Since the Major cuts across both college and departmental boundaries, it was modeled on the non-departmental, cross-college Molecular Biology Major, with some of its curricular requirements based on the School of Education's Biology Education major. The Biology Major, the Molecular Biology Major and the major in Biological Aspects of Conservation (BAC) have provided pioneering models for future cross-college, non-departmental majors at the UW.

The requirements of the Biology Major were designed to provide 1) a rigorous background in mathematics and the sciences relevant to biology; 2) access to any of three introductory biology programs; 3) a small set of "foundational" courses that provide a core of biochemical and genetic information; 4) a broad spectrum of upper level biology courses that allow specialization, while still requiring exposure to a wide range of biological disciplines; 5) exposure to laboratory or field and, for most students, high-impact independent research or Capstone experiences. The Biology Major has also become home for two more specialized options within the Major, one in Neurobiology and the other in Evolution (see below). Each of these, while sharing the general outlines of the Biology Major, substitute their own specific coursework requirements.

The Biology Major is administered by an Executive Committee that is co-chaired by faculty from L&S and CALS. Students are advised both by faculty volunteers from throughout the campus and by academic staff. The Major and its staff were originally funded by L&S and CALS, and housed within the Botany Department. When the Institute for Cross-college Biology Education (ICBE) was founded in 2003-04, the funding, staff and housing of the Major was moved to ICBE.

Neurobiology Option- The Neurobiology Option was proposed in 2001 and initiated in 2001-02. At the time the University had no specific department or major dedicated to neuroscience. Nonetheless, over 100 faculty members from 25 different departments were affiliated with the Center for Neuroscience, which helped administer a very strong Neuroscience Training Program for graduate students. Moreover, undergraduate interest in the neurosciences had been growing, leading to the restructuring of old undergraduate courses and the development of new ones in several departments. The Neurobiology Option supported the broad goals of the Biology Major, but sought in addition to enhance the experience of students who are explicitly interested in neurobiology. This Option has allowed students to devote more of their course work to neurobiology courses, and ultimately encouraged a passion for neuroscience in the students. To this end the faculty has worked to develop a strong set of fundamental and intermediate/advanced courses that provide different approaches to the subject.

Evolution Option- In 2004, University faculty and students formed the *Evolution Initiative*, a community dedicated to advancing the discipline of evolution on campus. This led to the formation of the Evolution Coordinating Committee (ECC), an elected body composed of faculty, students, and staff. In 2007, the ECC proposed initiating an Evolution Option within the Biology Major; this was approved by the Biology Major Executive Committee and the University, and the first students started in the spring of 2008. The purpose of this Option is to enable undergraduate students to develop a solid

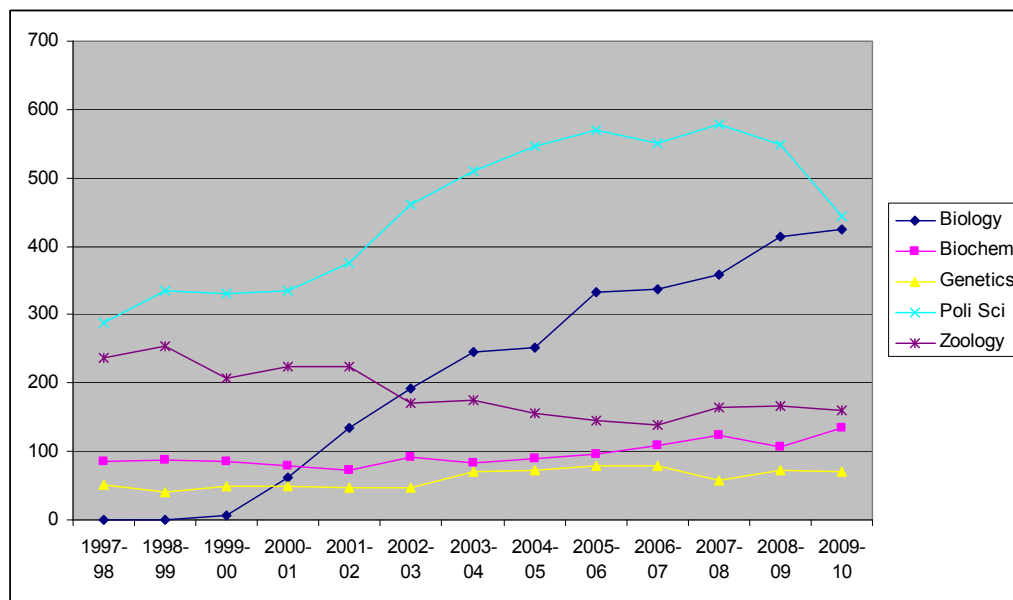
foundation in evolutionary biology and to aid them in identifying relevant courses. This Option is supervised by Biology Major Executive Committee and the ECC, the latter now part of the J.F. Crow Institute for the Study of Evolution, founded in 2010.

III. Demographics of the Major

Number of students- The Biology major has been hugely successful, growing over the last 12 years to finish second only to Political Science for the title as largest major on the campus. While in part this reflects the growth in undergraduate interest in the biological sciences, it also shows the strong desire amongst students for a broadly-based, interdisciplinary biological major. The number of declared Biology majors is now nearly double that in Nursing, and over double that in the other largest biological majors: Biochemistry, Genetics, Kinesiology or Zoology. **Figure 1** charts the number of degrees granted in selected majors, and **Figure 2** and **Appendix 1** charts the number of students declared in selected biological majors.

Of the 1,172 students who graduated with a Biology Major from 2007-08 through 2009-10, 68.8% were from L&S and 31.2% were from CALS. A higher proportion of CALS students have declared the Biology Major, but this is because few L&S freshmen and sophomores declare a degree (**Figure 2**). The proportion of CALS students in the Major appears to be increasing, likely in anticipation of the new 2011 CALS BS degree: 52.0% of declared Biology Majors were in CALS at the start of spring 2010-11, up from 40.3% in spring 2008-09 and 43.6% in spring 2009-10.

Figure 1. Number of undergraduate degrees granted in selected majors. Compiled from Stats_DegCntsbyDiversityandDegLvlwnAcadGroupFYandTerm.pdf



While the increase in the number of students in the Biology Major has to some extent been at the expense of other biological majors on campus, very few of the other majors

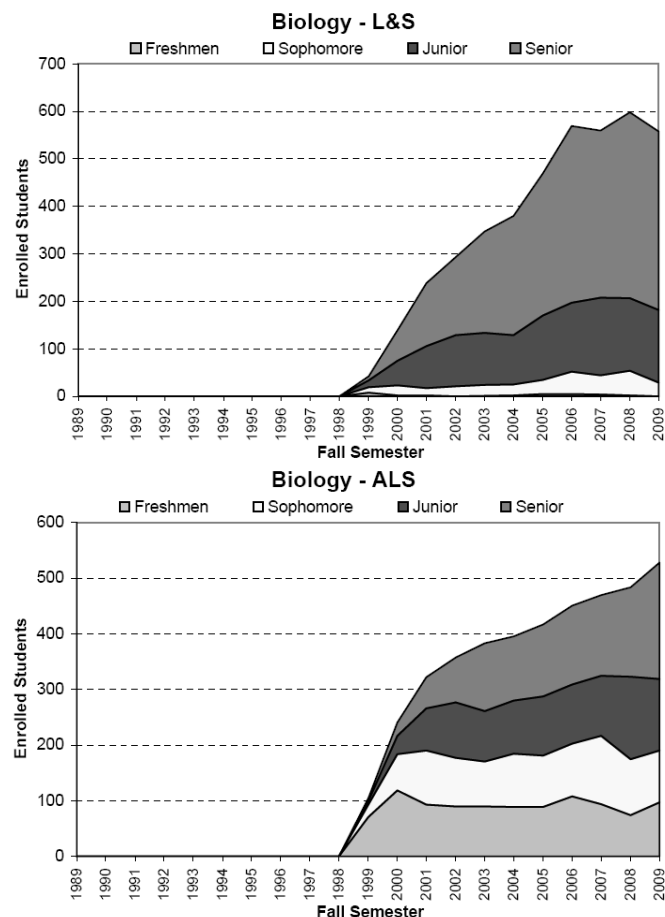
have been severely depleted. Some reductions were anticipated; for instance, Zoology, previously the most broadly-based animal biology major in L&S, had approximately 450 declared majors in 1999 when the Biology Major was introduced, and currently has approximately 300. Molecular Biology and a few others have also been reduced. The number of declared students and degrees granted in the Genetics and Biochemistry majors, however, has increased since 1999. Some of the Biology Major's growth may also be caused by the transformation of some pre-health undergraduate majors into graduate programs (e.g. Pharmacy, Physician Assistant), or the cancellation of the Clinical Laboratory Science Major.

The options have also proven popular. 186 students had declared for the Neurobiology Option at the end of fall 2010. This represents about 15% of the total number of Biology majors. While the number of students in the Evolution Option has been smaller, it had grown to 24 by the end of fall 2010. We expect enrollment in the Evolution Option to increase due to campus efforts at promoting evolutionary studies, such as the creation of the J.F. Crow Institute for the Study of Evolution, the Center of Rapid Evolution, and the Systems Biology group at the Wisconsin Institutes for Discovery.

When the Biology Major was originally conceived, it was thought that it might also (or even largely) provide a temporary "holding" major that would provide coursework and advising services for undecided students early in their careers, and that many students might then leave the Biology Major for more specialized majors before graduation. While we are still collecting data on this point, it is clear that many students have chosen instead to graduate with a Biology Major. In fact, there is a slight increase, rather than a decrease, in CALS students declared in the Major in their junior and senior years (**Figure 2**).

Gender and minority enrollment- 60.3% of the Biology Major's graduates from 2007-08 through 2009-10 have been women, comparing favorably with women's graduation rates from CALS (54.0%) and L&S (55.8%).

Figure 2. Number of students declaring the Biology Major in L&S and CALS. From <http://apa.wisc.edu/Charts%20of%20undergraduate%20majors.pdf>



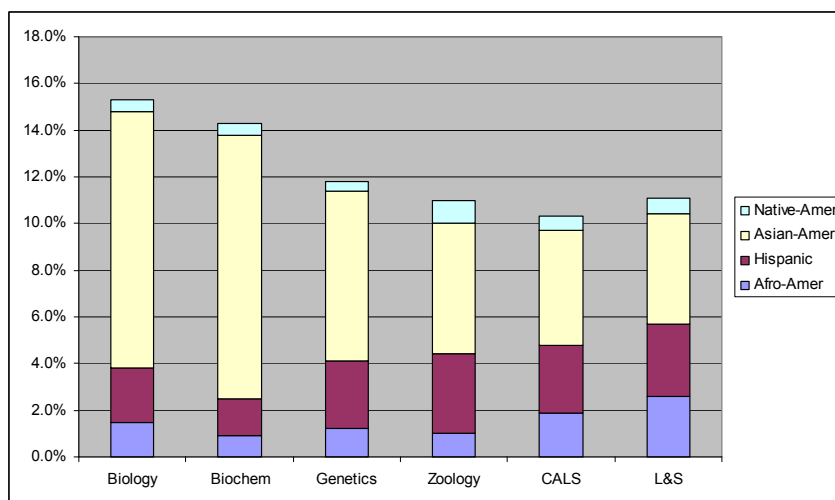
15.4% of the Biology Major's graduates over the same period have been minorities, again comparing favorably with these rates in CALS (10.7%) and L&S (11.0%). That said, as shown in **Figure 3**, African-Americans are under-represented (1.5%) in comparison to graduates from CALS (1.9%) and L&S (2.6%). Hispanics are also slightly under-represented. Similar trends are found in other large biology majors, such as Biochemistry, Genetics, and Zoology. To look at this another way, 2.7% of the currently enrolled students that have declared a Biology Major identified themselves as African-American, while over the last three years only 1.5% of those who graduated with a Biology Major identified themselves as African-American. This is a cause for concern, since it suggests that a disproportionate number of some minority groups are leaving the Major before graduation.

Performance of

students- Students in the Biology Major have performed well. The average GPA of all Biology Major graduates was 3.31 in courses taken for the Biology Major degree. This compares favorably with the average GPAs of all L&S (3.17) and CALS (3.10) students from fall 1999 through spring 2010. GPAs for targeted minorities

in the Biology Major average 0.3 lower. Students are also completing their degrees in an average of 4.1 years from 2005-06 through 2009-10, and 4.0 years in 2009-10 alone. This is slightly faster than the equivalent averages in all L&S majors (4.1 in 2005-06 through 2009-10; 4.1 in 2009-10) and in all CALS majors (4.2 in 2005-06 through 1009-10; 4.1 in 2009-10) (http://apa.wisc.edu/degrees_timetodeg.html). This indicates that there are no serious impediments to completing the Biology Major in a timely fashion.

Figure 3. Percentage of degrees granted to minorities, from 2007-08 through 2009-10. Compiled from Stats_DegCntsbyDiversityand DegLvlwnAcadGroupFYandTerm.pdf"



IV. Assessment of the Major

Beyond simple performance data, the Biology Major has provided a number of ways for our present and former students to “weigh-in” on their experience here at the university and in our major. First, in 2006-07 we administered, in conjunction with the Wisconsin Alumni association and the University of Wisconsin Survey Center, a survey to a random sample of 500 Biology Major Alumni. This survey assessed a wide range of topics,

including satisfaction with the major, satisfaction with advising, and how well various aspects of the Biology Major curriculum had prepared them for their post-graduate goals (**Appendix 2**). Second, we administer Exit Surveys every semester to our graduating seniors, asking questions about their satisfaction with the major, and how well they felt the major functioned in aspects ranging from course availability and advising to our methods of communication with students. Most answers in the Exit Survey are not quantitative, but scanning the open-ended answers gives us some sense of overall trends. Finally, we also use data from surveys conducted by other units on campus. The campus conducted a demographic and satisfaction survey as part of the University of Wisconsin-Madison 2008 Alumni Profile for the L&S portion of the Biology Major (**Appendix 3**), but the number of respondents was quite low (26), and the even lower number of respondents to the equivalent survey of the CALS portion of the Major prevented them from posting those scores. CALS conducted a survey in 2010 that was specifically directed towards advising in each CALS major (**Appendix 4**).

Our 2006 Survey of Alumni had a 53% response rate. 49.8% of respondents to this survey felt that their education at UW left them very well prepared, and 40.3% somewhat prepared, for their post-graduate goals; only a small minority felt that they were not too prepared (4.9%) or not at all prepared (1.5%). Similarly, 39.2% felt that the Biology Major left them very well prepared, and 40.8% somewhat prepared, for their current employment situation. Respondents were overwhelmingly satisfied with the breadth of knowledge (91.6%) and the breadth of experience (88.5%) provided by the Major. The vast majority of respondents felt that the Biology Major had done an excellent or good job helping them develop a number of skills and attributes, including critical thinking (52.3% excellent, 38.3% good) and a commitment to life-long learning (54.9 % excellent, 34.8% good). We will discuss detailed responses to advising and curriculum below in subsections of this report, but it is noteworthy that the majority of respondents felt that the strong emphasis that the Biology Major places on field and research experience provided them with an excellent basis for following their professional, post-graduate goals. These results are mirrored by the University of Wisconsin-Madison 2008 Alumni Profile, which graded responses from 5 (highly related) to 1 (not at all related). To the question “For your current position, how applicable is the skill set you developed at UW-Madison (verbal and written communication skills, problem solving skills etc.)”, the vast majority of Biology Major alumni responded 5 (50%) or 4 (35%).

The graduating seniors that have responded to our Exit Surveys since 2006 reported that, on average, the Biology Major prepared them well for their career goals (17% very well prepared, 58% well prepared in 2006, 15% very well prepared, 61% well prepared in 2007, 26% very well prepared, 47% well prepared in 2008, and 11% very well prepared, 55% well prepared in 2009). Additionally, the Exit Surveys indicate that these students were also satisfied, overall, with the biology major (14% highly satisfied, 53% satisfied in 2006, 7% highly satisfied, 58% satisfied in 2007, 16% highly satisfied, 50% satisfied in 2008, and 11% highly satisfied, 42% satisfied in 2009). Many of these students indicated that “flexibility” and “breath of the major” are strong points of the major. We will discuss the results of the 2010 CALS Advising Survey in the Advising section below.

We have some limited information about the careers of Biology Major graduates from the 2006 Survey of Alumni and from the smaller numbers in the University of Wisconsin-Madison 2008 Alumni Profile. 50.2% of the respondents to the Alumni Survey were taking some form of post-graduate education, similar to the 48% in the Alumni Profile. 55% of the Alumni Profile respondents reported earning over \$30,000 per year in 2008.

Future Assessments- In addition to continuing our Exit Surveys, we are currently preparing another method to assess the effectiveness of the Biology Major. We are using Qualtrics Survey Hosting Service to craft a document that would assess the student's satisfaction with the pedagogical philosophy of our major. We are crafting questions, based on our study of previous surveys; in particular, we wish to make the data we receive from graduates and current students in the program more accessible and useful. Therefore, we will be taking the open-ended answers that were provided on previous Exit Surveys, and turning them into questions to be answered on multi-point rating scale. With this survey data we will be able to provide a more quantifiable assessment tool to further examine our students' satisfaction rates, and their readiness for a professional life after the University of Wisconsin. We expect to have these surveys out to our alumni early on in the spring 2011 semester and have data compiled by the spring or summer of 2011.

V. Administration of the Major

The Biology Major Executive Committee- Since the Biology Major is not linked to any specific department, it is administered by an Executive Committee. As described in the Governance and Operating Procedures document (**Appendix 5**), the Executive Committee has nine members that are elected by and from faculty and academic staff advisors within the Major. The representatives for each of the options within the major, and the two current staff advisors for the major, are also voting, ex-officio members of the committee. The committee is co-chaired by faculty from CALS and L&S, elected by the committee from its current members.

The Executive Committee carries out the quasi-departmental functions associated with the Biology Major. These include periodic evaluation of curriculum requirements and courses, considering especially whether new courses might be included in the major and fulfill Capstone requirements for CALS. The committee also handles special cases, appeals and exceptions, and oversees the advising functions of the Major, including the duties of academic staff. In addition, the committee reviews assessments of the Major and plans new initiatives.

The Neurobiology Option and the Evolution Option each have their own administrative structure, but changes recommended by the representatives of each Option are approved by the Biology Major Executive Committee.

Neurobiology Option- With approval of the Center for Neuroscience, the Executive Committee appoints a Coordinator of the Neurobiology Option (currently Dr. Peter Lipton) who becomes a member of the Executive Committee. Up to the present time the Neurobiology Coordinator has had full responsibility for the proper functioning of the Option, including the recommendation of courses for inclusion within the option's curriculum. The Coordinator also collaborates with the Executive Committee, the staff of the Biology Major, and the Center for Neuroscience.

The Biology Major staff members advise students at SOAR, maintain and update the Web page, administer the Honors program, perform trouble shooting for individual students, take the responsibility for getting faculty advisors, and provide a conduit for interactions with the Executive Committee.

The Center for Neuroscience is housed in, and funded by, the School of Medicine and Public Health (SMPH); Jessica Karis administers a good deal of the program. The Center is responsible for running the Neurobiology 500 undergraduate seminar series, organizing the semester-by-semester course schedule, ensuring that each course is appropriately listed in the timetable (including Honors designations), and that appropriate classrooms are maintained. The Center also carries out a great deal of liaison work between the coordinator, the neuroscience faculty and the Neurobiology Option students. The continued support of Center staff by the SMPH has been invaluable for the administration of the Option.

Some funding has also occasionally been provided by the Center for social activities in the Option. Recently there has been generous support from ICBE for Neuro Nite, and also for an end-of-year gathering for graduating seniors, friends and family.

While this has worked well to date, Dr. Lipton feels that the Neurobiology Coordinator's tasks are getting too numerous to be handled by one person. He has suggested replacing the Coordinator with a three person Neurobiology Coordinating Committee (NCC). Members would serve for at least 3 years, and no more than one new person would join the committee each year. Dr. Lipton, with help from the Biology office and the Center for Neuroscience, is completing a list of the functions the NCC would take over. Dr. Lipton is willing to serve on the NCC for at least a year to make sure that people "learn the ropes".

The Evolution Option- The Evolution Coordinating Committee (ECC) is responsible for recommending courses for the Evolution Option, through a curricular subcommittee. The ECC is currently administered through the J.F Crow Institute for the Study of Evolution, and is elected by evolution faculty, staff and students. The ECC supplies a Coordinator of the Evolution Option (currently Dr. Carol Lee) who becomes a member of the Biology Major Executive Committee.

Problems with governance- In general, this governance structure has functioned very well, with three exceptions. First, the structure of the committee can make it difficult to find and elect Co-Chairs from CALS and L&S. Second, compensation for taking on the

Co-Chair position may be lapsing, which will reduce the incentive to Co-Chair the Major. Third, since the movement of the Major and its staff into ICBE, the formal relationship between ICBE, the staff (now employees of ICBE) and the Executive Committee has never been codified. We discuss each of these issues below.

1) Chair election- The CALS and L&S Co-Chairs of the Major must be elected from those members of the Executive Committee that are also faculty. Ideally, the Co-Chairs will be Committee members that have had some prior experience on the Committee. The pool of candidates, however, does not always make this possible. Since the Committee also has members from the SMPH and other units, like the School of Veterinary Medicine, and can include academic staff, the number of CALS or L&S faculty on the Committee can get quite low, and available candidates may not be able or willing to serve as Chair. In fact, beyond the stipulation that no college can contribute more than 5 members to the Committee, there is nothing in the election of Committee members that guarantees the presence of even a single CALS or L&S faculty member on the Committee. Finally, no member of the Committee can serve longer than six years without a three year hiatus. This has led to situations where Co-Chairs have had to serve past their allotted 6 year term, or new Co-Chairs with no prior experience have had to be recruited from outside the Committee.

