STRATEGIC PLAN OF THE DEPARTMENT OF BIOLOGY

University of Minnesota Duluth

This draft Strategic Plan is in response to the review of the Department of Biology and the Integrated Biosciences (IBS) Graduate Program in February 2012. The review document provided incentive to develop a strategic plan for the growth of the department. This plan was undertaken to address the rising numbers and expectations of our students, the infrastructure and staff support needs of the faculty, and to maintain the healthy growth of our research programs. The review team suggested that we should consider the future of the department in light of several recent documents from national organizations that chart the opportunities and challenges of training future biologists and meeting societal needs that face all biology departments. Most notable of such documents was the 2009 Vision and Change in Undergraduate Biology Education joint report of the National Science Foundation and the American Association for the Advancement of Science. The development of our strategic plan is based partly upon the suggestions in this NSF-AAAS report and the specific points made by the review team in their report.

Two committees were appointed to draft responses to the review and which formed the basis of this strategic plan: 1. Curricular Issues (S. Stevenson, chair, D. Branstrator, J.Dahl, J. Itami, J. Liang, L. Shannon), and 2. Research and Facilities (J. Pastor, chair, T. Hrabik, J. Etterson, C. Carter). The design and contents of our strategic plan was the focus of the retreat of the Biology faculty on August 29, 2012.

This Strategic Plan outlines a mission statement for the department to help guide our detailed efforts, presents plans for bringing the curriculum into line with the new liberal education requirements and the Campus Strategic Plan and the NSF-AAAS Vision and Change Report, reviews infrastructure needs to meet expanded teaching and research directions, and prioritizes faculty hires to implement these new directions. The curricular changes could be initiated within the next one to two academic years but the improvements to infrastructure and faculty hires will continue on an ongoing basis for the next five-to-ten years. Curricular changes can be completed partly within the department but some will require approval by selected campus committees. Infrastructure improvement and faculty hires will require ongoing discussions and planning with College and University Administrations.

MISSION OF THE DEPARTMENT

To guide and focus this plan, we suggest the following mission statement:

> The mission of the Department of Biology of the University of Minnesota Duluth is to educate undergraduate and graduate students in the biological sciences with a foundation that includes depth, breadth, philosophy, and practice of science, understanding the origins of life, the diversity of life and its evolution, and the societal implications of scientific discovery so that the students can succeed in their careers as lifelong learners and globally engaged citizens.

This mission of the department is commensurate with the mission of the campus:

> The University of Minnesota Duluth integrates liberal education, research, creative activity, and public engagement and prepares students to thrive as lifelong learners and globally engaged citizens.

CURRICULAR ISSUES

In the past several years, UMD has revised its liberal education requirements and developed a campus-wide Strategic Plan. These two initiatives will greatly change the climate for undergraduate education on campus. In 2009, the National Science Foundation and the American Association for the Advancement of Science issued a joint report entitled Vision and Change in Undergraduate Biology Education (http://visionandchange.org/finalreport). This document is redefining undergraduate education in biology nationwide. Our strategic plan for the Biology undergraduate curriculum addresses the campus revised liberal education requirements, the Campus Strategic Plan, and the NSF-AAAS Vision and Change Report.

1. Biology BA Degree

The Biology BA degree has been transferred to the Swenson College of Science and Engineering this Fall, 2012. The Biology Dept. now has three degrees within its purview – Biology BA, Biology BS, and Cell and Molecular Biology BS. The Biology BA may be appropriate for biology majors who do not plan to attend graduate or professional schools but who still need a background in biology to pursue other careers, such as working for non-profit organizations or government agencies in conservation biology or health care, sales representatives for scientific or medical equipment companies, etc. The decreased requirements of physics, mathematics, and chemistry in the Biology BA compared to the Biology BS will allow BA students to take courses in business, economics, political science, geography, or other subjects appropriate to their career plans. We will discuss the advantages of each of these pathways to a degree in Biology with our undergraduates during advising weeks and help them choose the degree appropriate for them (Implementation immediately in Fall 2012).