Possible solutions include 1) constraining the results of elections so that some minimum number of CALS and L&S faculty are present on the Committee; 2) modifying the six-year limit; 3) increasing the number of elected members allowed to serve on the Committee; 4) allowing a single chair to take on the duties for both colleges.

2) Co-Chair Compensation- Both the CALS and L&S Co-Chairs of the Major have historically been compensated by ICBE with a half month's summer salary or its equivalent in research funds. However, ICBE funding has been reduced, and the Director of ICBE has indicated that this practice might not be continued using ICBE funds. This will greatly reduce the incentive to serve or continue serving as a Co-Chair, especially since the position has become more complex and has more demands placed on it than when originally conceived. The Co-Chairs currently receive no other compensation for their work, such as release from teaching obligations.

3) Relationship with staff and ICBE- a) Staffing History- When the Biology Major was initiated, funds for administrative and advising staff were provided by L&S and CALS; the funding was controlled by the Executive Committee, but run through Department of Botany in Birge Hall, where the staff was also housed. Funding was provided for a single full-time academic staff advisor and administrator. As the Major grew in size, this was supplemented by the addition of a student temp position (Sarah Kuba), and later Ms. Kuba was hired into a 100% academic staff position while Mary Smith took the other 100% academic staff position. These staff also performed administrative and advising duties for the Molecular Biology Major.

In 2004 the Institute for Cross-college Biology Education (ICBE) was formed, and as part of its duties it was given oversight of three non-departmental biology majors: the Biology

Major, the Molecular Biology Major, and the major in Biological Aspects of Conservation (BAC). The staff positions were moved from Botany to ICBE. The staff was housed with the rest of ICBE in the old Genetics Building, which provided an office which now became the center of advising for the major. This also led to some reassignment of duties, as the staff now also performed some administrative duties for ICBE that were not connected to the three Majors. Pat Henrikson, ICBE's general advisor for all biological science majors on campus, also performed staff advising duties for a limited number of Biology Major students, but for the most part these were students that were already seeing her before declaring the Major..

In 2009, Sarah Kuba left her position and Pat Henrikson retired. This led to another reassignment of duties. Mary Smith's non-Major administrative duties were moved so that she now could work purely for the Biology, Molecular Biology and BAC Majors. A single position, held by Will Lipske, was created with 40% committed to the advising duties for the three Majors that were formerly performed by Sarah Kuba; the remaining time for this position was committed to replacing the non-Majors work of Pat Henrikson (40%) and performing additional non-Major duties for ICBE (20%). The Director of ICBE tried to supply an additional staff person on a temporary basis each semester during course enrollment ("crunch" time for undergraduate advising), but the staff person's other ICBE duties have prevented this from happening. This in effect reduced the staff time committed to advising and administration in the Majors from 200% prior to incorporation into ICBE, to its current total of 140% (100% Mary Smith and 40% Will Lipske).

b) Administration of staff- Before ICBE was created, the staff budget was requested by, and controlled by, the Biology Major Executive Committee. When ICBE was created, the staff became employees of ICBE. Dr. Sharkey was both the head of ICBE and the L&S Co-Chair of the Biology Major Executive Committee, and while he regularly convened and consulted a Steering Committee for ICBE, the oversight of staff duties and performance and of budgets for the Majors was informal, and never codified.

When Dr. Sharkey left the University in 2007, the interim ICBE Directors Dr. Linda Graham and Dr. Gary Roberts proposed a governance structure (listed as Policies and Procedures on ICBE's website; http://www.biology.wisc.edu/Administrative_Information/p&p.asp) that included the Biology Major Co-Chairs serving as members of ICBE's Executive Committee and its Program Committee. This structure, however, was not adopted by the new ICBE Director Dr. Teri Balser, and these Committees were never formed. Thus, the Executive Committee of the Biology Major (and the Molecular Biology and BAC Majors) have been left with no formal structure for the supervision of the budgets or staff that it uses to run the Major.

While in general this informal arrangement has worked, there have been some issues that would be improved by a more formal relationship. First, the Executive Committee assigns duties to the staff, acting as their supervisor. This supervisory role, however, is not a part of the Committee's or ICBE's governance documents. ICBE is the staff's supervisor of record, even though the staff has Biology Major duties in their job descriptions; therefore, the staff is not certain who their "boss" is. The Executive

Committee plays no role in the performance evaluations of the staff; instead, this is performed by the Director of ICBE and her staff.

Second, the Committee has no formal control over staff hiring or its budget, and no regular meetings or reporting structure between the Biology Major Executive Committee and ICBE. This can lead to poor communication. For instance, when Sarah Kuba and Pat Henrikson left and proposals for new positions were considered, it was not clear whether the Committee or ICBE should be making the decisions about the number of positions needed, negotiating for the positions, writing the Position Vacancy Listings (PVLs), and assigning their duties. In the end these decisions were largely made by ICBE.

Recommendations: These problems would be improved by a formal governance structure that regulates the relationship between ICBE, the Biology Major, and the academic staff that serves the major. While this structure could take several different forms, it should include the Biology Major (as well as the BAC and Molecular Biology Majors) having: 1) formal oversight of the staff and participation in their evaluations; 2) participation in a decision-making process or body that controls budget and hiring decisions; 3) regular communication with the director of ICBE. It may prove helpful to have the staff advisors of the three majors funded through a separate budget line to ICBE.

VI. Curriculum and Requirements of the Major

The Biology major serves a diverse group of students with interests ranging from pre-health to ecosystem analysis. Modeled originally from courses offered in two existing curricula – the Molecular Biology major and the School of Education’s Biology program – the Biology Major is an excellent choice for those students seeking breadth in biology and an opportunity to explore different fields of study.

The Biology Major curriculum has several key features that distinguish it from many other campus majors in the biological sciences. First, its requirements in math, chemistry and physics are more stringent than in some other majors, and so provide rigorous training in sciences relevant to biology. Second, as part of its introductory biology requirements, the Major requires one of five “foundational” courses in modern genetics or biochemistry. Third, the Major’s intermediate/advanced coursework give students access to a huge variety of campus courses, all reviewed and selected by the Biology Major Executive Committee. Fourth, the Major requires that students take intermediate/advanced coursework from several different areas of biology; this model forces students to explore the myriad of approaches to understanding living organisms, while also allowing students the greatest possible flexibility within a structured framework. Thus, the Biology Major is able to translate the desired experience of any student into a specific degree path preparing them for nearly any career. Finally, the Major requires a strong emphasis on hands-on experiences in laboratory courses and faculty-mentored independent research and field experiences. The faculty-mentored

research project is one of the strongest and best-appreciated features of the Major, providing students with the experience of real scientific inquiry and techniques.

The Biology Major Executive Committee has also provided a forum for the discussion of curricular innovations within the Major, and on the campus as a whole. Present and former members of the Executive Committee are heavily involved with courses and committees that are reshaping the nature of biological science instruction on the campus. While the Executive Committee is non-departmental, and so has no physical or monetary resources to drive curricular innovation, the meeting of minds from different colleges and departments can be quite influential, especially in the context of the largest biological science major on campus.

As noted above, students have prospered in the curriculum developed by the Biology Major Executive Committee. The majority of students in the Biology Major program finish within four years, indicating that they are not encountering major obstacles preventing timely completion of their degree. Students in the Biology Major averaged a GPA of 3.305 in courses fulfilling the Major's requirements, with little difference (about 0.1 grade points) between students in CALS and L&S. The GPAs of targeted minority groups averaged approximately 0.3 grade points below this.

In what follows, we go through each category of requirements in the Major, and discuss aspects of each, including the specifics of the Neurobiology and Evolution Options. For an outline of the Major's curriculum, as well as the curricular of the Options, see **Appendices 6, 7 and 8**). We will also be presenting results from the curricular questions in the 2007-08 Alumni Survey (**Appendix 2**). It should be noted, however, that this survey asked respondents to rate how well various courses prepared them for their post-graduate careers. The answers may thus reflect the bias in those careers, rather than the perceived quality of a particular course by students in the Biology Major.

1. Mathematics- The study of biology requires a solid foundation in math, chemistry, and physics. The recommended mathematics experience includes 10 credits (cr) of calculus, but may also be satisfied with 10 cr of Math 171 and 217 along with a 3 cr statistics course. Approximately 28% of our students have satisfied the final math requirement with second semester calculus (Math 222), the remaining 72% fulfilled this requirement with one of several Statistics courses (41% Stats 301, 28% Stats 371, 2.4% Stats 541 or Stats 571; the latter two are recommended courses for graduate students). Stats 371 is based on examples from the biological sciences. The students' preference for statistics instead of calculus courses is also reflected in the Alumni Survey: respondents thought that statistics courses were more useful for their current careers than second semester calculus (27.8% excellent vs. 13.7% excellent, respectively).

2. Chemistry- Chemistry requirements include a general 9 cr analytical sequence, for which the more advanced Chem 109 may serve as a 5 cr, 1 semester substitute. Students aspiring to medical school, however, still need to take an additional semester of chemistry beyond Chem 109 to fulfill medical school entrance requirements of 2 semesters of chemistry, regardless of the level of classes taken. Many medical and

graduate schools also require organic chemistry. We therefore require an 8 cr Organic Chemistry lecture-lab sequence in the Biology Major. The majority of our students complete the final course (Organic Chemistry lab) during either their 4th or 5th semesters.

3. Physics- Minimally, all biology majors must also complete a two-semester general physics sequence selected from courses either emphasizing algebra or calculus. Most of the students (75.6%) opt to complete the algebra-based Physics 103/104 series, while fewer opt for 201/202 (9.1%) or 207/208 (15.3%).

Depending on the specific needs of the student, particularly with respect to post-undergraduate plans (e.g. graduate or professional school), these elementary courses in mathematics, chemistry and physics can be substituted – or augmented – with more challenging options.

4. Introductory Biology and Foundational Courses- As with most biological science majors on campus, the specific requirements begin by enrollment in one of three introductory biology sequences: the two semester 10 cr introductory lab/lecture course Biology 151/152, the four semester 16 cr Biocore honors sequence that serves those seeking a more comprehensive introductory experience, or the combination of introductory animal biology (the 3 cr Zoology 101 and its associated 2 cr lab Zoology 102) and introductory plant biology (the 5 cr lecture/lab course Botany 130). Those students with an AP Biology score of 4 or 5 can opt out of Biology 151 or Zoology 101/102.

Biology 151/152, the two semester sequence, is the most common option, taken by approximately 65% of Biology Major graduates. Students must apply to enter the four semester Biocore honors sequence (competitively limited to a maximum of ~160 entrants per year); approximately 13% of Biology Major graduates took this option. The remaining 22% of Biology graduates opted for the Zoology 101/102-Botany 130 sequence.

Very few students begin any of these sequences in their first semester; a few begin in their second, and most in their third. This is in part by design, and in part a consequence of credit load and the remaining prerequisites. Entry into Biocore requires sophomore standing. Past experience has indicated that first semester students, depending on their academic background, often struggle with university science courses because of the increased pace and increased emphasis on higher learning skills in comparison with high school. Moreover, most incoming Biology Major students are enrolled in mathematics, chemistry, and a suite of other non-science courses including humanities and social science (to fulfill their Comm A requirement) and language (to receive language “retro” credits). Integrating a 5-credit introductory biology course into their schedule is often not possible, particularly in light of an average 12-15 cr load in the freshman year.

There has been much discussion of the strengths and weaknesses of these various options, both within the Biology Major, and by a number of groups on campus. Past and present members of the Biology Major Executive Committee co-chaired and served on the

Introductory Biology Exploration Workgroup, which met and produced a report in the summer of 2009 suggesting possible alterations to the introductory biology offerings on campus (http://www.biology.wisc.edu/ICBEimages/IBEWG_Report_081209.pdf). That Working Group felt that change was needed if the Madison campus was to keep pace with the quickly transforming nature of biological sciences today, and the need for interdisciplinary biologists who can translate biology into health, environment, conservation and other fields. The involvement of current and past members of the Biology Major Executive Committee with this Working Group reflects the depth of Biology Major's commitment to campus efforts in curriculum reform and development in the biological sciences, together with innovation in teaching and student engagement.

Members of the current Biology Major Executive Committee have also gone further, helping to organize and co-author, in partnership with ICBE and other units on campus, two recent proposals seeking support for curricular changes from the Madison Initiative for Undergraduates (MIU). The first of these proposals sought support for changes that allow greater freshman engagement with biology material, both by supporting "pre-introductory" biology courses, and by developing biology-based math courses that both better engage and students are reduce freshman credit load (http://www.biology.wisc.edu/images/MIU_Intro_Biology_June_4.pdf). The second sought support for developing both a modular lab-lecture alternative to Biology 151 and an experimental active learning section within 151, to allow experimentation and assessment of innovative learning techniques. While the extant form of Biology 151/152 scored well in the Alumni Survey (37.9% excellent and 47.1% good in supporting post-graduate goals), the challenge for introductory biology has never been greater, and our curricular offerings and methods of engaging students in the Biology Major will need to keep evolving to best prepare students for the changing nature of tomorrow's postgraduate careers. The Biology Major Executive Committee strongly supports increased University investment in introductory biology, and had stayed engaged with these developments in order to ensure that curriculum delivery and development supports the needs of its large number of students.

Another facet of that discussion has been the concern that the Zoology 101/102-Botany 130 sequence may provide a weaker introductory experience. Each course is also taken by (and is in part intended for) students in majors that require only a single semester introduction to either plant biology (e.g. Botany) or animal biology (e.g. Kinesiology, Nursing, Psychology, Zoology). The Zoology 101/102-Botany 130 courses, therefore, have to cover redundant introductory material, to the detriment of other topics. This may be reflected in the Alumni Survey (**Appendix 2**), which rated the Zoology 101-2/Botany 130 sequence slightly lower in its utility for post-graduate goals than the Biology 151/152 sequence (28.1% excellent for 101-130, 37.9% excellent for 151-2).

Nonetheless, the Zoology 101/102-Botany 130 sequence has been chosen by a sizeable minority of Biology Major graduates since the inception of the Major, averaging 16-26% without any progressive increase or decrease over time. This option provides a route for those that have taken Zoology 101 or Botany 130 to complete introductory biology without having to take another complete introductory sequence; this is particularly important for L&S students who are still deciding whether to go on in biology. It is also

popular with transfer students who have completed a sequence elsewhere that is better complemented by a single semester of plant or animal biology, and with those students that require a more flexible schedule (since the Zoology 102 lab does not need to be taken concurrently with Zoology 101). In the past it may also have been taken by students wishing to start biology in their freshman year, since enrollment pressures had closed out 151/152 to freshmen. Freshman, however, are no longer closed out of 151/152. Of more concern is the report that some students are taking the 101/102-130 sequence because they perceive it to be less challenging. The Executive Committee is therefore engaged with current discussions concerning these courses in the Departments of Botany and Zoology.

A strong feature of the Biology Major is that all students, excepting those taking the four semester Biocore sequence, are also required to take at least one of five additional “foundational” courses that stress either genetics or biochemistry. The two most popular choices are Genetics 466 (46%) and Biochem 501 (38%), followed by BMolChem 503 (10%), and Microbiol 370 (2%) and a small number of students in either Agr 338 or Micro 470.

5. Intermediate/Advanced Courses- The intermediate/advanced biology course requirements are distributed over five broad categories, of which selections must be made from at least three: (A) cellular and subcellular biology; (B) organismal biology; (C) ecology; (D) evolution and systematics; and (E) applied biology, agriculture and natural resources. The numbers that have enrolled in specific courses are given in **Appendix 9**.

One course must be selected from A or B, one from C or D, and a third must be selected from an A-E category not yet chosen. This ensures that students receive a broad background in biology, no matter what their intended career goal. This is somewhat unpopular with particular groups of students whose interests are well-defined. Indeed the C (ecology) and D (evolution and systematics) category courses were rated by the Alumni Survey as slightly less supportive of alumni’s post-graduate goals, likely a consequence of the strong pre-health bias in our student population. The breadth requirement, nonetheless, is one of the key features that distinguishes the Biology Major from the other, more specialized biological science majors on campus. It should also be noted that students benefit from the diversity of these course categories, as they can accommodate their interests by choosing from a wide range of courses. Students also must take intermediate/advanced coursework with a total of 3 hours a week of laboratory experience, guaranteeing exposure to laboratory work in an organized, upper-class level setting.

A challenge for the Biology Major program is that some of the categories have fewer choices than others. For example, there are fewer than half as many courses to choose from in C (ecology) (22) and D (evolution and systematics) (20), when compared to category A (59), B (65), and E (46) courses (see **Appendix 9**). The number of laboratory courses is also low, especially in categories C and D. The Biology Major Executive Committee is aware of these problems, and is attempting to alleviate the discrepancies when possible by adding courses to the curriculum. As part of its duties, the Biology

Major Executive Committee evaluates the appropriateness of specific courses in an appropriate category (faculty can also submit solicitations). The Executive Committee, however, has no mechanism or resources, beyond persuasion, for encouraging course development in particular areas. The Biology Major often must rely on enrollment pressures and the actions of individual departments to respond to perceived student needs. This has been successful in some cases (e.g. Physiology 435) and less successful in others, most notably the development of a larger array of lab courses. Most recently, the abrupt elimination of AnSci/CBS 404 (Principles of Vertebrate Physiology) has created an unfilled void in a previously popular course. This particular occurrence demonstrates the volatility of the current system and, given current financial concerns, things may be expected to get worse, particularly in laboratory courses.

6. Independent research- An important hallmark of the Biology Major is its requirement for an additional laboratory experience, preferably fulfilled by doing independent, faculty-mentored research in a biology lab on campus. The independent research provides exposure to real scientific thinking and techniques in faculty laboratories or field sites. This is an incredibly powerful component for Biology Major students, as UW Madison is, and has been, one of the foremost biological sciences research campuses in the country. UW Madison has been at the cutting-edge of discoveries in biology for many decades. For CALS students, an independent research project also fulfills, with advisor approval, the Capstone requirement.

While there are other ways of fulfilling this laboratory research requirement (see below), nearly 70% of CALS biology majors opt for performing faculty-mentored research, reflecting the importance that students ascribe to the experience. In total, nearly 2000 students have received credits in either 299, 399 or 699 courses. In the Alumni Survey, 61% stated that independent, faculty-mentored research provided excellent support for their post-graduate goals, the highest rating of any course category in the survey. It is possible that even more students would pursue this route (both in L&S and CALS) if there was a central clearing house “brokering” research opportunities. It is not clear, however, that participating research labs have the capacity to absorb all biology majors, restricting the number of students to those most motivated or least intimidated by the process. Part of this limitation may be due to faculty receiving no teaching “credit” for students in 299, 399 or 699 courses.

For students who do not perform independent research, this requirement can be fulfilled by taking additional laboratory coursework, although the nature of that coursework varies between L&S and CALS. In L&S, taking any designated laboratory course with a sufficient number of lab hours will fulfill the requirement. In CALS, this coursework must also meet the Capstone requirement: each Capstone experience is evaluated to meet specific requirements and only a small subset of laboratory-based courses (9) is approved.

Curricula of the Neurobiology and Evolution Options- These two options share the same basic requirements in non-biology courses and introductory biology sequences with the rest of the major. The differences emerge in having more specific requirements in the

foundational and Intermediate/Advanced Courses, and the addition of Option-specific seminar courses (see **Appendices 7 and 8**).

In the Neurobiology Option, the students are required to take four intermediate/advanced neuroscience courses. These must include the 3 cr Neurosci/Psych/Zool 523 (Neurobiology I) and the 3 cr Neurosci/Psych/Zool 524 (Neurobiology II), the first covering cellular neuroscience and the second systems neuroscience. These are meant to be taken in the junior year. One of the other two courses must be a cellular/molecular neurobiology course (from the Neurobiology category A list), and the other a systems neurobiology course (Neurobiology category B). Several of these courses can be taken for Honors.

As in the standard Biology Major, an additional, non-neuronal course must be taken from C (ecology) or D (evolution and systematics). Students must take one laboratory class in which there are at least 3 hours of lab work per week, and do independent research or an additional laboratory course. While it is encouraged, these lab and research courses do not have to be in the neurosciences. As in the standard Biology Major, a current challenge is to institute an adequate number of laboratory courses. At present there is only one neurobiology lab course, which can take 16 students. As there are approximately 160 seniors and juniors in the Option, it is clear that we are very much short of meeting this challenge. Neurobiology faculty are currently working on getting finances for a second lab course that would be able to take about 24 additional students.

Neurobiology Option students must also take one semester of the Neurobiology Seminar course (Neurosci 500). This is a 1 cr course in which students are exposed to a different neuroscience faculty member each week. The faculty member presents their research, at a fairly sophisticated level. This course is meant to be taken by seniors.

The Evolution Option requires that students must take Genetics 466 as their foundational course, and must take a specific 3 cr intermediate/advanced course in evolution (Anthro/Botany/Zoology 410- Evolutionary Biology) and an additional course from category D (evolution and systematics), as well as a course from C (ecology) and A or B. Students must also take Biology 675, a one-semester 1 cr undergraduate Evolutionary Biology seminar. As with the standard Biology Major, the Evolution Option would be improved by having more category D courses available.