2. Sustainability course within the liberal education curriculum

Sustainability is one of the major categories within the university's liberal education curriculum. These courses examine ways in which the natural environment interacts with economic, social, and political forces in a local, national and/or global context. Appropriate biology courses will be proposed and approved for inclusion in the Sustainability category. Currently, Julie Etterson is redesigning Biol 4802 – Evolution for inclusion in the sustainability category (to be completed by end of Fall 2012). We also expect to propose Biol 2801 – Ecology for sustainability credit.

3. Oral and written communication in the liberal education curriculum

Competencies in writing and oral communication are the purpose of Liberal Education Categories Writing and Information Literacy and Oral Communication and Languages. The NSF-AAAS Vision and Change document also emphasizes "ability to communicate and collaborate with other disciplines" and the practice of communication of science through both formal and informal written, visual and oral methods, and core competencies expected of graduating biology students. To improve our delivery of writing and oral communication in biological sciences, we propose the following plan.

A. Writing instruction currently begins in the general biology sequence and is expanded in each of the required 2000 level laboratories. Students also take an Advanced Science Writing course (WRIT 3150), two sections of which are reserved for biology majors. However, we have found that students still require additional training in writing in order to achieve professional-level proficiency.

We have generated a plan that integrates writing from freshman courses through senior-level advanced courses and independent capstone research experiences. The majority of this plan can be implemented by existing faculty members who have already agreed to take on this added responsibility or who are already implementing extended writing assignments in their courses. In addition, the department has already adopted a department-wide writing manual to be used in all courses.

However, one element of this plan is beyond the capacity of our current faculty complement, and would require a new term faculty hire with expertise in science writing. This plan moves advanced science writing instruction into the Department of Biology. It will both improve the writing skills of our graduates and fulfill the university's 3-credit advanced writing requirement. It has three components:

1) Students would earn their 1st writing credit for their required writing-intensive 2000 level laboratory (Genetics Laboratory, Cell Biology Laboratory, or Ecology Laboratory).
2) The 2nd credit will be earned as part of the Evolution course, which is currently being revised as part of the UMD Strategic Plan. The restructured course will integrate interactive learning tools that enable students to improve their writing skills through manuscript revision and peer review.
3) The 3rd credit will come from a new writing course, taught by the new faculty member, associated with and taken in concert with a 3000 or 4000 level elective.

B. Oral communication. All UMD students are required to take a 3 credit course in oral communication. Currently, all Biology majors are required to take a senior Seminar (Biol 3987) in which they learn how to give talks, attend and analyze talks by professionals in the department's seminar, and prepare and deliver a talk on a biological topic of interest to them. This course now meets twice per week as well as requires attendance in department seminars. We will revise this course to be a 3 credit oral communications course that increases student practice in oral communication and broadens student understanding of the communication interfaces between biology and society. This would strengthen our students' practical experience in oral communication (NSF/AAAS Vision and Change competency 5) and their ability to understand the relationship between science and society (MSF/AAAS Vision and Change competency 6). This would require additional teaching staff to offer the six to seven sections each semester (to be completed by end of academic year 2012-2013).

4. Improve our Biostatistics offerings

Modern biology is inherently interdisciplinary and requires the use of quantitative reasoning (NSF/AAAS Vision and Change core competencies 2 and 4). Most students take a statistics course as part of their

biology degree but this course (Statistics 2411) does not focus on biological problems. Currently, our students lack the basic ability to choose and apply the correct statistical test and interpret their results. A dedicated biostatistics course is needed for our students to gain these abilities. This course could be a pre-requisite course for many upper division electives. Such a prerequisite would allow these courses to teach students how to use biostatistics when designing experiments and analyzing laboratory data.

We also note that the Review Team also recommended that the Integrated Biosciences Graduate Program review the types of courses required for biostatistics at the graduate level, so a joint solution to this problem would benefit both undergraduate and graduate programs.

A biology hire or joint hire of a biostatistician with the Department of Mathematics and Statistics would strengthen our curriculum by teaching undergraduate and graduate courses. Discussions with the Department of Mathematics and Statistics will begin in Fall 2012.