Other trends and issues- 1) AP credit- An increasing number of students are entering the university with AP credit. In terms of facilitating their degree progress, AP credit can enhance significantly a student's overall experience, particularly if mathematics, chemistry, and/or biology AP is achieved. Appropriate advising is needed to accommodate students with AP credits, especially in L&S where students do not declare until later in their careers, thereby bypassing early advising from the Major.

2) Study abroad- Many students are electing to study abroad. While a valuable experience, transfer of science-based credits can be difficult. Moreover, scheduling,

especially with required laboratory experiences, becomes a difficult challenge. This is evident in CALS, where the more stringent Capstone requirement is in place.

3) Increasing numbers of Majors in CALS- Recent changes in CALS requirements will likely increase its attractiveness for Biology Major students, partly because of the different GPA requirements in the two colleges. There is an advantage for L&S students with lower GPAs to transfer into CALS prior to their last semester, as it can enable graduation that would not have been possible if they remained in L&S. The primary adverse effect on CALS is additional pressure on limited Capstone course and independent research experiences. While [apparently] not problematic at this time, there is ample evidence that the popularity of the CALS Biology Major will continue to grow. By its own success such problems may arise, warranting continued close observation.

4) Double majors- Many of the students receiving a degree in Biology also complete a second major or certificate program, some even chose to triple major. A total of 1288 other degrees have been coupled to the 2807 Biology degrees granted, suggesting this is a common practice. Approximately 223 students have received diplomas with honors designations obtained from various programs.

Given the broad nature of the Biology Major curriculum, there was some concern that students were using a common set of course requirements to boost their resumes in terms of numbers of majors completed, without greatly increasing their coursework. We therefore examined the nature of the double majors being granted. Nearly 120 additional majors are represented among Biology Major students who undertook more than one major. The most common second majors are Zoology (160), Psychology (158), and Spanish (108). The numbers for other biological majors are lower (48 in Genetics, 33 in Biochemistry, 25 in BAC, etc.). Given the several courses that are common to the Biology and Zoology Majors, the moderate but nonetheless substantial number of double majors in Biology and Zoology remains a concern given the few additional classes required to permit attainment of such double major combinations.

VII. Advising in the Major

Since the inception of the Biology Major, advising within the Major has been handled by 1) faculty advisors and 2) academic staff advisors/support staff. Since 2003, CALS freshman have also received advising through a Peer Advising Program. The numbers of advisors, however, have not grown to match progressive increases in students declared in the Major, placing strain on the entire advising system within the Major. The Peer Advising Program has been particularly impaired by recent departures and cuts to staff that oversee the program. The appropriate roles of each advising group have also been the subject of recent discussion and modification. There has also been discussion of the difficulties created by serving both CALS and L&S undergraduates, especially with access to students early in their careers, since L&S students do not generally declare the Biology Major until they are juniors. Finally, the task of advising has been made more

difficult by ongoing problems with the Degree Auditing Report System (DARS). We discuss each of these issues below.

Faculty Advising- When the Biology Major was established, students wishing to enter the major were assigned a faculty advisor by the staff advisor (see below). Approximately 30 faculty advisors were recruited by the Deans of CALS, L&S and the College of Education, together with the newly-appointed chair of the Biology Major. The faculty advisors were primarily based in CALS and L&S, but also included faculty associated with the major through activities such as teaching undergraduate biology classes, particularly introductory level biology. This original cohort of faculty advisors became an integral part of the Biology Major's initial Executive Committee until it evolved into its current form (Administration of the Major, section IV above). Initially, this advising structure was established to support about 100-150 undergraduates, because most Biology Major undergraduates were expected to transition out of the Biology Major into more specialized biological science majors, and relatively few were expected to stay within the Biology Major.

Faculty advisors were subsequently recruited on an *ad hoc* basis by the Chairs of the Biology Major Executive Committee, Dr. Sharkey, the Biology Major support staff, and faculty advisors already in the program. The number of faculty advisors increased to 70-80 faculty advisors within 2-3 years of establishing the Major.

Over the last 5 years, however, the top challenge for faculty advising in the Biology Major has been a by-product of the major's successful broad appeal to students in biological sciences. Unanticipated and progressive increases in the numbers of undergraduate students remaining within the major to graduation has led to approximately 1200 students now declared as Biology Majors. Despite the explosive growth in the number of Biology Major students, the number of faculty advisors has been static. Currently, faculty advisors for the major number around 70-80, with about 50% from CALS, 22.5% each from L&S and SMPH, and about 5% from the School of Veterinary Medicine. About 14% and 10% of these advisors serve the Neurobiology and Evolution options, respectively. *Ad hoc* recruitment continues, mainly through the efforts of Biology Major support staff, but succeeds only in replacing the ~10% annual attrition of faculty advisors, reflecting the precarious situation of purely voluntary faculty advisors.

The static numbers of faculty advisors over the last five years has meant progressive increases in the numbers of students per faculty advisor. These increased student numbers are not evenly distributed among faculty advisors, as some faculty severely restrict the number of students they will advise. A few faculty members are advising as many as 35-45 students. There is also the concern that the apparent recent increase in the proportion of Biology Major students in CALS will increase the burden specifically on CALS faculty advisors. The high case loads also mean that students often cannot find faculty advisors that share their interests. Students choose from a list of faculty that states each faculty member's expertise, but often those faculty that are expert in the more popular areas of biology are not available for additional advisees. Because of the

increased number of students, capacity-limits on faculty caseloads, and delayed conferral of degrees, incoming freshmen have not been assigned faculty advisors at SOAR for the last two years.

It should also be noted that advising in the Major is voluntary, and advisors do not receive any compensation from the Major or their departments. Nonetheless, a survey and focus group of 30 advisors found that most rated their Biology Major student advising experiences as “somewhat rewarding” to “extremely rewarding”. Faculty advisors particularly enjoyed helping and interacting with students.

Staff advising- As noted in more detail in the Staffing History subsection of section IV above. Administration of the Biology Major, when the Biology Major was established one academic staff member was hired to provide support, including student advising for the Biology Major and the Molecular Biology Major. As the Biology Major grew in size, a second 100% academic staff position was added. However, when the staff was moved into ICBE in 2003, they took on as well advising and administration of the BAC Major and additional non-Major administrative duties. In 2009 one of these staff members, Sarah Kuba, left and was replaced in spring 2010 with 40% commitment from a new hire, Will Lipske. Thus, the number of staff members available for advising in the Major has gone from 200% (Mary Smith and Sara Kuba) when the Major had approximately 700 students, to 140% (Mary Smith and 40% Will Lipske) when it has approximately 1200.

These circumstances have led to a large increase in the number of students per staff advisor. Moreover, since one of Sarah Kuba’s main roles was to oversee and organize CALS Peer Advising Program for the Major, this program has been impaired (see below).

Until recently, only faculty advisors were officially listed as advisors on student records, and so the Biology Major’s staff advisors were not officially recognized as advisors by the campus. To rectify this situation, the Biology Major Executive Committee recently voted to list both the staff and faculty advisors on student records.

CALS Peer Advising Program- Since a large number of CALS Biology Major students are freshmen, a limited Peer Advising program was initiated in 2003 by Sarah Kuba. The program helps address the advising load by recruiting junior and senior Biology majors from CALS and L&S to prepare CALS freshmen for meetings with their faculty advisor, and to provide a peer connection to biology students on campus and to campus resources useful to biology students. Ten freshmen were assigned to each undergraduate Peer Advisor (an upperclassman Biology Major student), and a faculty advisor was assigned two Peer Advisor. Sarah Kuba prepared Peer Advisors for their roles during the spring semester prior to receipt of their freshmen. The freshmen met with their Peer Advisor at least once per semester before the freshmen met with their faculty advisor. Faculty members supervising a pair of Peer Advisors were compensated by not being assigned any additional advisees for 2 years after the start of each year in which they worked with Peer Advisors. Although they were not compensated, numerous students viewed Peer Advising as a service or leadership opportunity. Anecdotal feedback suggests that the

faculty advisors, Peer Advisors and undergraduate advisees thoroughly appreciated this program.

After the departure of Sara Kuba, however, the Peer Advising Program went into abeyance. With the hiring of Will Lipske, the Peer Advisor Program was re-started this year, but there were numerous shortcomings. Because Will Lipske began his appointment midway through the spring 2009-10 semester, Peer Advisors were not selected until after SOAR began. This meant that students were not connected with a Peer Advisor who would welcome them to campus during the summer. Peer Advisors did not receive training until the start of the fall semester, and were not paired with students until midway through out the term. Faculty advisors were not identified to participate in the program.

Consequences of Large Increase in Biology Major Students- Although the huge increase in student numbers within the Biology Major has greatly stressed advising in the Major, students on the whole still receive considerable quality advice. Biology Major students have an average time to graduation of 4.1 years; this is a worthy and notable achievement that suggests there are no serious impediments to student progress, especially as faculty advising in the major is on a purely voluntary basis.

he most common negative feedback from graduating seniors, however, involves dissatisfaction with advisors, something not surprising in this overloaded situation. In the 2006-07 Alumni Survey conducted by the Biology Major (**Appendix 2**), 21.4% of respondents rated the overall quality of advising as poor, 36.4% as fair, 27.3% as good, and 11.4% as excellent. Respondents were less satisfied with faculty advisors than staff advisors: 24.2% of the respondents rated the quality of faculty advice as poor, while 10.6% rated the quality of advice from staff as poor. Complaints about advising are also frequent in the Exit Surveys; the reasons given by students for their dissatisfaction include difficulties in getting advising appointments, faculty being unwilling to deal with issues beyond their areas of expertise in biology, and faculty being unable to answer complex questions about fulfilling requirements. Many of the recent complaints about staff advisors were directed to the temporary staff supplied to the major while awaiting a replacement from Sarah Kuba and Pat Henrikson. In the 2010 CALS survey of advising within the college (**Appendix 4**), Biology majors gave excellent ratings to various aspects of advising ~10% less frequently than did all CALS students, depending on the type of advising assessed.

The low number of faculty advisors has also prevented the Major from being as pro-active as it would like. Students are under no obligation to visit their advisor, and many faculty do not demand sessions, even with at-risk students.

The Major is considering a number of changes to alleviate this situation.

Faculty Advisor Expectations- In addition to the increased numbers of students assigned to faculty advisors, the responsibilities for faculty advisors in the Biology Major

have notably increased since the Major's inception. Early in the history of the Major, faculty advisors were expected to:

- 1) devise a curriculum appropriate to the student's goals and interests related to the requirements of the Biology Major.
- 2) provide information about the various majors and options for studying biology.
- 3) discuss the career implications of the various biology majors and options.

However, it was recently proposed that advisors are expected to:

- 1) provide understanding and information about requirements of the biology major and options within the major in a timely manner.
- 2) invite advisees to meet with them once during each semester.
- 3) discuss student interests as they relate to courses and options within the major.
- 4) assist students with monitoring and evaluating their progress in the Biology Major.
- 5) work with students to clarify the student's values, goals and potential.
- 6) help students understand the nature and purpose of Biology Major, and of a college education.
- 7) provide a safe space for students to share their thoughts, aspirations, concerns and interests.
- 8) maintain confidentiality.

Indeed, much of the faculty's time is now spent counting credits for Major and college requirements, interpreting and correcting DARS reports, advising students on transfer credits and travel abroad programs, etc. While new faculty advisors receive training on these roles and functions from the Major staff, the rapid changes in advising techniques, tools and resources on campus make it difficult for faculty to stay abreast of these, much less the changes in curriculum and requirements. Indeed, despite the goals of advising in the Major, some faculty advisors tell their students that they will not perform these functions, undoubtedly leading to student frustration. The increasingly complex advisor role also makes it more difficult to recruit new faculty advisors.

Therefore, the Executive Committee has been discussing how to revise the faculty's advising role, so as to direct students with many of the more mundane advising issues towards the staff advisors. BAC has already instituted a similar change with some success, albeit with a much smaller number of students. The Committee is currently polling faculty and staff to generate an explicit list of advising functions, and to decide which functions are best handled by staff, faculty and/or peers. While this process is still underway, it is thought that the faculty would retain roles in explaining general requirements, giving curriculum advice, granting exceptions, and especially giving career advice. It should also be noted that some of the recent career advising innovations on campus, such as the Center for Pre-Health Advising, will reduce the load on even the career advice role of Biology Major faculty and staff.

We think it likely that a clear, web-published set of advising roles will greatly decrease student frustration. It should be noted, however, that these changes will increase the burden on already overtaxed Biology Major staff. We are therefore likely to propose increased staffing, especially through the Madison Initiative for Undergraduates (MIU),

along the lines proposed in the 12/2010 draft report from the MIU Advising Working Group chaired by Dr. Don Woolston. That report states a goal of approximately 400 students per staff advisor. With 1.4 advisors, 1200 students from the Biology Major, and another 200 students from the Molecular Biology and BAC Majors, the Biology Major staff is well over that mark.

Other changes in faculty advising have also been actively discussed. First, the changes above may increase the time faculty members have for pro-active advising with at-risk students. Second, we are also strongly considering advising or even requiring faculty to use WiscCal Scheduling Assistant, to allow students to independently schedule appointments during faculty-set office hours. The staff has been using this method, and find that it greatly decreases student frustration with the advising process. Other campus-wide innovations, like the Advisor Notes System, are being adopted by various advisors in the Major and, if successful, may become an integral part of our advising process.

The Problem With Advising CALS and L&S Biology Major Students- Advising in the Biology Major can be particularly challenging because CALS undergraduates are required to declare their major in their freshman year, while students in L&S are encouraged to take a diverse undergraduate curriculum and declare a major in their junior or senior year (see the distribution of students in **Figure 2**). Since about two thirds of Biology Major graduates are from L&S, that means that two thirds of our students are not advised by Biology Major advisors until they are juniors and seniors, with a constrained period to incorporate requirements or change coursework for the Major.

The L&S students are also largely excluded from the CALS Peer Advising Program, and the onus is on these freshman and sophomores to find their own way to advice on prerequisites and requirements. And while L&S provides freshman advising through SOAR, this differs from SOAR advising through CALS. Biology Major staff were once part of both CALS and L&S SOAR, but they are no longer allowed to be part of the L&S SOAR experience on freshmen days, and act only as consultants on transfer days. Instead, L&S delivers the bulk of SOAR advising through peers who must be conversant with the requirements of many majors. Many L&S students report receiving erroneous advice from peer SOAR advisors on AP biology, introductory course offerings, prerequisites, etc. Unless the poorly-advised L&S student mentions this to another advisor, this initial advice is not corrected until the student declares the Biology Major in their junior year, which is almost always too late to correct the problem.

Problems with DARS- Another burden added to the advising process has been ongoing appearance of errors in students' DARS records. A recent analysis by Will Lipske showed that 51 of the 346 current L&S Biology Major students that have 120 or more credits had erroneous DARS entries. While the DARS coders have been trying to correct these errors, new ones always crop up. We have been told that the complexity of our requirements places us at the limits of what DARS can successfully encode, and it is difficult to correct errors without introducing new ones. While it is not clear what can be done about this, it is something we would like to call to the attention of the campus, as it makes the process of advising much more difficult for advisor and student alike.

Currently, many students are being told by DARS to take additional courses that they do not need. Some students may even be graduating without meeting their requirements.

Suggestions for Improving Biology Major Advising

- 1) Formalize the currently ad hoc recruitment of voluntary faculty advisors. Too few faculty are dealing with too many students just on a voluntary basis. The time and effort that faculty advisors contribute also needs to be recognized in a positive way at the department level. This does not happen right now, as the reality of the advisory load can cause pushback from departments concerned about a faculty member's commitment to non-departmental effort.
- 2) Provide a clear set of advising functions, and a clear sequence of instructions to students, about which advisor to see for which advising function. Students should be directed to Biology Major support staff first to address administrative questions and DARS issues, and leave career guidance (and other larger issues) to faculty advisors.
- 3) Provide clear, readily accessible information for students and faculty advisors to make use of career advising professionals on campus, rather than trying to do it all themselves.
- 4) Establish better methods for pairing students and faculty advisors with common interests.
- 5) Provide more formalized support for arranging advising appointments with faculty, and consider requiring appointments, especially for at-risk students. Too many students leave it too late to really fix things within a 4-year degree.
- 6) Establish a proactive, preventative system for incorporating the late inclusion of L&S students as seniors and juniors. Timely advice earlier in their career will help prevent students struggling to meet remaining graduation requirements.
- 7) Submit a proposal from the Biology Major in spring 2011 to the MIU requesting funds to support an additional 1.5 FTEs for staff-based advisors for the Major. Such support will go a long way towards addressing advising needs for the Major and will engage the Major with the current campus initiative to centralize and improve student advising across all Schools and Colleges, as part of MIU developments.

Summary- The strengths of the current system for advising Biology Major students are: 1) a dedicated, specialized volunteer faculty advisor pool, 2) dedicated, enthusiastic, and knowledgeable support staff (Mary Smith, Will Lipske), 3) most students graduating on time within 4 years, and 4) mostly positive experiences shared by students and faculty.

The major weaknesses are: 1) overtaxed advisors dealing with students who are struggling to navigate complex degree requirements and academic procedures, 2) volunteer faculty advisors recruited ad hoc despite the Biology Major being the second (and soon-to-be largest?) major on campus, 3) very little incentive for faculty advisors to

be other than minimally involved, 4) overwhelmed support staff struggling to deal with increased student needs and maintaining faculty involvement, and 5) lack of opportunity to develop relationships between faculty and major students because of ad hoc nature of advisors and late entry of L&S students.

VIII. Community for the Major

Peer communities- One problem faced by any large major is providing a supportive and interactive community for its students. These problems are greatly exacerbated for the Biology Major because it is both inter-college and non-departmental. The advising, peer and faculty interactions that might be used to increase community awareness are made more difficult by the lack of a central department and building. Moreover, the students are separated into two distinct populations from two different colleges. As noted above, each of these colleges has different philosophies and approaches to advising and peer support, especially in the first two years of an undergraduate's career before most L&S students have declared a major.

Another way of unifying students is through shared coursework, but this is hurt again by the breadth of the Major and the many course options that are available. Nor does the Major have control over any of the courses. For instance, many CALS departments funnel their seniors through a small number of Capstone courses, and many CALS and L&S departments assign faculty to supervise seminar courses devoted to senior theses. But since the Biology Major has no faculty, it must use the Capstone and thesis courses provided by other departments.

Finally, as the Major is not a department, it has little in the way of free faculty, staff, space or monetary resources to leverage support for its very large community of students. While ICBE has provided occasional support for these activities, its shrinking resources (and many other responsibilities) have reduced this support.

Nonetheless, various experiments have been tried to increase community awareness. The most successful of these have been based on the CALS Peer Advising Program. When running, that program supplied advising for CALS students and the occasional L&S student, and upperclassmen felt enough community responsibility to keep the program running. As noted above in Advising in the Major (section VII), the departure of Sarah Kuba, who administered the peer program, caused it to lapse; with the hiring of Will Lipske to supervise and organize the program we hope it can be successfully resurrected.

Periodic attempts were also made to run a welcome social for entering CALS students, proving them an opportunity to meet with peer upperclassmen and faculty. However, there was limited participation by peers and faculty, so this has not been attempted in recent years. A similar attempt was made to run several Study Days, but although it was heavily advertised, attendance was sparse. ICBE does have a monthly email/online Newsletter for the BAC, Biology and Molecular Biology Majors, that lists several items

of interest, including new courses and research, internship and scholarship opportunities (<http://icbemajorsnews.wordpress.com>).

More successful attempts to build a peer community have been made in the more specialized Neurobiology and Evolution Options within the major. The Neurobiology Option has a smaller, although still substantial, group of students with shared interests, and it has provided several avenues to build peer interactions. First, all Neurobiology students must take Neuroscience 523, 524 and 500, the latter a seminar course intended to expose seniors to neuroscience faculty and campus research. Second, Neurobiology organized a number of successful social/scientific events: a social journal article night at a faculty's house, Neuro Nite on campus in the spring, and an end-of-year social for graduating seniors and their families. Finally, about 80 students are members of the Undergraduate Neuroscience Society. The Evolution Option runs a weekly seminar series in evolution, a weekly reading group, and allows students to sign up for a listserv to obtain a weekly newsletter and other events notices.

The success of the Neurobiology and Evolution communities provides a possible model for the rest of the major, and discussions are underway to try implementing various aspects of the program on a larger scale. However, it should be said that some aspects of the Neurobiology Option, in particular the monetary and staff contributions from the Center for Neuroscience, the specialized interests of the students and their more constrained class choices, and the resultant peer interactions, may be difficult to reproduce given the large numbers of student in the Major and their broad interests. An alternative is to provide organizational and other support for more specialized groups. Indeed, there are some undergraduate societies already in existence that, although not specifically aimed at Biology Majors, could provide benefits for the Major's students. Examples include the Tri-Beta Honors Society (<http://tribeta.rso.wisc.edu>) for students interested in the biological sciences and a number of pre-health societies (see listing at http://www.prehealth.wisc.edu/involved/student_orgs.html). A more concerted effort could be made to direct students to these groups, support their activities, and help to initiate new groups as needed. Both the Biology Major advisors and the Major's links to the introductory biology programs provide possible mechanisms for publicizing and recruiting for these groups.

Another issue is raised by the small number of physical spaces that are available for use by Biology Major students. ICBE has access to only a few small meeting rooms, and these would not be able to handle meetings of any substantial number of students. ICBE has made attempts to find funding and space for a Biology Learning and Community Center, as a home for tutoring and peer advising of especially first and second year biology students (see ICBE's MIU Report on Enhancing the Introductory Biology Experience at http://www.biology.wisc.edu/images/MIU_Intro_Biology_June_4.pdf). The formation of a Biology Learning and Community Center would, of course, be a huge benefit to students in the Biology Major. To date, however this has only led to the assignment of another very small meeting room in the Wisconsin Institutes for Discovery.

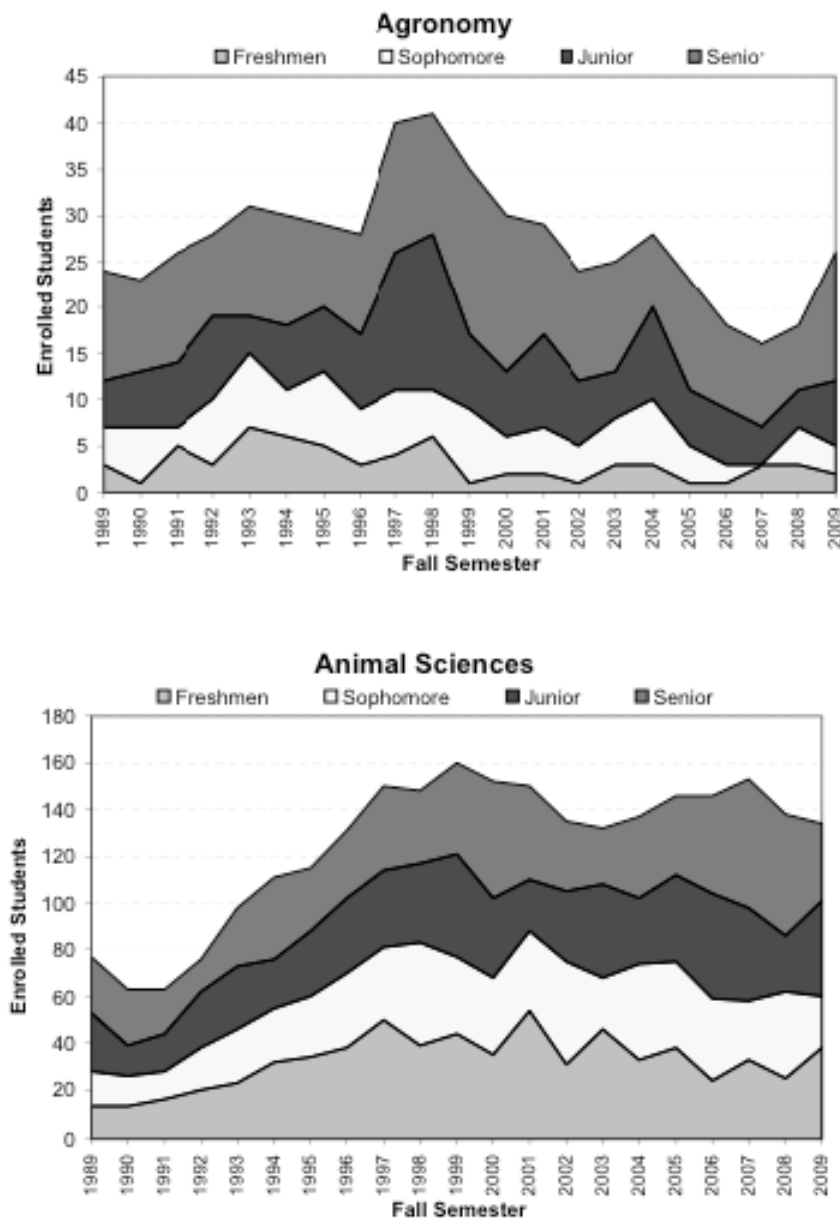
Alumni and donations- Another consequence of the non-departmental nature of the Biology Major is that it has at present no mechanism to solicit or disperse contributions from alumni. The alumni often go on to successful professional careers in the health sciences, environmental science, academia or business. The Major (and the campus) is missing a possible resource that could be used to support many of the initiatives discussed above. Some mechanism should be considered that would allow the Major to solicit donations, either on its own or via ICBE.

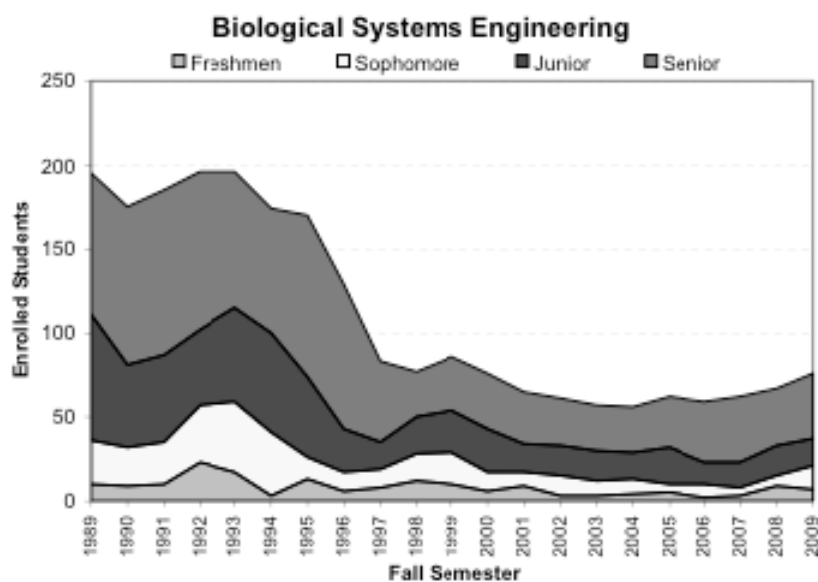
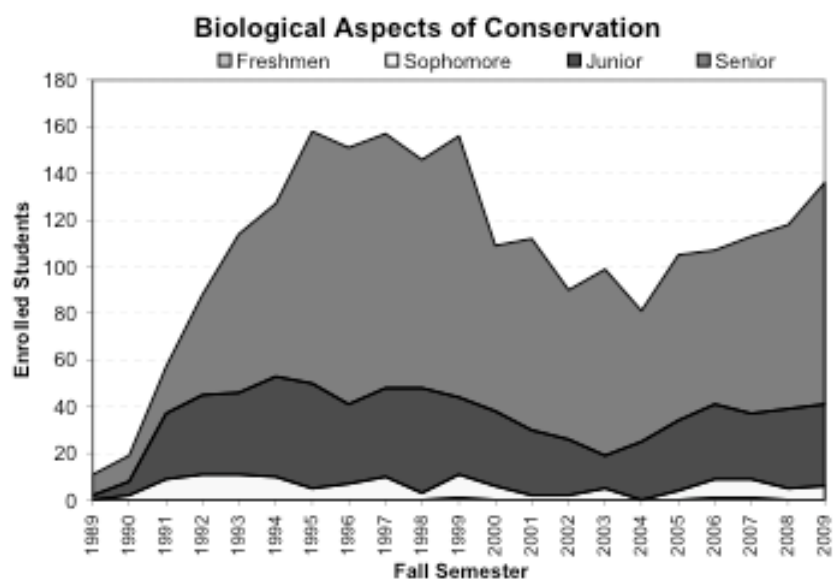
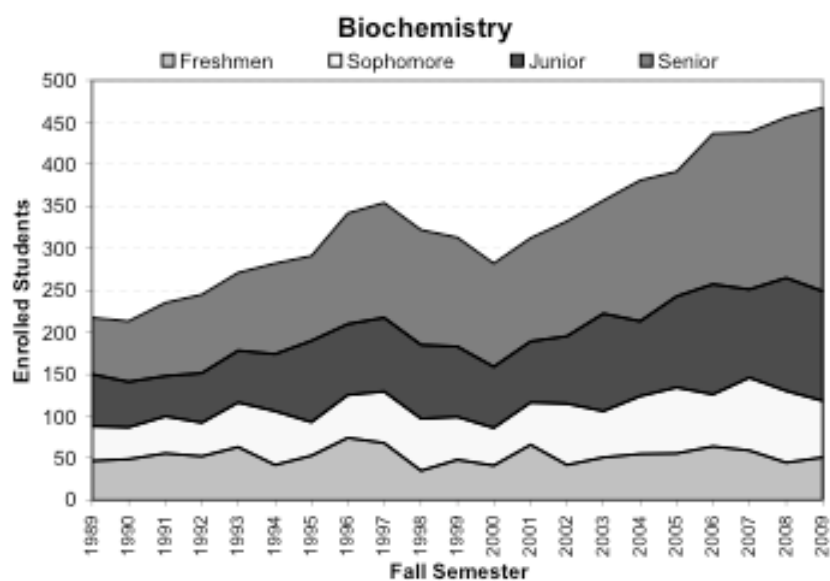
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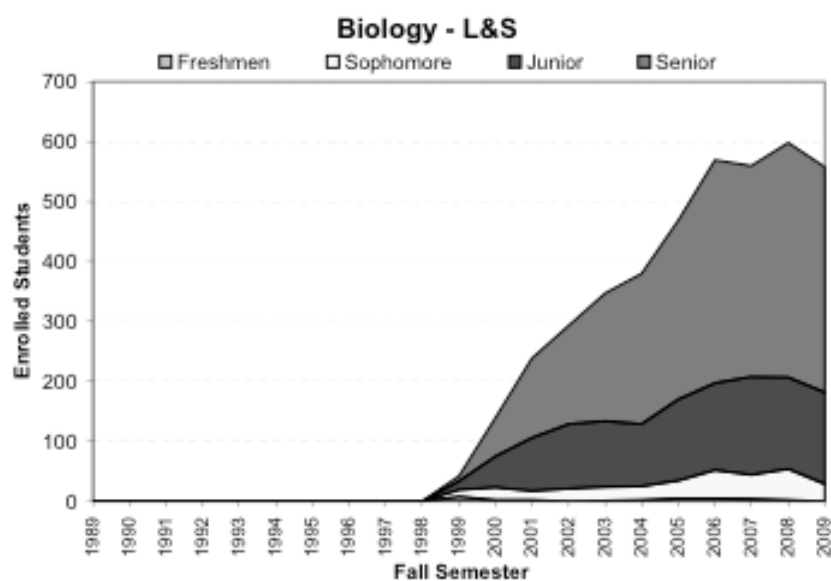
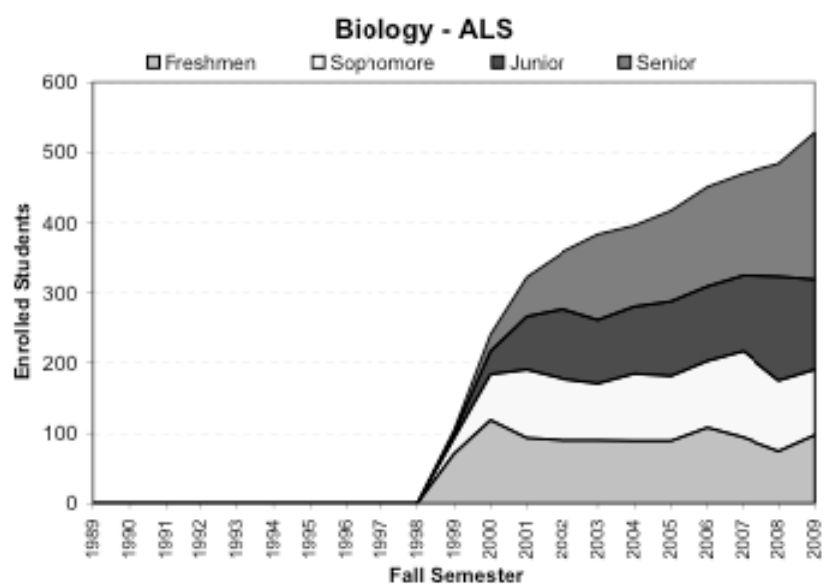
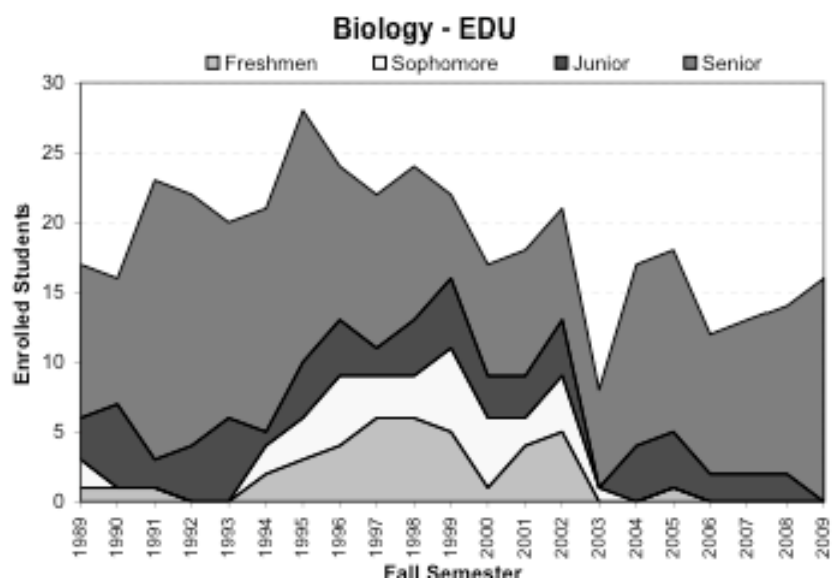
Timelines of students declaring majors in selected biological majors.

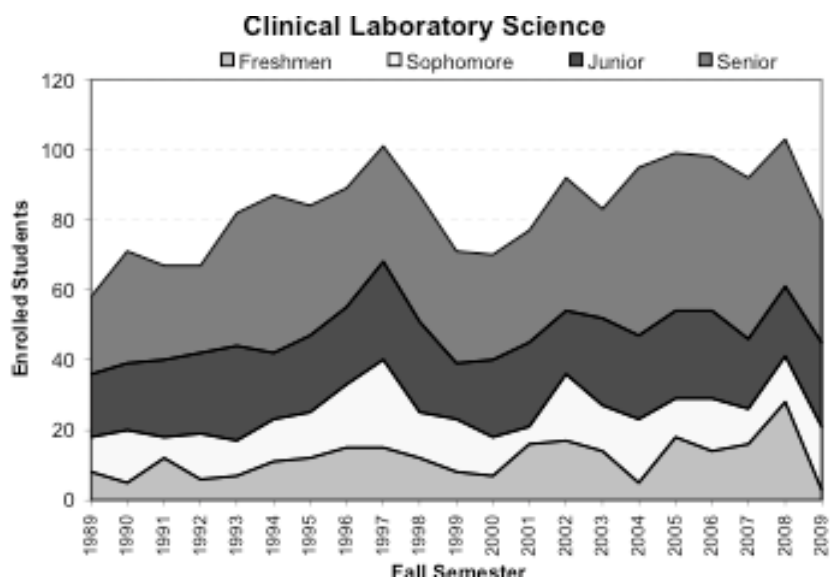
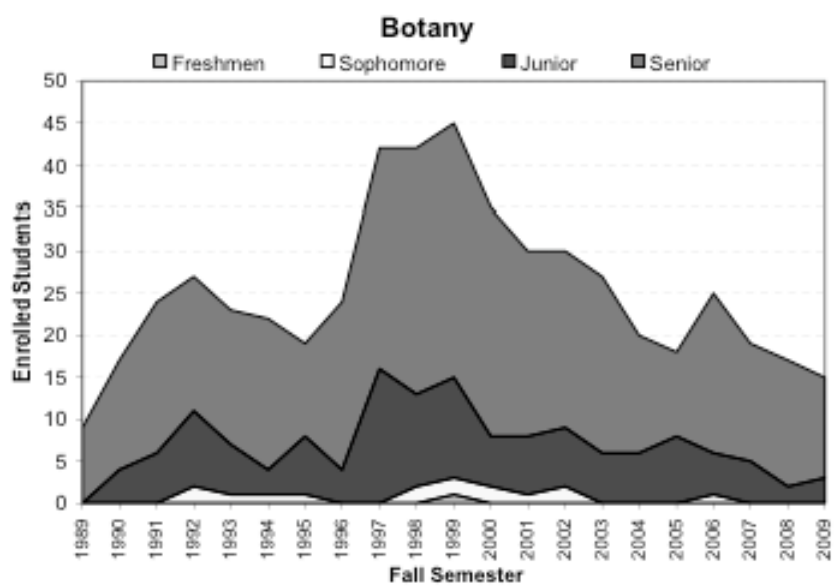
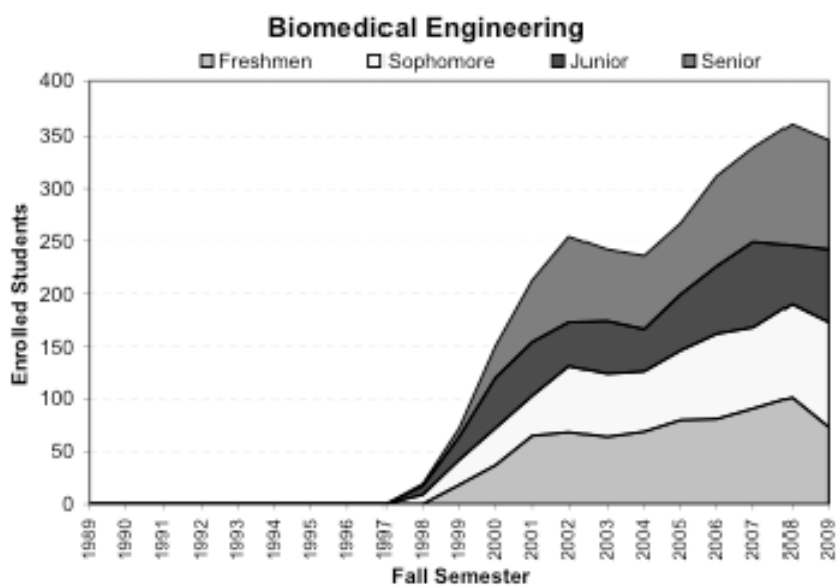
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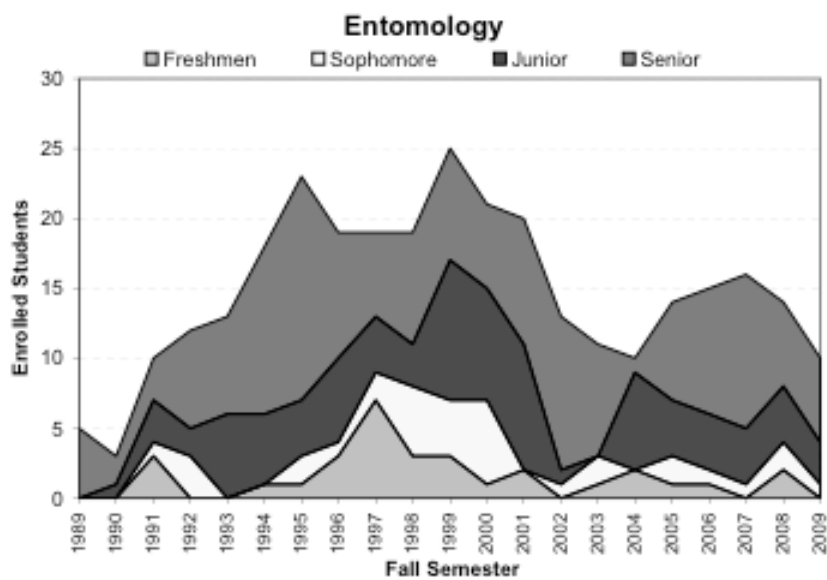
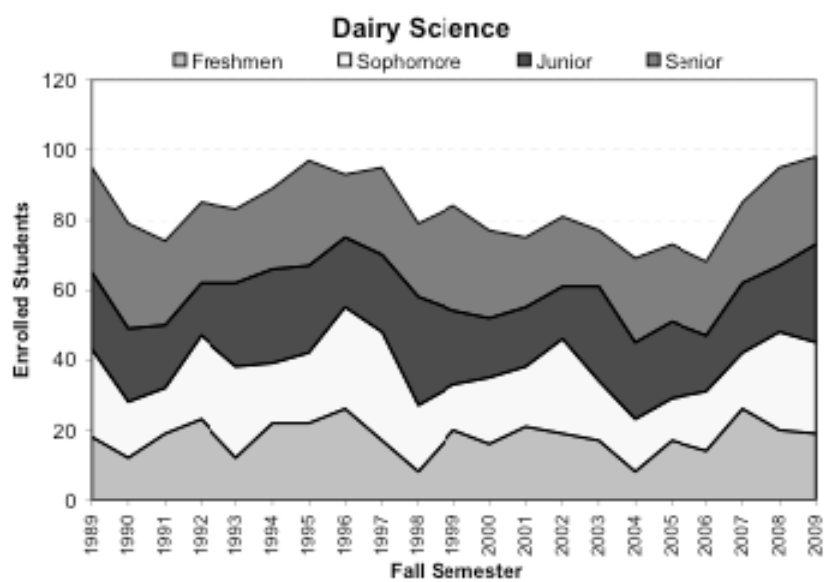
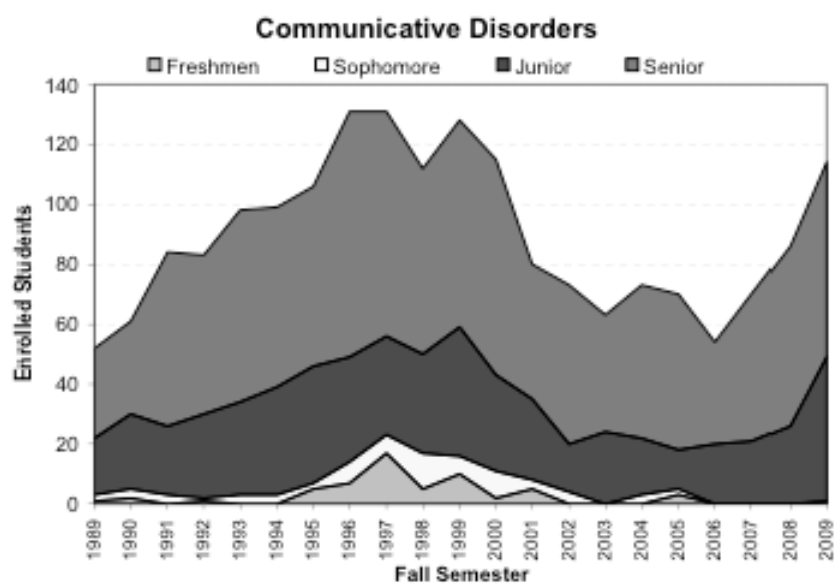
- 1) These are “stacked area” charts. The student levels are stacked on top of each other.
- 2) Few L&S freshman and sophomores declare majors, while currently most CALS freshman and sophomores do. The proper comparison between L&S and CALS majors is between the numbers of seniors.
- 3) Pharmacy, Physical Therapy, Physician Assistant, and a few other “medical” majors stopped offering undergraduate degrees during this timeline.