5. Increased emphasis on ethics and history in our courses

A liberal education teaches students to understand their obligations to society and the culture they live in. The University's core liberal education requirements highlight this goal. The NSF/AAAS Vision and Change document includes "The ability to understand the relationship between science and society" as a core competency within biology education (NSF/AAAS Vision and Change Competency 6).

Currently, there is no formal inclusion of ethics or discussion of how biology fits into broader society. Individual courses and instructors can work towards increased emphasis in these areas, but the joint hire of a bioethicist or historian with the philosophy or history department would allow a dedicated liberal education course at the interface of biology with these disciplines. The new Natural History Minor, administered through the Biology Dept., would also benefit from increased course offerings in history of biology. These topics could also be added to an expanded senior biological communications class (point 3B above).

6. Systems Biology

Systems Biology seeks to understand complex biological processes by elucidating the dynamic interactions among components of a system across many levels (NSF/AAAS Vision and Change concept 5). This is a part of some courses (Biology 5807 – Mathematical Ecology, Biology 5863 – Ecosystems Ecology, and Biology 5235 – Biotechnology). We will begin to investigate how to further incorporate the understanding of systems biology into our curriculum.

7. Student Centered Classroom

Active learning techniques are now expectations of courses which offer liberal education credit. In addition, the NSF/AAAS Vision and Change document outlines the need for the redesign of courses to be more student-centered. Student centered classrooms "tend to be interactive, inquiry driven, cooperative, collaborative, and relevant."

The biology department has begun the process of updating our curriculum, including the addition of small discussion sections (24 students) to the general biology sequence and revisions of individual courses such as Biol 2101 – Cell Biology and Biol 4802 – Evolution. The department will continue to investigate how

other departments have implemented these types of classrooms and develop recommendations for required resources, including additional faculty.

8. Improving Student Preparedness

Our goal is to prepare students to succeed in their undergraduate careers and in the careers after leaving UMD. There is, however, a substantial minority of students who are not prepared to meet the standards of the freshman biology and mid-level biology courses. This lack of preparedness results in students taking some courses multiple times before they pass. It is not uncommon, for example, for students to take some of our 2xxx courses three times. This swells enrollment when our student faculty ratio is already at 40:1.

We need to do a better job of screening for these students to either help them successfully meet our standards or find other majors in which they can succeed. To this end, we will implement the following standards:

1. An ACT score of 21 in Mathematics or successful completion of College Algebra for incoming freshmen to be eligible to take Biology 1011. This is the same as the ACT requirement for Chemistry. Preparedness at this level will allow us to introduce simple quantitative data analysis in General Biology lecture and laboratory exercises. An ACT score of 21 is supported by a statistical analysis of student performance data completed by the department during summer 2012.
2. A grade of C- or better in all courses that serve as a prerequisite for another course. Preparedness at this level is essential for students to proceed to the next level of requirements from the general biology sequence Cell Biology (Biol 2101), Genetics (Biol 2201), and Ecology (Biol 2801) and from the 2000 level courses to the upper division electives. This goal is supported by a statistical analysis of student performance in required sophomore courses (Biol 2101 – Cell Biology, Biol 2210 – Genetics, and Biol 2801 – Ecology) which was just recently completed.

However, we do not wish these standards to serve merely as "weed out" standards. We can help students who do not meet these standards in several ways. First, through advising (see below), we can help them choose a major in which they are interested and in which they can succeed. Second, if we receive additional resources for faculty and laboratory facilities, we can implement a remedial course in biology for students to make the transition between high school biology and the standards of General Biology. This course would be similar in intent to College Algebra (Mathematics 1005) or Basic Mathematics and Introductory Algebra (SSP 103).

These standards, advising, and curricular initiative have the added benefits of both making sure the students who remain in the major have a firm basis for taking upper division courses in biology as well as helping other students find more suitable majors early in their career and thereby increase their ability to graduate in 4 years. In addition, they may also help reduce our student:faculty ratio from 40:1so that we can focus on helping those students who have the basis for successful careers in biology.

9. Assessment

As the new changes are made throughout the curriculum, assessment practices will be updated to match the new curricular changes. We will match our assessment back to our goals for all biology undergraduate students.