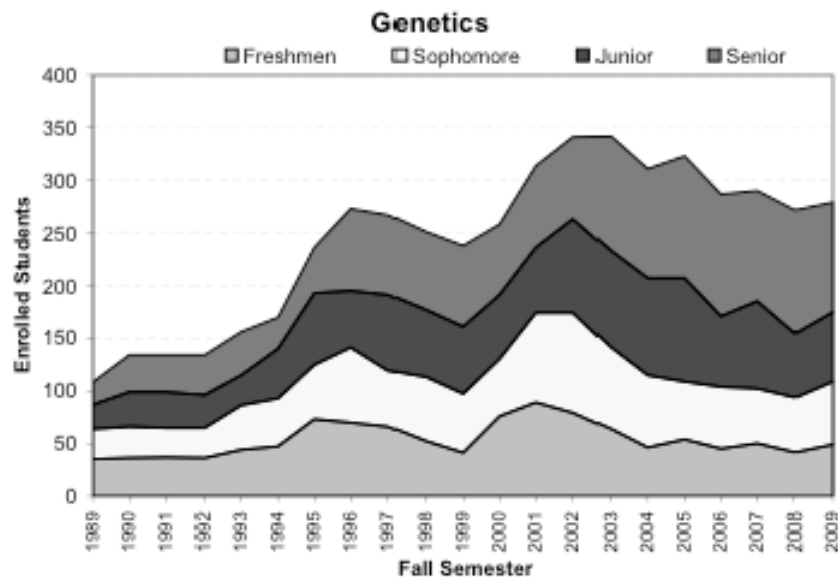
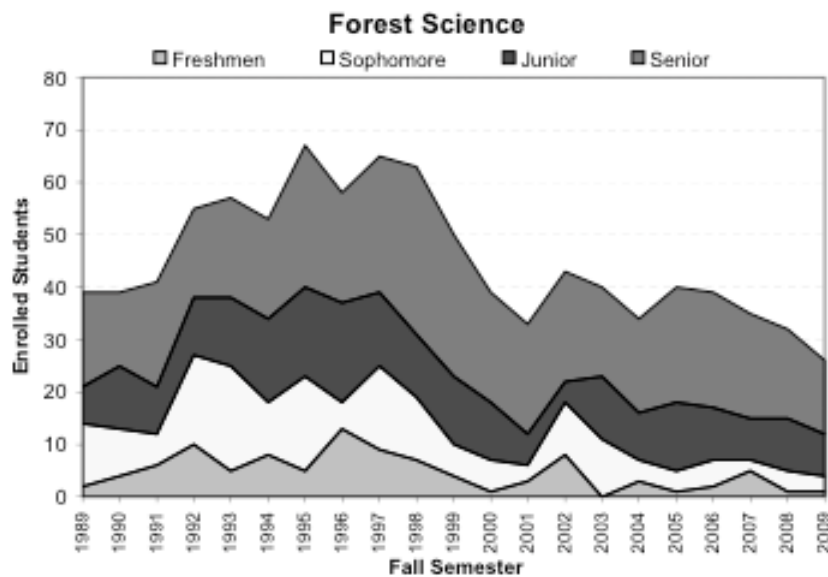
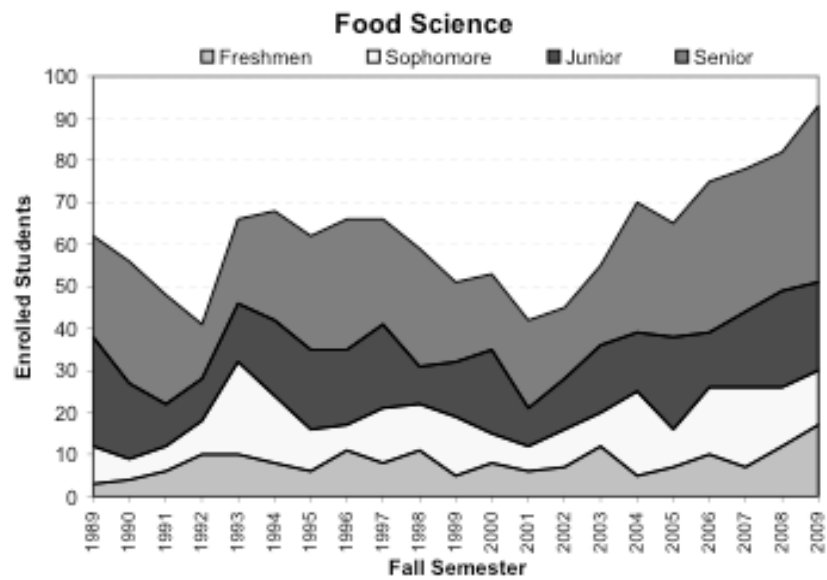


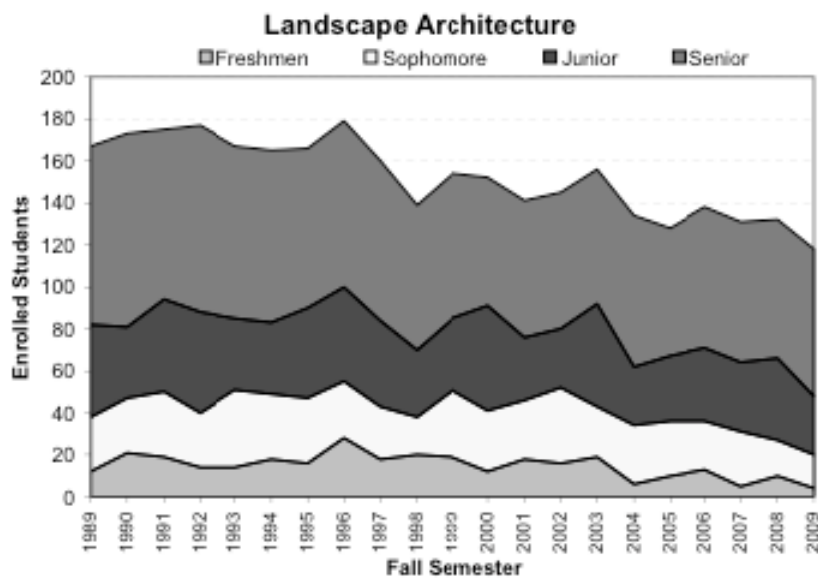
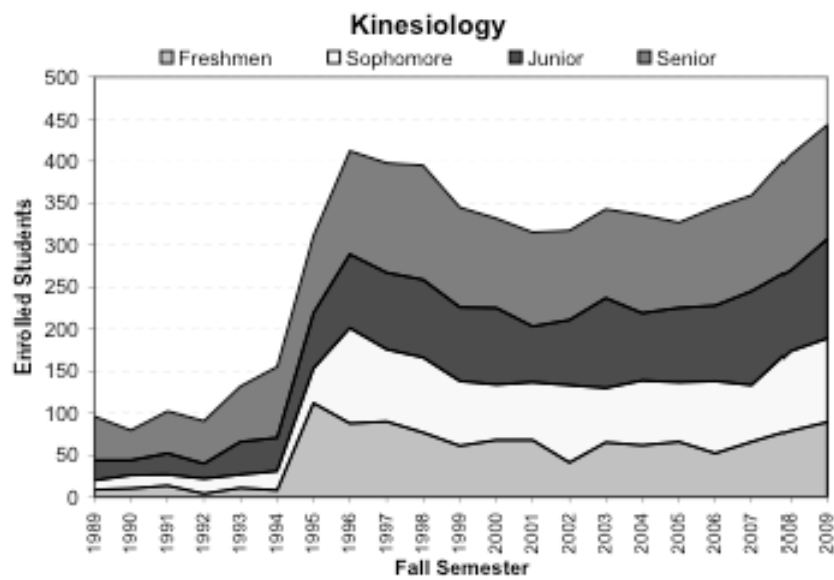
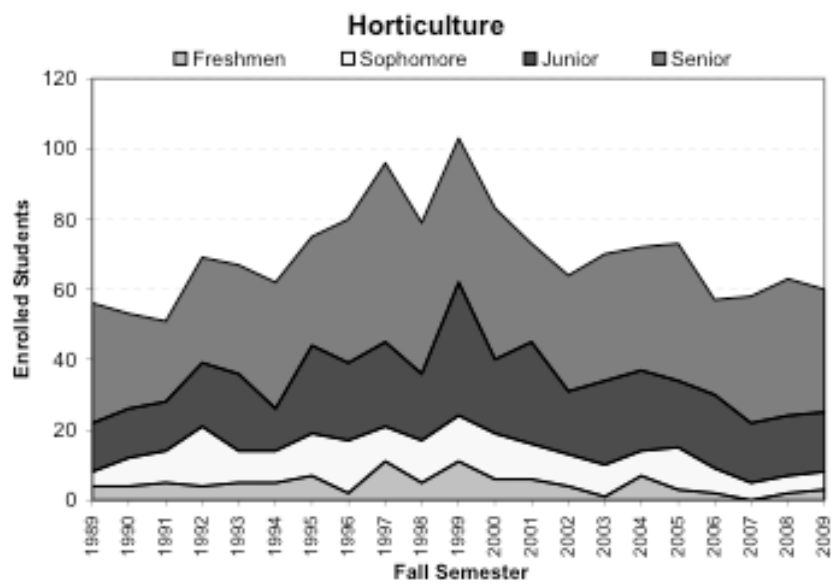




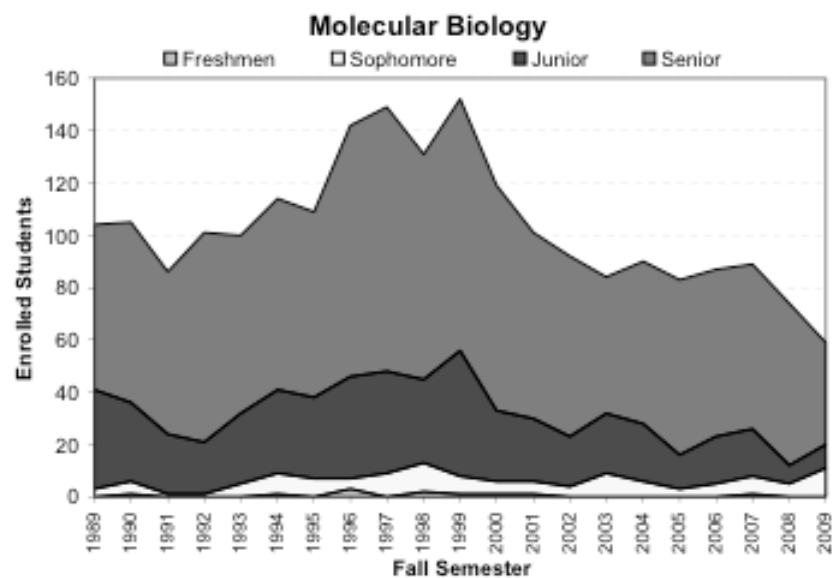
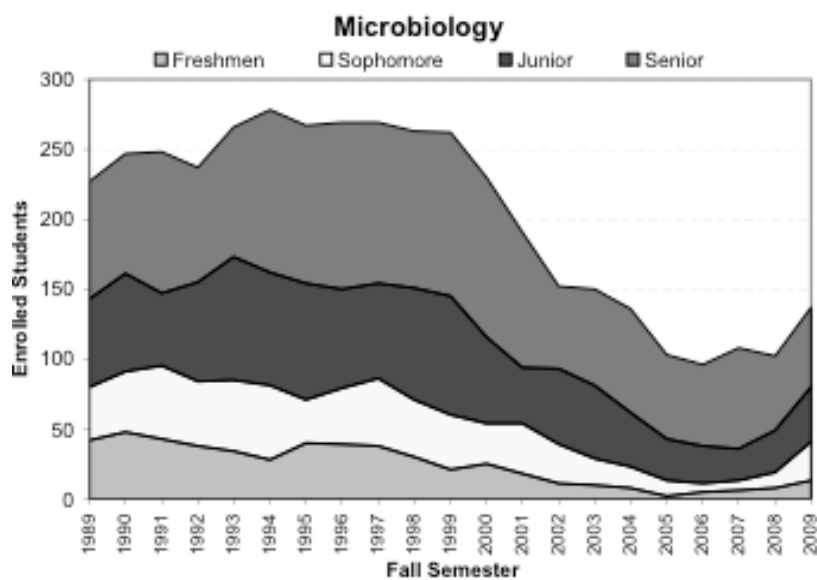
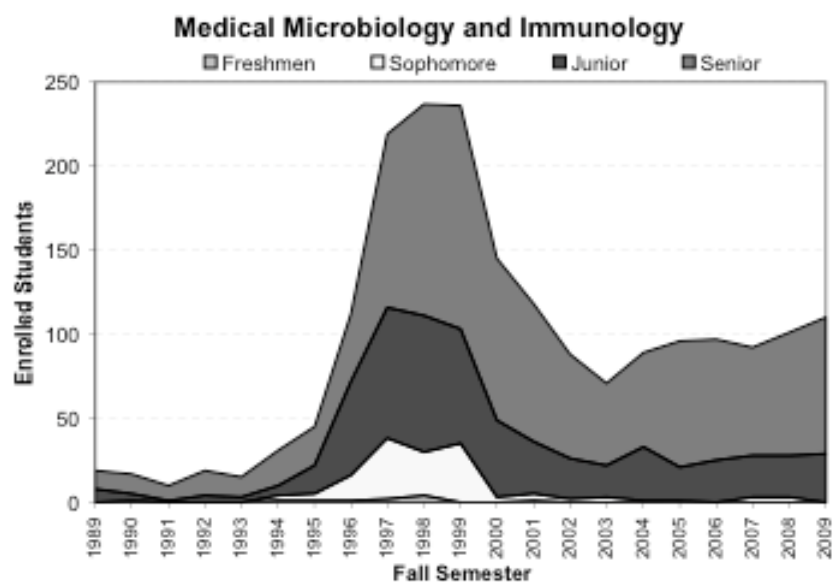


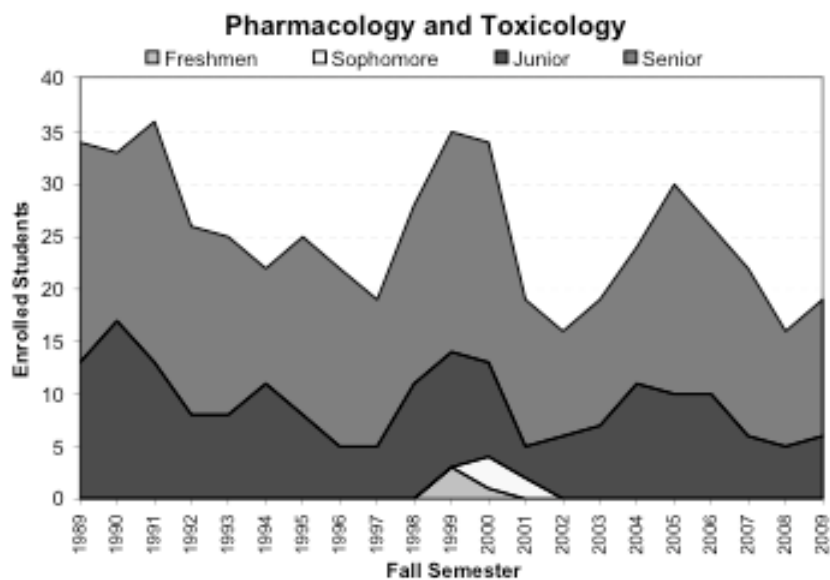
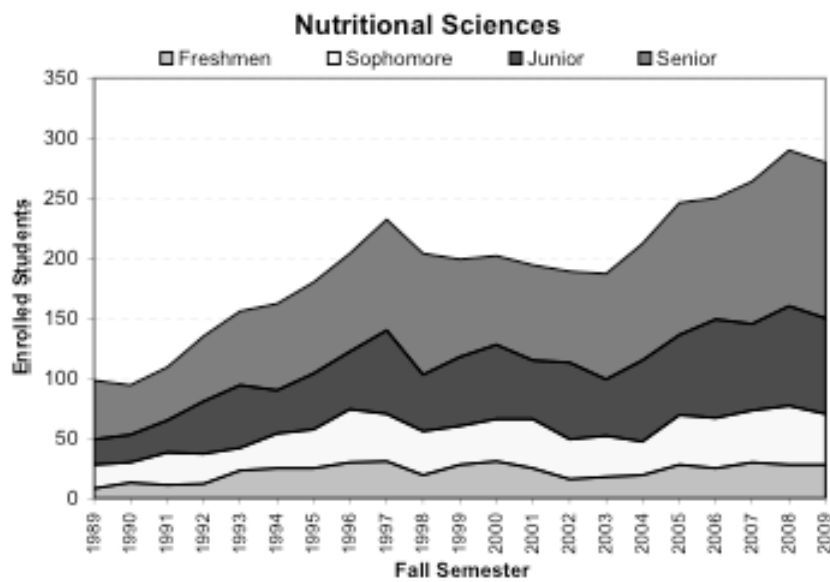
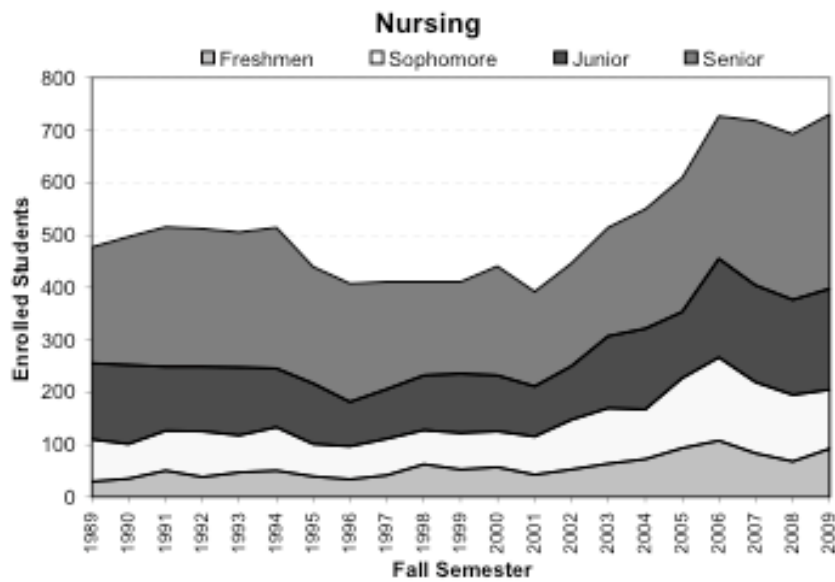


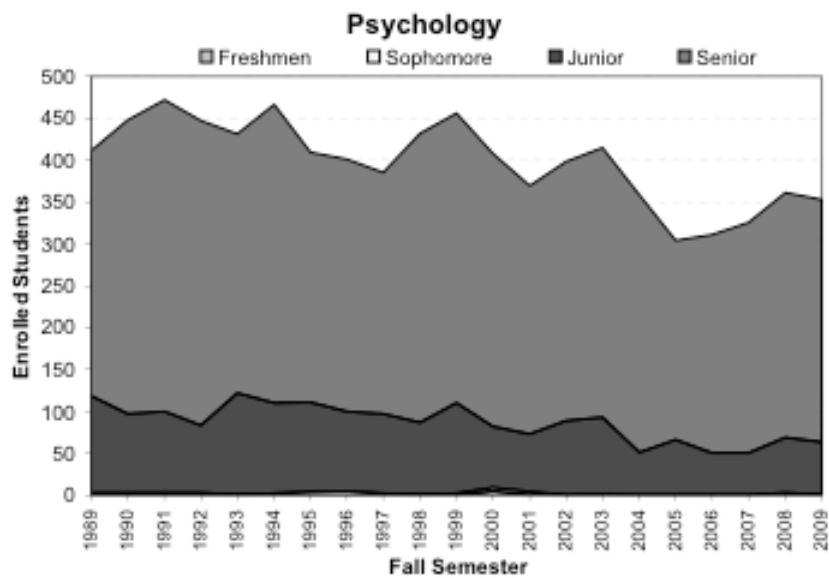
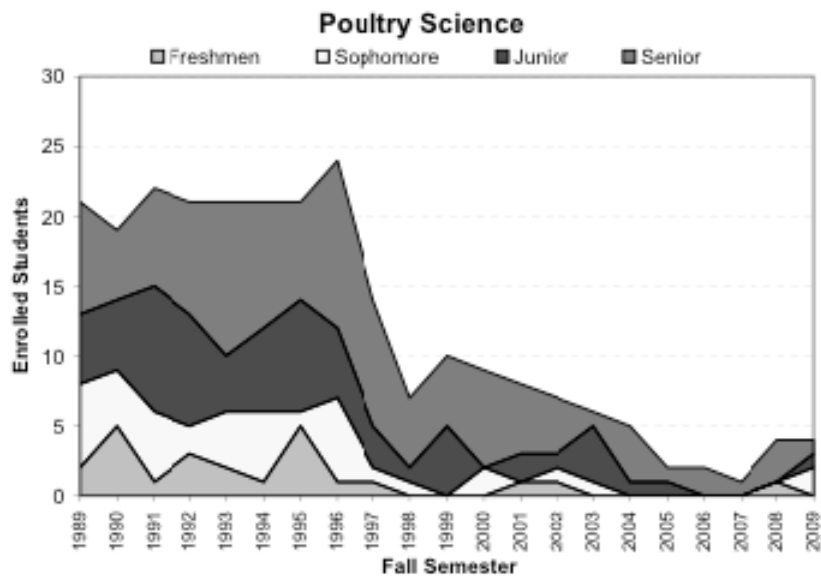
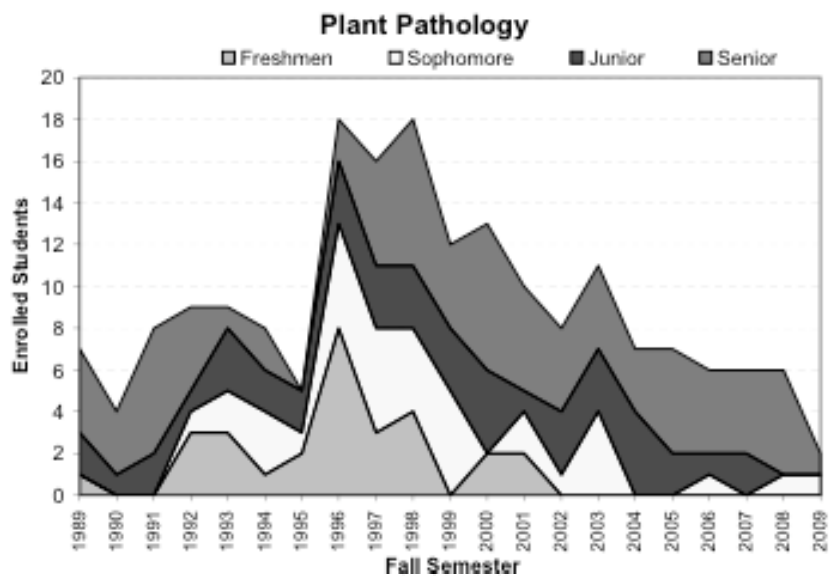


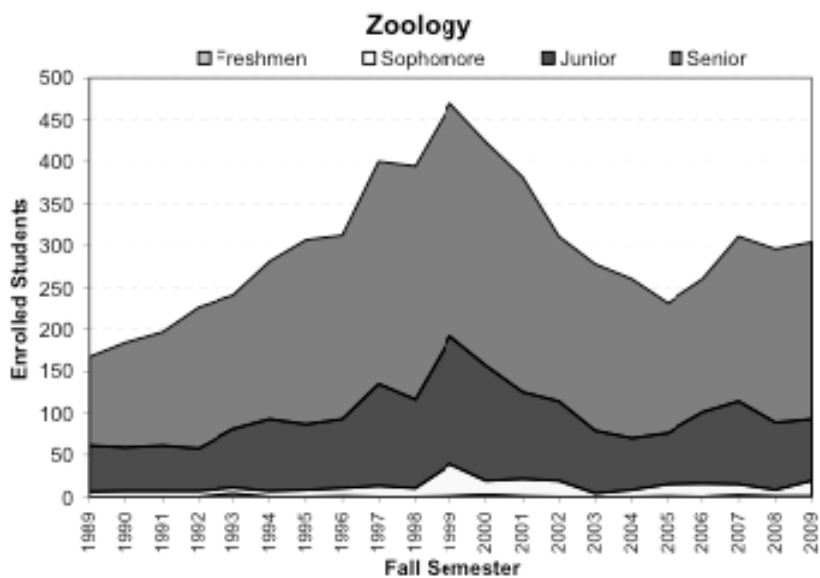
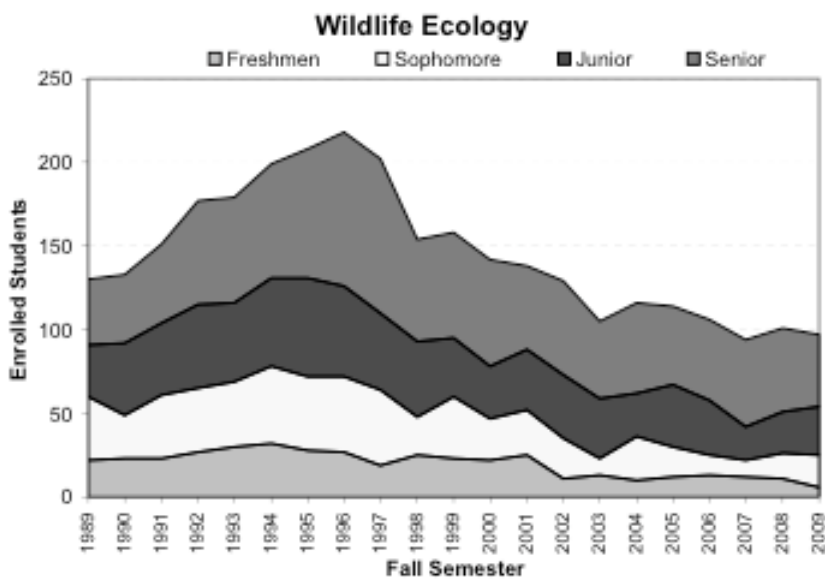
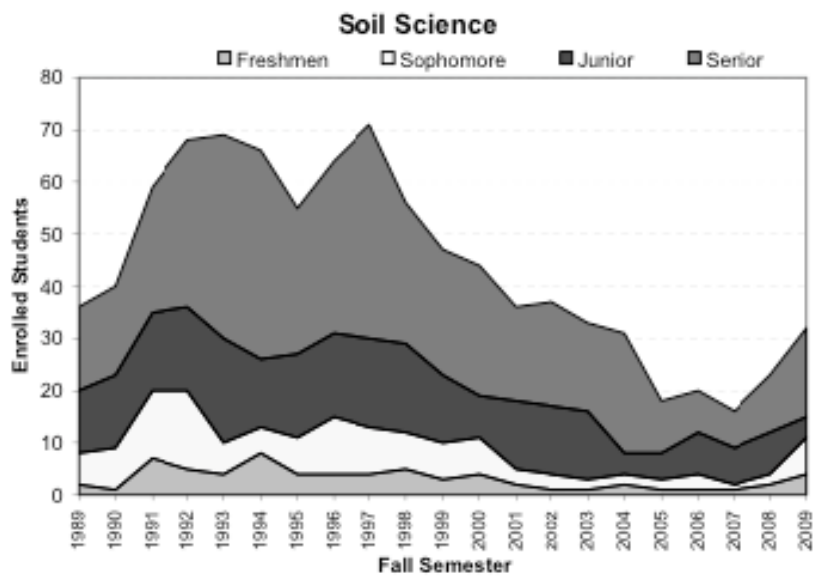


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Appendix 2: BIOLOGY MAJOR ALUMNI SURVEY WINTER 2006-2007

265 people responded to the survey (53% return rate)

1. Overall, how well do you think your education and experiences at UW-Madison prepared you to pursue your professional post-graduate goals?

49.8% ☐ Very well prepared 4.9% ☐ Not too prepared 3.4% ☐ Don't know/Not sure
40.3% ☐ Somewhat prepared 1.5% ☐ Not at all prepared

2. How would you rate your education and experiences in the Biology Major at UW-Madison in helping you develop the following professional skills and attributes?

(Circle the most appropriate response for each item.)

	Poor	Fair	Good	Excellent	Don't Know
a. Laboratory procedure skills	2.7%	18.5%	48.1%	28.8%	1.9%
b. Research (laboratory or field) skills	1.9%	25.0%	38.3%	31.4%	3.4%
c. Problem solving skills	0.4%	8.0%	42.2%	48.1%	1.1%
d. Critical thinking skills	0.8%	6.8%	39.0%	52.3%	0.8%
e. Ability to work as a team member	0.8%	9.1%	37.1%	52.3%	0.8%
f. Written communication skills	1.1%	16.3%	42.6%	39.5%	0.4%
g. Oral communications skills	3.0%	26.1%	40.5%	29.9%	0.4%
h. Leadership skills	4.2%	23.5%	41.7%	28.8%	1.9%
i. Commitment to life-long learning	1.5%	6.4%	34.8%	54.9%	2.3%

3. How would you rate each of the following aspects of advising you received at UW-Madison? (Circle the most appropriate response for each item.)

(% in parentheses excludes Not Applicable answer)

	Poor	Fair	Good	Excellent	Don't Know	Not Applicable
a. Quality of advising overall	21.2% (21.4%)	36.4% (36.8%)	27.3% (27.6%)	11.4% (11.5%)	2.7% (2.7%)	1.1%
b. Quality of advice from your faculty academic advisor	24.2% (25.1%)	28.8% (29.8%)	25.8% (26.7%)	15.5% (5.3%)	2.3% (2.4%)	3.4%
c. Quality of advice from a faculty member other than your academic advisor	7.2% (8.5%)	15.9% (18.8%)	34.8% (41.2%)	22.0% (26.1%)	4.5% (5.3%)	15.5%
d. Quality of advice from Biology Major Office staff	10.6% (11.5%)	27.3% (29.6%)	25.8% (28.8%)	11.0% (11.9%)	17.4% (18.9%)	0.4%

4. Did the Biology Major at UW-Madison provide you with an adequate breadth of knowledge to prepare you for your post-graduate career?

91.6% ☐ Yes 8.4% ☐ No

5. Did the Biology Major at UW-Madison provide you with an adequate breadth of experience in the biological sciences to prepare you for your post-graduate career?

Appendix 2: BIOLOGY MAJOR ALUMNI SURVEY WINTER 2006-2007

88.5% ☐ Yes

11.5% ☐ No

6. Did you complete the Neurobiology Option within the Biology Major?

10.5% ☐ Yes → go to question 8 on the next page

89.5% ☐ No → go to question 7

7. How well did courses in the following curriculum areas prepare you to achieve your professional post-graduate goals? (% in parentheses excludes Not Applicable answer)

	Poor	Fair	Good	Excellent	Don't Know	Not Applicable
a. 1st semester calculus	14.3% (19.0%)	26.6% (35.4%)	26.2% (34.8%)	6.8% (9.0%)	1.3% (1.7%)	24.9%
b. Statistics (if taken)	1.7% (2.3%)	16.4% (22.5%)	33.6% (46.1%)	20.3% (27.8%)	0.9% (1.2%)	27.2%
c. 2nd semester calculus (if taken)	7.5% (19.3%)	9.3% (24.0%)	16.3% (42.0%)	5.3% (13.7%)	0.4% (1.0%)	61.2%
d. Introductory Biology Option A: (Biology/Botany/Zoology 151 & 152)	1.3% (2.0%)	8.7% (13.1%)	31.2% (47.1%)	25.1% (37.9%)	0.0% (0.0%)	33.8%
e. Introductory Biology Option B: (Biocore)	0.0% (0.0%)	2.7% (11.7%)	7.7% (33.5%)	12.6% (54.8%)	0.0% (0.0%)	77.0%
f. Introductory Biology Option C: (Biology/Zoology 101& 102, Biology/Botany 130)	0.9% (2.7%)	5.3% (16.0%)	17.6% (53.2%)	9.3% (28.1%)	0.0% (0.0%)	67.0%
g. Foundational Courses in Genetics (if taken)	4.7% (5.8%)	18.8% (23.2%)	30.8% (37.9%)	26.5% (32.6%)	0.4% (0.5%)	18.8%
h. Foundational Courses in Biochemistry (if taken)	1.3% (1.8%)	9.4% (12.9%)	28.6% (39.1%)	33.8% (42.6%)	0.0% (0.0%)	26.9%
i. Intermediate/advanced Biology, Category A: Cellular and Subcellular Biology	0.4% (0.5%)	7.8% (10.0%)	30.3% (38.7%)	35.5% (45.3%)	4.3% (5.5%)	21.6%
j. Intermediate/advanced Biology, Category B: Organismal Biology	0.0% (0.0%)	6.9% (9.0%)	31.9% (40.9%)	32.3% (42.2%)	6.0% (7.8%)	22.8%
k. Intermediate/advanced Biology, Category C: Ecology	5.5% (6.9%)	16.9% (21.2%)	31.4% (39.4%)	24.6% (30.9%)	1.3% (1.6%)	20.3%
l. Intermediate/advanced Biology, Category D: Evolution and Systematics	3.9% (5.6%)	15.5% (22.1%)	30.5% (43.5%)	15.0% (21.4%)	5.2% (7.4%)	30.0%
m. Intermediate/advanced Biology, Category E: Applied Biology, Agriculture and Natural Resources	0.9% (1.5%)	14.2% (24.1%)	23.7% (40.2%)	15.5% (26.3%)	4.7% (8.0%)	40.9%
n. Independent / Mentored Laboratory and Field Research Experience (CAPSTONE course if you were in CALS)	1.3% (1.8%)	9.5% (13.3%)	13.8% (19.4%)	45.7% (64.2%)	0.9% (1.3%)	28.9%

Appendix 2: BIOLOGY MAJOR ALUMNI SURVEY WINTER 2006-2007

→ If you answered question 7 go to question 9 on the bottom of the next page.

8. FOR THOSE WHO COMPLETED THE NEUROBIOLOGY OPTION: How well did courses in the following curriculum areas prepare you to achieve your professional post-graduate goals? (% in parentheses excludes Not Applicable answer)

28 respondents for this question

	Poor	Fair	Good	Excellent	Don't Know	Not Applicable
a. 1st semester calculus	14.8% (18.2%)	29.6% (36.4%)	22.2% (27.3%)	11.1% (13.6%)	3.7% (4.5%)	18.5%
b. Statistics (if taken)	7.4% (14.3%)	3.7% (7.1%)	11.1% (21.4%)	22.2% (42.9%)	7.4% (14.3%)	48.1%
c. 2nd semester calculus (if taken)	11.5% (25.0%)	11.5% (25.0%)	11.5% (25.0%)	3.8% (8.3%)	7.7% (16.7%)	53.8%
d. Introductory Biology Option A: (Biology/Botany/Zoology 151 & 152)	0.0% (0.0%)	7.4% (10.5%)	37.0% (52.6%)	25.9% (35.8%)	0.0% (0.0%)	29.6%
e. Introductory Biology Option B: (Biocore)	0.0% (0.0%)	7.4% (28.6%)	11.1% (42.9%)	3.7% (14.3%)	3.7% (14.3%)	74.1%
f. Introductory Biology Option C: (Biology/Zoology 101, & 102, Biology/Botany 130)	0.0% (0.0%)	0.0% (0.0%)	3.7% (20.0%)	11.1% (60.0%)	3.7% (20.0%)	81.5%
g. Foundational Courses in Genetics (if taken)	3.7% (4.9%)	18.5% (23.8%)	22.2% (28.6%)	33.3% (42.9%)	0.0% (0.0%)	22.2%
h. Foundational Courses in Biochemistry (if taken)	0.0% (0.0%)	3.7% (7.1%)	11.1% (21.4%)	37.0% (72.4%)	0.0% (0.0%)	48.1%
i. Neuroscience 523 (Neurobiology I)	0.0% (0.0%)	3.7% (3.8%)	14.8% (15.4%)	77.8% (80.0%)	0.0% (0.0%)	3.7%
j. Neuroscience 524 (Neurobiology II)	0.0% (0.0%)	3.6% (3.7%)	10.7% (11.1%)	82.1% (82.5%)	0.0% (0.0%)	3.6%
k. Intermediate/advanced Biology, Category A: Cellular and Molecular Neurobiology	0.0% (0.0%)	15.4% (17.4%)	15.4% (17.4%)	57.7% (65.2%)	0.0% (0.0%)	11.5%
l. Intermediate/advanced Biology, Category B: Systems Neurobiology	0.0% (0.0%)	7.7% (10.0%)	15.4% (20.0%)	53.8% (70.0%)	0.0% (0.0%)	23.1%
m. Intermediate/advanced Biology, Category C: Ecology	15.4% (23.6%)	11.5% (17.6%)	19.2% (29.4%)	19.2% (29.4%)	0.0% (0.0%)	34.6%
n. Intermediate/advanced Biology, Category D: Evolution and Systematics	7.7% (11.1%)	3.8% (5.5%)	30.8% (44.5%)	26.9% (38.9%)	0.0% (0.0%)	30.8%
o. Neuroscience 500 – Undergraduate Neurobiology Seminar	0.0% (0.0%)	3.7% (3.8%)	18.5% (19.2%)	74.1% (76.9%)	0.0% (0.0%)	3.7%
p. Independent/Mentored Laboratory and Field Research Experience (CAPSTONE course if you were in CALS)	0.0% (0.0%)	0.0% (0.0%)	14.8% (19.0%)	63.0% (81.0%)	0.0% (0.0%)	0.0%

Appendix 2: BIOLOGY MAJOR ALUMNI SURVEY WINTER 2006-2007

9. If you rated any of the areas listed in question 7 or in question 8 as “Poor”, please explain why you rated each as “Poor”, otherwise go to question 10 on the next page.

10. Are there any topics not covered in the required curriculum that should be required?

32.3% ☐ Yes → Please specify:

27.2% ☐ No

40.6% ☐ Don't Know/Not Sure

11. How many opportunities were provided in your coursework to gain “hands on” or practical experience?

11.0% ☐ Very few opportunities 56.3% ☐ Some opportunities

32.7% ☐ Ample opportunities

12. If you have you ever enrolled in formal education of any kind since you completed the Biology Major at UW-Madison, please list the degree program(s), major(s) or area(s) of concentration, and institution(s) in which you enrolled.

a. Degree Program (type): _____

b. Institution: _____

c. Major or Area of study: _____

13. Check the answer that best describes your current employment situation.

23.8% ☐ public sector employment → job title: _____

16.1% ☐ private sector employment → job title: _____

2.7% ☐ volunteer or related work → please describe: _____

39.1% ☐ not working yet; enrolled in post-graduate education

11.1% ☐ working part-time while enrolled in post-graduate education

7.3% ☐ other (please specify): _____

14. How well do you think the Biology Major at UW-Madison prepared you for your current employment situation?

39.2% ☐ Very well prepared

6.8% ☐ Not too prepared

40.8% ☐ Somewhat prepared

2.8% ☐ Not at all prepared

10.4% ☐ Don't know/Not sure

15. In the space provided below, please provide any additional comments you feel would be useful, as we review the Biology Major.

Written comments:

Question 2., part a:

- more labs in classes like intro biochem & genetics
- Instead I got a job working at a research lab

Question 3, part a:

- When I requested a bio counselor (sic), I was assigned a professor of literature
- I did not have advisor I know of.
- I had an advisor in CALS and was required to see him 2x's a year. I really think L&S should do this as well.

Question 3, part b:

- Did not receive any counseling from major
- Switched advisor before 4th yr. Previous advisors not helpful.
- Was a plant professor – knew nothing about my interests.

Question 3, part c:

- Catherine Reinitz was very helpful
- Not bio though

Question 4

- Mediocre
- Not sure
- But went into a different field (business)
- I figured it out myself

Question 5

- Mediocre
- Not sure
- What about depth?

Question 10

- More emphasis on ecology/environment should be encouraged.
- I enjoyed the freedom of taking classes I wanted without too many required courses.

Question 11

- Too many work studies, not enough actual lab jobs.
- (Through Biocore) → ample opportunities
- Limnology! Ornithology! LABS!
- Only because I sought out to do mentored lab research.

Question 12, part a

- PhD MPH
- Currently in AmeriCorps & applying to medical school
- Don't wish to say

- Bachelors of Nursing, in progress, exp. Grad 2008

Question 12, part b

- Optometry
- Don't wish to say
- Nursing B.S.
- Doctor of Optomtery
- Public Health

Question 12, part c

- Also worked in a lab as a research assistant for 1 year prior
- Don't wish to say
- Prior to med school Teach for America 00> high school chemistry teacher in Oakland, CA
- Case Western Reserve University
- Both MPH and Nursing

Question 13

- Other → which was interviewing for masters of PA programs
- Currently applying for PhD programs to start fall '07
- Chicago-area hospitals
- Registered Nurse
- Lab Tech II
- Full time 1 year Americorps program in Berkly (sic) California doing health education at West Berkeley family practice (clinic for lower income population)
- Volunteer EMT
- Clincial Study Coordinator for Neuroscience Research
- Biology Teach
- As a Registered Nurse
- Accepted into the Medical School for the fall 2007
- It took me ten months after graduating to get a temp job that I quit after 4 months to go back to school
- UW Hospital
- 90% employed Pharmacist Assistant
- Working full time in I.S. Dept. as clinical systems analyst for UWMF
- Field Museum of Chicago, RIC Chicago
- I start working full-time starting April 17.

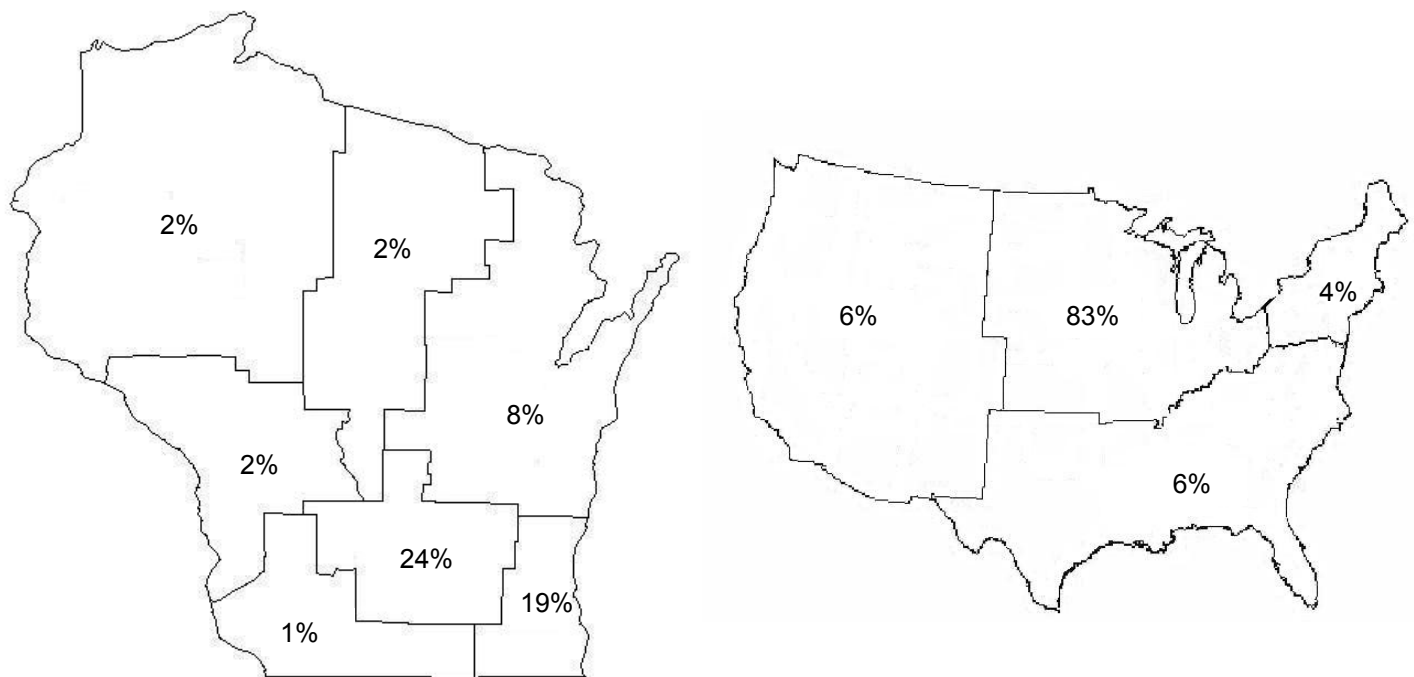


College of Letters and Science

Biology

ALUMNI DEMOGRAPHICS

Years Since Graduation	1-5	6-10	11-15	16-20	>20
Total Alumni	941	143			
% Female	61	63			
% Minority ¹	11	12			
% Targeted Minority ²	5	7			
% Current Address Available ³	98	99			
% Providing Employer Information ⁴	13	27			
% Providing Job Title Information ⁴	16	30			
% Engaged with WAA ⁵	17	27			
% Living in Wisconsin	60	51			

WHERE ALUMNI LIVE (% OF TOTAL)⁶

¹Includes African American, Hispanic, American Indian and all Asian alumni.

²Includes African American, Hispanic, American Indian alumni AND Asian alumni that are Hmong, Vietnamese, Laotian or Cambodian.

³Alumni with "active" addresses are counted. These are addresses that alumni provided themselves or one that was obtained through an address verification service.

⁴Employment information is provided by alumni themselves. The percent shown is those who ever provided employment information.

⁵Alumni that are "engaged" have done at least one of the following in the past five years: donated to WAA, volunteered with WAA, attended a WAA event, or corresponded with WAA.

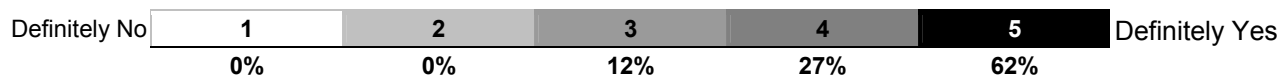
⁶Wisconsin regional county groupings are based on Workforce Development Areas (WDA) utilized by the Wisconsin Department of Workforce Development. U.S. regional state groupings are based on the U.S. Census Bureau.

College of Letters and Science

Biology

Number of Responses = 26

1. Regardless of any financial benefits, has your UW-Madison education improved your quality of life?



2. Which one of the following best describes your current educational status?

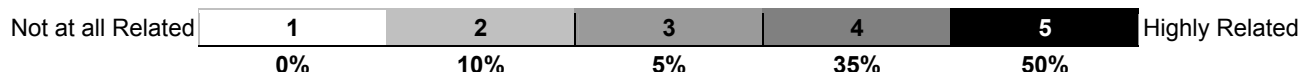
Enrolled full-time in a program leading to another degree	40%
Enrolled part-time in a program leading to another degree	8%
Enrolled in classes not leading to another degree	4%
Not presently enrolled, but plan on taking further coursework	44%
Not presently enrolled and have no plans for further coursework	4%

3. Which one of the following best describes your current employment status?

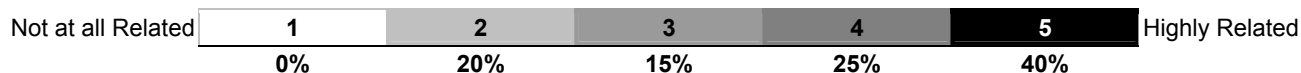
Employed full-time	62%
Employed part-time	15%
Not employed, seeking employment	4%
Not employed, not seeking employment	19%

The following questions were asked of the respondents who were/are employed.

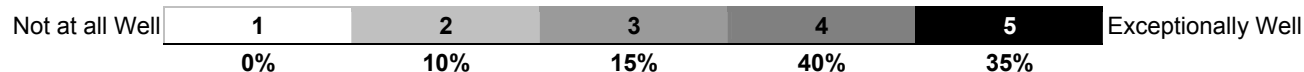
4. For your current position, how applicable is the skill set you developed at UW-Madison (verbal and written communication skills, problem solving skills etc.)?



5. How closely related is your current position to the curriculum of the major/field in which you received your most recent UW-Madison degree?



6. How well did your academic experiences at UW-Madison prepare you for your current position?



7. For the most recent year, what was the annual income/salary of your current position? (If you are working part-time, estimate your salary at a full-time rate.)

Less than \$30,000	\$30,000-\$59,000	\$60,000-\$89,000	\$90,000 or more
45%	45%	0%	10%

⁷These questions were asked of alumni receiving bachelors degrees in the last 10 years when alumni updated personal information on WAA's website. Collection of survey information started in July 2006 and is ongoing. Totals may not add to 100% due to rounding and/or because a few respondents checked an "other" response option and these are not shown.

About the Alumni Profile

Sources: Wisconsin Alumni Association – Address, employment, WAA engagement and survey responses as of 2/25/2008. UW-Madison Infoaccess awards data views – degree and program, race/ethnicity, gender.

Appendix 4

2010 CALS vs. Departmental Student Satisfaction with Advising

Item	Question/Topic	Percent of Students By Category In:									
		Biology Major (n = 132)					CALS (n = 678)				
		Extremely Satisfied	Somewhat Satisfied	Neither	Somewhat Dissat.	Extremely Dissat.	Extremely Satisfied	Somewhat Satisfied	Neither	Somewhat Dissat.	Extremely Dissat.
6	How would you evaluate your overall experiences with advising in CALS?	24	36	13	18	10	36	35	10	13	7

7	How much do you agree or disagree with the following about your current CALS advisor?	Biology Major (n = 132)					CALS (n = 678)				
		Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
a	My advisor shows interest in me as a person	38	33	9	12	9	47	30	7	10	6
b	My advisor is a good listener	43	31	12	12	3	51	28	9	8	3
c	My advisor makes an effort to understand my interests and goals	41	32	10	9	9	51	26	9	9	5
d	My advisor seems to remember or keep track of our previous meetings	26	29	17	13	15	34	29	15	13	9
e	My advisor is available when I need assistance	43	28	12	12	5	52	26	10	8	5
f	My advisor knows enough about my interests to advise me effectively	23	31	16	14	16	38	28	14	12	9
g	My advisor is willing to spend as much time with me as is necessary	35	29	18	9	9	46	26	15	7	6
h	My advisor gives a high priority to advising	35	25	16	11	13	42	23	16	9	10
i	My advisor is knowledgeable about my requirements and courses	40	20	12	12	17	53	23	10	9	7
j	My advisor is knowledgeable about courses outside my major area of study	20	30	25	8	17	29	27	21	13	10
k	My advisor seems to want to make my decisions for me	5	11	13	26	45	7	10	16	31	36
l	My advisor just signs my forms and sends me on my way	8	11	20	21	40	7	11	14	24	45
m	My advisor helps me if I am having trouble with a particular course or instructor	13	12	52	11	13	14	16	51	12	6
n	My advisor knows enough about me to write a letter of recommendation	12	17	18	24	29	21	20	18	20	20
o	My advisor responds to my phone or email messages in a timely manner	34	36	14	7	9	51	27	9	5	8
p	My advisor is a helpful, effective advisor whom I would recommend to other students	35	25	11	12	19	44	22	12	11	12
q	My advisor encourages me to assume an active role in planning my academic program	34	31	18	10	8	45	31	14	6	4
r	My advisor seems to enjoy advising	34	28	20	10	9	44	25	16	8	8
s	My advisor challenges me to make the most of academic opportunities	28	30	21	9	13	37	28	20	9	6

8	How IMPORTANT to you are each of the following advising services and characteristics?	Biology Major (n = 132)					CALS (n = 678)				
		Essential	Somewhat Important	Not Very Important	Not at All Important	Essential	Somewhat Important	Not Very Important	Not at All Important	Essential	Not at All Important
a	Help with course selection	63	29	7	2	66	30	4	1		
b	Help with meeting major requirements	80	15	4	2	79	17	3	1		
c	Help with finding opportunities for internships, research experience and independent study	55	38	5	3	55	39	4	2		
d	Help with thinking about career possibilities	51	36	8	5	56	36	6	3		
e	Help with thinking about international study opportunities	17	45	31	8	22	44	26	8		
f	Help with thinking about post-graduate educational possibilities	57	34	7	3	54	35	7	3		
g	Referral to other academic resources	46	47	5	2	43	46	8	2		
h	Talking about personal problems	3	28	39	31	6	24	41	30		
i	Referral to help with personal problems	9	31	40	20	9	31	38	22		
j	Help with coping with academic difficulties	30	48	17	6	27	50	18	6		
k	Encourage student to take an active role in planning academic programs	42	44	12	2	44	44	10	2		
l	Challenge student to make the most of academic opportunities	51	43	5	2	55	39	5	1		

m	Showing interest in student as a person			55	37	6	3	69	27	3	1
n	Be promptly available when student needs assistance			67	30	3	1	71	27	2	1

9 How would you ASSESS the following aspects of advising you have experienced in CALS?											
	Excellent	Very Good	Good	Fair	Poor	Excellent	Very Good	Good	Fair	Poor	
a) Assessment of help with course selection	19	27	25	16	13	34	26	20	13	7	
b) Assessment of help with understanding major requirements	27	23	26	14	11	41	25	18	12	5	
c) Assessment of help with finding opportunities for internships, etc.	10	14	36	22	18	19	23	26	20	12	
d) Assessment of help with thinking about career possibilities	11	17	37	17	18	18	23	29	18	13	
e) Assessment of help with thinking about international study opportunities	7	15	36	24	18	12	17	30	25	17	
f) Assessment of help with thinking about post-graduate educational possibilities	11	22	35	18	14	18	21	29	19	14	
g) Assessment of referral to programs for academic help	13	22	32	17	17	15	23	29	20	13	
h) Assessment of referral to help with personal problems	9	18	26	24	22	8	14	36	25	16	
i) Assessment of help with coping with academic difficulties	12	20	32	18	18	13	21	33	20	13	

10 What do you EXPECT from your CALS advisor?											
	Definitely Should	Probably Should	Probably Should not	Definitely Should not	Definitely Should	Probably Should	Probably Should not	Definitely Should not	Definitely Should	Probably Should	Probably Should not
a) Help me select courses	57	38	5	0	66	31	2	0			
b) Help me understand major requirements	89	11	0	0	94	6	0	0			
c) Help me find opportunities for internships, research experience, and independent study	46	54	0	0	48	51	2	0			
d) Help me think about career possibilities	53	44	3	0	60	38	1	0			
e) Help me think about international study opportunities	20	71	9	0	26	63	9	1			
f) Help me think about post-graduate educational possibilities	55	43	2	0	55	42	3	0			
g) Refer me to programs for academic help	56	43	1	0	47	49	3	0			
h) Talk with me about my personal problems	7	33	47	12	7	27	52	15			
i) Refer me to people or programs that can help me with my personal problems	17	63	13	7	17	54	24	7			
j) Help me cope with academic difficulties	33	61	5	1	33	56	9	2			
k) Encourage me to take an active role in planning my academic programs	61	37	2	0	65	33	2	0			
l) Challenge me to make the most of academic opportunities	63	37	0	0	69	30	1	0			
m) Show an interest in me as a person	59	38	3	0	66	31	2	0			
n) Be promptly available to me when I need assistance	67	32	1	0	70	29	1	0			

11 How much do you agree or disagree with these statements regarding your experience with advising in CALS?											
	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree	
a) I come prepared for meetings with my advisor	72	26	2	0	0	77	21	1	1	0	
b) I would not see my advisor if I did not have to in order to register	6	13	21	35	24	9	15	19	32	24	
c) I have a pretty definite idea of what career I want	42	29	11	9	8	35	36	12	12	6	
d) I have a pretty definite plan for completing graduation requirements	50	35	6	9	0	55	32	6	5	2	
e) I get as much help in planning my academic program from other students as from my advisor	24	29	27	16	3	27	27	21	18	7	
f) I would be comfortable asking my advisor for help with non-academic problems	9	21	16	21	32	11	21	20	26	22	
g) I regard my advisor as a mentor	10	22	26	15	27	18	26	23	16	18	
h) I have met with my advisor at times other than when it is time to register for next semester	26	26	10	21	16	30	27	9	16	19	
i) I would describe my advising experience as collaborative	19	35	23	7	15	32	35	16	9	8	

12 How much do you think each of the changes would improve advising of CALS students?											
	A great Deal	Some	Only a Little	Not at all	A great Deal	Some	Only a Little	Not at all			
a) Offering more group advising sessions	15	46	20	18	13	38	29	21			
b) Provide students with handbook containing information on CALS policies and procedures	27	43	26	5	24	40	25	11			
c) Having full-time advisors, rather than faculty members, assist with course planning	51	25	19	5	41	26	20	13			
d) Make seeing advisors voluntary, not mandatory	9	24	28	39	9	19	26	46			
e) Requiring students to have more contact with advisors	27	35	25	13	22	39	26	13			
f) Put more resources on the Web so contact with advisors for routine matters is unnecessary	28	36	21	15	26	34	25	16			
g) Make it easier for students to change to a new advisor when dissatisfied with their advisor	53	41	6	0	53	35	9	3			

Note: Some respondents did not answer every question

Appendix 5

Governance and Operating Procedures of the Biology Major

I. Eligibility for Participation in the Biology Major

All faculty in the Biological Sciences Division and faculty in other divisions who are actively involved in research and teaching in the life sciences are eligible to advise students after appropriate training. Academic Staff active in life sciences or involved in teaching or advising of students in life sciences can also be advisors. All advisors shall constitute the Biology Major Council.

II. Governance

The governance of the Biology Major shall be vested in an Executive Committee elected by the Council and approved by the Deans of CALS and L&S. No School or College can have more than five members on the Executive Committee. The Biology Major staff advisors are also voting ex officio members of the executive committee. Additional voting ex officio members will be added to represent tracks within the major. The Executive Committee shall meet at least once per semester.

III. Co-Chairs

Co-Chairs are selected from among the Executive Committee by the Deans of CALS and L&S (one Co-Chair from each college) based on a preference ballot by the Executive Committee conducted in the Spring semester. While preference ballots shall be cast annually, it is anticipated that Co-Chairs will serve for three years and may serve two consecutive terms for a maximum of six years.

IV. Executive Committee

A. The Executive Committee is composed of nine advisors within the major elected to three year terms plus the permanent, voting, ex officio Biology Advisor and additional voting ex officio members representing the tracks in the major. The terms of the elected members are staggered so that three members are elected each year. Nominations for the Executive Committee shall be solicited from among the Council and a slate selected from among the nominees. In selecting nominees the Executive Committee shall consider the interests of the candidates to work toward breadth of the Executive Committee. Advisors can serve up to six consecutive years and thereafter can be reelected after being off the Executive Committee for three years.

B. The executive committee will carry out the quasi-departmental functions associated with the Biology Major. These include periodic re-evaluation of curriculum requirements and courses appropriate for item 5 (Intermediate/advanced courses); handling of special cases, appeals and exceptions; recruitment of advisors; and so on.

C. The executive committee will also consult with existing or proposed programs, such as the Molecular Biology Major or the Neurosciences initiative, that might wish to establish themselves as "tracks" with the Biology Major. Proposals for such tracks within the Biology Major would then be referred to the CALS and L&S colleges for evaluation and approval.

V. Committees

The Executive Committee may set up committees as needed such as a curriculum committee, committee for tracks within the major, an honors committee, and a committee to approve exceptions to requirements in the major. Chairs of committees shall be drawn from the Executive Committee but other members need not be from the executive Committee.

Appendix 6. Biology Major Curriculum

In addition to fulfilling all University and College requirements, students must fulfill the following requirements for the Biology Major.

1. Mathematics [Math 171: Calculus with Algebra and Trigonometry I \(5 cr\)](#) and [Math 217: Calculus with Algebra and Trigonometry \(5 cr\)](#) OR [Math 221: Calculus and Analytic Geometry \(5 cr\)](#)

AND

[Math 222: Calculus and Analytic Geometry \(5 cr\)](#) OR Stat 301: Intro to Statistical Methods (3 cr), OR Stat 371: Intro to Applied Statistics for the Life Sciences (3 cr)

2. Chemistry a. General Chemistry

[Chem 103](#) and [104](#): General Chemistry (4 cr, 5 cr) OR [Chem 109: General and Analytical Chemistry](#) (5 cr)

Some medical schools require two semesters of inorganic chemistry.

b. Organic Chemistry

[Chem 343: Intro Organic Chemistry](#) (3 cr) and [Chem 344: Intro Organic Chemistry Lab](#) (2 cr) and [Chem 345: Intermediate Chemistry](#) (3 cr)

3. Physics Physics 103 and 104: General Physics (4 cr each) OR Physics 201 and 202: General Physics (5 cr each) OR Physics 207 and 208: General Physics (5 cr each)

Some biological science majors require the calculus-based physics courses - 201/202 or 207/208.

BIOLOGY COURSES

(The total number of credits in sections 4, 5, and 6 must equal at least 31.)

4. Introductory Biology

[Which Intro Biology Course](#) is available as a guide for students choosing courses in selected biological sciences.

Option A: [Biology/ Botany/ Zoology 151 and 152: Intro Biology \(5 cr each\)](#) plus one foundational course. (The wait list link for 151 and 152 is indicated in a footnote on the course timetable pages.)

Option B: [Biocore 301: Evolution, Ecology, and Genetics \(3 cr\)](#), [Biocore 303: Cellular Biology \(3 cr\)](#), [Biocore 323: Organismal Biology \(3 cr\)](#), and [Biocore 333: Biological Interactions \(3 cr\)](#)

AND two of the following laboratory courses:

[Biocore 302: Evolution, Ecology, and Genetics Lab \(2 cr\)](#), [Biocore 304: Cellular Biology Lab \(2 cr\)](#), [Biocore 324: Organismal Biology Lab \(2 cr\)](#)

(Students who use Biocore 302 and 304 to fulfill the introductory biology requirement can use Biocore/ Biology 324 to fulfill the intermediate lab or field course requirement described in part 5. Biocore courses fulfill both introductory and foundational course requirements.)

[Biocore](#) is highly selective and based on applications due in mid-March. You may pick up an application from the Biocore office (345 Noland Hall), or call 262-5979 for more information.

Option C: Biology/ Zoology 101: Animal Biology (3 cr), Biology/ Zoology 102: Animal Biology (2 cr), [Biology/ Botany 130: General Botany \(5 cr\)](#) plus one foundational course.

Advancement Placement: If your AP Biology exam score was 4 or 5, you may be able to place out of some introductory courses. See the AP policy [document](#).

Foundational Courses

(The course used to satisfy this requirement does not count toward requirement 5):

Genetics

Botany/Genetics/Zoology 466: General Genetics

Microbio 470 (formerly 370): Microbial Genetics and Molecular Machines

Agronomy 338: Plant Breeding and Biotechnology

Biochemistry

[Biochem 501: Introduction to Biochemistry](#)

[Bmolchem 503: Human Biochemistry](#)

(Students are best prepared for graduate study or professional school by taking both a genetics course and a biochemistry course. A second course taken from this list will count toward requirement 5.)

5. Intermediate/advanced Biology (13 credits minimum)

A minimum of **three courses** (at least 13 credits) at the intermediate/advanced level, selected from **three of the five areas listed** below, are needed to satisfy the biology breadth requirement. These courses must include **one or more lab or field courses with a total of 3 hours or more per week of laboratory/field instruction**. At least one course must be from category "a" or "b" and at least one course must be from category "c" or "d." The third required course may be selected from any of the five categories not previously chosen. The course or courses used to satisfy any category must be at least, or

add up to, 2 credits. Overall, the courses taken should span plant, animal and microbial biology topics.

In accumulating other biology credits toward the total credits required for their degrees (120 in L&S and 124 in CALS), students, in consultation with their advisors, will have the opportunity to specialize or to take many biology intermediate/advanced courses of interest to them. All courses listed below have prerequisites that would be satisfied by the general requirements of the Biology Major. Other courses may also be appropriate and can be approved on a case-by-case basis.

NOTE: The following lists of courses are subject to modification. Please consult with your advisor.

- a. [Cellular and Subcellular Biology](#)
- b. [Organismal Biology](#)
- c. [Ecology](#)
- d. [Evolution and Systematics](#)
- e. [Applied Biology, Agriculture and Natural Resources](#)

6. A Laboratory or Field Research Experience (2 credits minimum)

Additional laboratory or field research experience is required. Two credits of directed study or research-based senior thesis in a biological science discipline can count. With advisor approval, these courses can also fulfill the CALS requirement for a capstone experience. 699 credits received simultaneously or prior to introductory biology (section 4 above), such as those received for Biology 152, cannot fulfill these requirements. Also, experiences that are focused on teaching assistance, even if the course number used is a 699 course, are not appropriate. This requirement can also be fulfilled with one or more intermediate/advanced laboratory or field biology courses involving a total of at least of 3 hours/week of lab or field instruction beyond that done for requirement 5. "Hours/week" refers to a normal 16-week semester and courses taken in other formats may be substituted where the total time commitment is equivalent. However, only a subset of the lab/field courses automatically fulfills the CALS requirement for a capstone experience. See capstone policy and list of approved [courses](#).

The credits taken for requirements 5 and 6 must equal at least 15 and satisfy college requirements for 15 course credits in the [major in residence](#).

Appendix 7. Curriculum for the Biology Major with a Neurobiology Option

In addition to fulfilling all University and College requirements, students must fulfill the following major requirements.

1. Mathematics. [Math 171: Calculus with Algebra and Trigonometry I \(5 cr\)](#) and [Math 217: Calculus with Algebra and Trigonometry II \(5 cr\)](#) OR [Math 221: Calculus and Analytic Geometry \(5 cr\)](#)

AND

[Math 222: Calculus and Analytic Geometry \(5 cr\)](#) OR Stat 301: Introduction to Statistical Methods (3 cr) OR Stat 371: Introduction to Statistics for the Life Sciences (3 cr)

(Some biological sciences majors require Math 222.)

2. Chemistry. a. General Chemistry:
[Chem 103](#) and [104](#): General Chemistry (4 cr, 5 cr) OR [Chem 109: General and Analytical Chemistry](#) (5 cr)

(Some medical schools require two semesters of inorganic chemistry.)

b. Organic Chemistry:
[Chem 343: Intro Organic Chemistry](#) (3 cr) and [Chem 344: Intro Organic Chemistry Lab](#) (2 cr) and [Chem 345: Intermediate Chemistry](#) (3 cr)

3. Physics

Physics 103 and 104: General Physics (4 cr each) OR Physics 201 and 202: General Physics (5 cr each) OR Physics 207 and 208: General Physics (5 cr each)

(Some biological science majors require calculus-based physics courses.)

BIOLOGY COURSES

(The total number of credits in sections 4, 5, 6, and 7 below must equal at least 31.)

4. Introductory Biology Courses

Option A:

[Biology/ Botany/ Zoology 151 and 152: Introductory Biology \(5 cr\)](#) plus one foundational course.

Option B:

[Biocore 301: Evolution, Ecology, and Genetics \(3 cr\)](#), [Biocore 303: Cellular Biology \(3 cr\)](#), [Biocore 323: Organismal Biology \(3 cr\)](#), [Biocore 333: Biological Interactions \(3 cr\)](#)

AND two of the following laboratory courses:

[Biocore 302: Evolution, Ecology, and Genetics Lab \(2 cr\)](#), [Biocore 304: Cellular Biology Lab \(2 cr\)](#), [Biocore 324: Organismal Biology Lab \(2 cr\)](#)

(Students who use Biocore 302 and 304 to fulfill the introductory biology requirement can use Biocore 324 to fulfill the intermediate lab or field course requirement described in part 5 below.)

Option C:

Biology/ Zoology 101: Animal Biology (3 cr), Biology/ Zoology 102: Animal Biology Lab (2 cr), [Biology/ Botany 130: General Botany \(5 cr\)](#) plus one foundational course.

Advancement Placement: If your AP Biology exam score was 4 or 5, you may be able to place out of some introductory courses. See the AP policy [document](#).

Foundational Courses

Genetics

Botany/Genetics/Zoology 466: General Genetics

[Microbio 470 \(formerly 370\): Microbial Genetics and Molecular Machines](#)

Agronomy 338: Plant Breeding and Biotechnology

(The course used to satisfy this requirement does not count toward requirement 5):

(Students are best prepared for graduate study or professional school by taking both a genetics course and a biochemistry course.)

Biochemistry

[Biochem 501: Introduction to Biochemistry](#)

[Bmolchem 503: Human Biochemistry](#)

5. Intermediate/advanced courses (13 credits minimum)

Required:

Neuroscience/Psychology/Zoology 523: Neurobiology I AND

Neuroscience/Psychology/Zoology 524: Neurobiology II

(It is VERY USEFUL to take a second semester physics course, which covers electricity, prior to taking Neurobiology 523. THIS MEANS DOING THIS IN THE SOPHOMORE YEAR.)

At least 13 intermediate/advanced level credits are needed to satisfy the biology breadth requirement. In addition to the above two required courses, students must take a minimum of three more courses: one from category “a”, one from category “b” and one from categories “c” or “d”. The course or courses used to satisfy any category must be at least, or add up to, 2 credits. At least three hours per week of laboratory/field instruction

from a course or courses in a) through f) must be taken. Additional courses taken from a-f can be taken to fulfill the 31 credit requirement.

NOTE: The following lists of courses are subject to modification. Please consult with your advisor.

[a. Cellular and Molecular Neurobiology](#)

[b. Systems Neurobiology](#)

[c. Ecology](#)

[d. Evolution and Systematics](#)

[e. Applied Biology, Agriculture and Natural Resources](#)

[f. Other Lab Courses](#)

Intermediate/Advanced Courses for the Biology Breadth Requirement (see requirement #5). In accumulating other biology credits toward the total credits required for their degrees (120 in L&S and 124 in CALS), students, in consultation with their advisors, will have the opportunity to take many biology electives of interest to them. All courses listed below have prerequisites that would be satisfied by the general requirements of the Biology major. Other courses may also be appropriate and can be approved on a case-by-case basis. Many courses are given in alternate years. Also, new courses are regularly added to the curriculum so you should always consult the website (Student Resources) to see what is actually available in any particular semester.

6. Independent research or laboratory experience (2 credits, minimum)

Additional laboratory or field research experience is required. Two credits of directed study or research-based senior thesis in a biological science discipline can count. With advisor approval, these courses can also fulfill the CALS requirement for a capstone experience. 699 credits received simultaneously or prior to introductory biology (section 4 above), such as those received for Biology 152, cannot fulfill these requirements. Also, experiences that are focused on teaching assistance, even if the course number used is a 699 course, are not appropriate. This requirement can also be fulfilled with one or more intermediate/advanced laboratory or field biology courses involving a total of at least of 3 hours/week of lab or field instruction beyond that done for requirement 5. "Hours/week" refers to a normal 16-week semester and courses taken in other formats may be substituted where the total time commitment is equivalent. However, only a subset of the lab/field courses automatically fulfills the CALS requirement for a capstone experience. See capstone policy and list of approved [courses](#). We expect that most students who choose to concentrate in neurobiology will be interested in an independent research experience in one of the many laboratories on campus. Indeed, we strongly urge all concentrators to do a senior thesis or independent research.

[Faculty interested in Taking Students for Work or Independent Study Credits](#)

The credits taken for requirements 5 and 6 must equal at least 15 and satisfy college requirements for 15 course credits in the [major in residence](#).

7. Neurosci 500: Undergraduate Neurobiology Seminar (1 credit)

This seminar will provide a weekly research seminar given by UW-Madison faculty active in Neurobiology or by students in the major and directed specifically to undergraduates. It will give those Biology Majors who choose the Neurobiology Option an orientation to the wide range of research questions in modern neurobiology at UW-Madison as well as provide a weekly social gathering. This seminar is best taken in the second semester of your junior year or first semester of your senior year.

Appendix 8. Curriculum for the Biology Major with an Evolutionary Biology Option

In addition to fulfilling all University and College requirements, students must fulfill the following major requirements.

1. Mathematics

[Math 171: Calculus with Algebra and Trigonometry I \(5 cr\)](#) and [Math 217: Calculus with Algebra and Trigonometry II \(5 cr\)](#) OR [Math 221: Calculus and Analytic Geometry \(5 cr\)](#)

AND

Stat 301: Introduction to Statistical Methods (3 cr) OR Stat 371: Introduction to Statistics for the Life Sciences (3 cr)

(Because some graduate programs require a second semester of Calculus, Math 222 is recommended, as an additional course)

2. Chemistry

a. General Chemistry:

[Chem 103](#) and [104](#): General Chemistry (4 cr, 5 cr) OR [Chem 109: General and Analytical Chemistry](#) (5 cr)

b. Organic Chemistry:

[Chem 343: Intro Organic Chemistry](#) (3 cr) and [Chem 344: Intro Organic Chemistry Lab](#) (2 cr) and [Chem 345: Intermediate Chemistry](#) (3 cr)

3. Physics

Physics 103 and 104: General Physics (4 cr each) OR Physics 201 and 202: General Physics (5 cr each) OR Physics 207 and 208: General Physics (5 cr each)

BIOLOGY COURSES

(The total number of credits in sections 4, 5, 6, and 7 below must equal at least 31.)

4. Introductory Biology Courses

Option A:

[Biology/ Botany/ Zoology 151 and 152: Introductory Biology \(5 cr\)](#)

Option B:

[Biocore 301: Evolution, Ecology, and Genetics \(3 cr\)](#), [Biocore 303: Cellular Biology \(3 cr\)](#), [Biocore 323: Organismal Biology \(3 cr\)](#), [Biocore 333: Biological](#)

Interactions (3 cr)

AND the laboratory course [Biocore 302: Evolution, Ecology, and Genetics Lab \(2 cr\)](#) AND [Biocore 304: Cellular Biology Lab \(2 cr\)](#) OR [Biocore 324: Organismal Biology Lab \(2 cr\)](#)

(Students who use Biocore 302 and 304 to fulfill the introductory biology requirement can use Biocore 324 to fulfill the intermediate lab or field course requirement described in part 5 below. Biocore courses fulfill both introductory and foundational course requirements.)

Option C:

Biology/ Zoology 101: Animal Biology (3 cr), Biology/ Zoology 102: Animal Biology Lab (2 cr), [Biology/ Botany 130: General Botany \(5 cr\)](#)

Advancement Placement: If your AP Biology exam score was 4 or 5, you may be able to place out of some introductory courses. See the AP policy [document](#).

Foundational Course

(Does not count toward requirement 5; course not required for those taking Option B to satisfy Introductory Biology)

Botany/Genetics/Zoology 466: General Genetics

(Because some graduate programs require biochemistry, either Biochem 501: Intro to Biochemistry or Biochem 503: Human Biochemistry is recommended as an additional course and will count towards category "a" of requirement 5.)

5. Intermediate/advanced courses (13 credits minimum)

Required:

Anthro/Botany/Zoology 410: Evolutionary Biology (3 cr)

A minimum of three additional courses at the intermediate/advanced level, selected from the areas listed below, are needed to satisfy the evolutionary biology breadth requirement. These courses must include at least one lab or field course with 3 hours or more per week of laboratory/field instruction. At least one course must be from categories "a" or "b", one must be from category "c" (Botany/Zoology 460: Ecology is recommended), and one must be from category "d". The courses satisfying these areas are the same as those accepted by the general biology major.

In accumulating other biology credits toward the 31 credit Biology requirement, students, in consultation with their advisors, will be encouraged to take additional intermediate/advanced courses from categories "a" through "e" related to evolutionary biology.

[a. Cellular and Subcellular Biology](#)

[b. Organismal Biology](#)

[c. Ecology](#)

[d. Evolution and Systematics](#)

[e. Applied Biology, Agriculture and Natural Resources](#)

6. Independent research or laboratory experience (2 credits, minimum)

Additional laboratory or field research experience is required. Two credits of directed study or research-based senior thesis in a biological science discipline can count. With advisor approval, these courses can also fulfill the CALS requirement for a capstone experience. 699 credits received simultaneously or prior to introductory biology (section 4 above), such as those received for Biology 152, cannot fulfill these requirements. Also, experiences that are focused on teaching assistance, even if the course number used is a 699 course, are not appropriate. This requirement can also be fulfilled with one or more intermediate/advanced laboratory or field biology courses involving a total of at least of 3 hours/week of lab or field instruction beyond that done for requirement 5. "Hours/week" refers to a normal 16-week semester and courses taken in other formats may be substituted where the total time commitment is equivalent. However, only a subset of the lab/field courses automatically fulfills the CALS requirement for a capstone experience. See capstone policy and list of approved [courses](#).

The credits taken for requirements 5 and 6 must equal at least 15 and satisfy college requirements for 15 course credits in the [major in residence](#).

7. Biology 675: Undergraduate Evolutionary Biology Seminar (1 credit)

This seminar will involve attending the weekly research seminar given in the Evolution Seminar Series and then participating in a roundtable discussion. It will give those Biology Majors who choose the Evolutionary Biology Option an orientation to the range of research questions and methods used in Evolutionary Biology, as well as providing a weekly social gathering. This seminar is best taken in the second semester of your junior year or in your senior year.

Appendix 9. Enrollment of Biology Majors in Category 5 Intermediate/Advanced Courses.

Category 5A. Cellular and subcellular biology

Count of Term	
Course Title	Total
Advanced Microbial Genetics	13
Bacterial Genetics	52
Biochem Mech-Regulatn/Cell	1
Biochemical Methods	44
Biochm Prin-Human&Anml Nutr	35
Biology of Viruses	120
Brain Cell Cultres&Imagng:Lab	10
Brain Cell Cultures:Lab Course	18
Cell Biology	411
Cellular&Molecular Neurosci	75
Cellulr Signal Transductn Mech	25
Clinical Nutrition	6
Coenzymes&Cofactrs-Enzymlgy	1
Development of Nervous Sys	113
Developmental Neuroscience	4
Eukaryotic Molecular Biology	7
Gen Virology-Multiplication	15
General Biochemistry I	186
General Biochemistry II	120
General Genetics	1621
Human Biochemistry	393
Human Biochemistry Lab	120
Human Cytogenetics	4
Immunology	906
Immunology Laboratory	55
Intro to Animal Development	275
Intro to Human Biochemistry	237
Introduction-Biochemistry	1493
Introductory Cytogenetics	48
Lab Techniques-Pharmacology	2
Lab Techniques-	
Pharmacol&Toxcol	16
Lab-Developmental Biology	47
Laboratory in Cell Biology	42
Micro Genetics & Mol Machines	5
Microbial Genetics	29
Molec & Cellular Mech-Memory	42
Molecular Physiology	18
Neurobiology	703
Neurobiology of Disease	48
Physiol Divrsty-Procarvates	16
Physiol Dvrsty-Procrvot Lab	25
Plant Biotech:Prin&Technique I	22
Plant Breeding&Biotechnolgy	23

Plant-Microbe Interactions	9
Prokaryotic Molecular Biol	14
Protein&Enzyme Struct&Funct	14
Soil Microbiology & Biochem	5
Special Topics	247
Veterinary Genetics	10
(blank)	
Grand Total	7745

Category 5B. Organismal biology

Count of Term	
Course Title	Total
Adv Microbiol/Food Pathgens	3
Algae	26
Behavioral Neuroscience	89
Biological Processes-Aging	88
Biology of Microorganisms	344
Biology of Microorganisms Lab	287
Biology of Mind	169
Bryophytes	2
Clinical Nutrition	6
Cognitive Psychology	143
Compar Anatomy-Vertebrates	333
Comparative Physiology	20
Comparative Physiology Lab	108
Comparatv&Evolutionry Physiol	197
Current Topics - Psychology	246
Dendrology	35
Endocrinology	48
Fungi	34
Genetics Laboratory	128
Herbl, Homeopthy&Diet Supplmnt	21
Honors Lab-Behavrl Neurosci	4
Honors-Behavioral Neurosci	4
Honors: Psych of Perception	7
Hormones and Behavior	4
Host-Parasite Interactions	21
Human Anatomy-Kinesiology	338
Human Genetics	59
Infect Disease-Human Beings	46
Intro to Plant Physiology	5
Intro-Experimental Oncology	162
Introduction to Entomology	227
Lab in Behavioral Neurosci	84
Lactation	3
Medical Microbiology Lab	44
Medical Mycology	45
Medical Mycology Laboratory	11
Neural Basis for Movement	13

Neural Basis-Norm&Path Mov	1
Neurl Mech Speech,Hear&Lang	46
Neurobi II:Intr-Brain&Behav	470
Neuronal Mech-Sensatn & Memory	69
Nutrition in the Life Span	20
Organismal Biology Lab	165
Ornithology	104
Parasitology	387
Parasitology Laboratory	88
Pathogenic Bacteriology	79
Pathogenic Microorganisms	7
Pathophys Princ-Hum Disease	142
Physiol of Microorganisms	34
Physiol-Microorganisms Lab	30
Physiologicl Animal Ecology	58
Physiology	1248
Physiology of Exercise	54
Plant Anatomy	51
Plant Physiology	71
Plant-Microbe Interactions	9
Principles-Plant Structure	6
Procaryotic Microbiol Lab	432
Procaryotic Microbiology	713
Psychology of Perception	52
Reproductive Physiology	69
Special Topics	247
Taxonomy of Mature Insects	9
Vertebrate Physiology	32
(blank)	
Grand Total	8097

Category 5C. Ecology

Count of Term	
Course Title	Total
Conservation Biology	51
Ecology of Fishes	151
Ecology of Fishes Lab	77
Ecology of Rivers and Streams	5
Ecotox: Impacts on Individuals	10
Ecotox: Populatn, Comm, Ecosys	8
Ecotox: The Chemical Players	13
Environmental Sys Concepts	10
Forest Ecology	55
General Ecology	652
Insect Ecology	26
Intro to Plant Pathology	33
Intro to Systems Biology	22

Lab:Conservatn-Aquatic Rsrc	185
Limnology-Aquatic Resources	405
Midwest Ecol Iss: Case Study	120
Modeling Animal Landscapes	17
Plant-Insect Interactions	3
Princ-Wildlife Management	58
Principles-Wildlife Ecology	272
The Vegetation of Wisconsin	70
Wetlands Ecology	46
(blank)	
Grand Total	2289

Category 5D. Evolution and systematics

Count of Term	
Course Title	Total
Animal Behavior	153
Animal Behavior-Primates	347
Animal Comm & Orig of Lang	21
Divrsty, Ecol&Evolutn-Microorg	23
Ecological Models-Behavior	12
Evolution of Behavior	112
Evolution of Genus, Homo	5
Evolutionary Biology	601
Evolutionary Genetics	4
Extinction of Species	881
Heredity,Envr&Human Populn	27
Hominoid Evolution	7
Phylogenetic Anal-Molec Data	3
Plant Geography	21
Plant Systematics	114
Primate Behavioral Ecology	61
Smr-Evolutionary Theory	1
The Evolution of Human Diet	12
Tropical Plant Diversity	14
Vascular Flora of Wisconsin	67
(blank)	
Grand Total	2486

Category 5E. Applied biology, agriculture and natural resources

Count of Term	
Course Title	Total
Air Pollution&Human Health	139

Animal Feeds&Diet Formulatr	11
Avian Physiology	4
Biol Determnts-Hlth Disparity	18
Colloquium-Organic Agriculture	1
Comparative Animal Nutritn	75
Cropping Systems	6
Cropping Systems-Tropics	20
Disease-Landscp	
Trees&Shrub	15
Diseases of Wildlife	129
Environmental Microbiology	18
Food Bacteriology	29
Food Bacteriology Lab	7
Food Microbiology	22
Food Microbiology Laboratory	8
Food Processing I	26
Food Processing II	15
Forage Mgmt & Utilization	7
Hum/An Relatn:Bio&Phils Iss	155
Human Nutritional Needs	411
Infect Diseases & Bioterrorism	33
Insects&Diseases-Forest Mgt	4
Integrated Weed Management	2
Intro to Animal & Vet Genetics	18
Intro-Environmental Health	159
Landscape Plants I	1
Management for Avian Health	2
Medical Entomology	40
Modern Biologicl Microscopy	1
Molec Approach-Crop Improvt	7
Molecular Biology Techniques	41
Nutrition for Health & Disease	40
Poultry Breeding	1
Principles of Animal Breeding	5
Principles of Silviculture	10
Principles-Econ Entomology	28
Principles-Plant Breeding	18
Radioisotopes-Med & Biology	3
Soil Biology	39
Soils and Environmental Chem	14
Terr Vertbrt:Life Hist&Ecol	70
Toxicology I	31
Tree Physiology	7
Wildlife Management Tech	32
World Hunger & Malnutrition	174
World Vegetable Crops	22
(blank)	
Grand Total	1918