10. Work with the Campus and College Unit Change Teams to increase diversity and retention

The university, college and department have a low rate of admission and retention of under-represented groups. The University's Strategic Plan Goal #2 is: "Create a positive and inclusive campus climate for all by advancing equity, diversity, and social justice." The Unit Change Team for the College of Science and Engineering is working to set up policies and procedures to improve both recruitment and retention of these groups. The Biology Department will work with this team to implement complementary programs to support all of our students.

ADDRESSING ADVISING ISSUES RAISED BY THE REVIEW COMMITTEE

UMD has an active commitment to improving access to advisement across the University. The review team emphasized the need for increased staffing for Advising in the Biology Department and or restructuring the way advising is delivered:

"We feel that something needs to be done in the short-term to alleviate the advising demands on the Department of Biology faculty. The most obvious way to alleviate the advising load is through additional staffing. Two approaches are to create an additional position in the Dean's office, similar to Dr. Itami's, with advising responsibilities heavily targeted toward Biology. Of course, this would move more toward centralized advising. Alternatively, a new non-tenure-track position could be created within the Department of Biology, with responsibilities split between teaching and advising, moving toward more decentralization of advising."

To address these recommendations of the Review Committee, Dr. Itami's office has been moved to the Biology Dept. Her duties will consist of advising Biology undergraduates until sometime during their sophomore year, whereupon they will be transferred to other faculty for advising during their final years. She will also direct and help coordinate other undergraduate affairs, such as pre-professional clubs. Dr. Itami's expertise in Undergraduate Education policy and Academic Advising would greatly enhance our ability to move the Department Strategic Plan forward in the areas of undergraduate advising and curricular issues. She would continue as the key liaison between Biology and the Dean's office and has the knowledge and background necessary to work with the Dean's office to address a long term strategic advising plan for SCSE. If necessary, the Biology Dept. would strongly support hiring a replacement for Dr. Itami in the Dean's office to assume other duties she currently has there, including advising of non-Biology students, campus tours, etc.

Dr. Itami will implement a plan she has already prepared for involving upper division biology majors in a peer mentoring program. Dr. Itami will also create a BIOL 39xx Undergraduate Advising and Mentoring course. Senior- level undergraduate mentors trained through this mentoring plan and course could assist during the advising and registration queue. We will explore the possibility of providing these student mentors with a stipend.

RESEARCH AND INFRASTRUCTURE NEEDS

The Biology Department has hired a number of new faculty members in the past ten years. These faculty members have greatly expanded our research in new directions. The construction of the Swenson Science Building and the renovation of the Life Science Building have helped accommodate many of these new research needs. However, these new laboratories are completely full. Further expansion of the department through faculty hires will require acquisition of more laboratory space. Furthermore, new research directions taken by some faculty require additional facilities or renovation of some existing facilities.

When, where, and how to develop these additional facilities will require extensive discussions with College and Campus Administrations. It is thought that there will not be any new building initiatives on the UMD campus for the next five years. If so, then the next five years should be devoted to preparing shovel-ready plans for one or more of the following initiatives so that we are ready once capital building funds become available from the Legislature.

We have begun discussions with Campus Administration about the possibility of developing the Duluth Vo-Tech campus as a "biological research park". Several faculty members have visited this building during the spring semester and summer of 2012 and enthusiastically support exploring options for a research park there. We hope that these discussions will continue over the next year. This facility contains a large greenhouse with headhouse space, offices, machine rooms, large garages, and other rooms which could be retrofitted for additional laboratories at a lower cost than building new buildings. If so, then some of these initiatives described below could be begun and even completed in the next five years at a modest cost. Specific issues that need to be addressed include the following unranked list:

1. **Facilities for plant biology**

   The Biology Department now has 7 faculty members with research programs in plant biology. This expansion into plant biology within the past 10 years has greatly outstripped our research facilities.

   Most especially, there is a significant need for research-quality greenhouse space. Lack of greenhouse space is limiting our ability to propose the experiments which make for successful proposals top NSF, USDA, and other agencies. The existing 4000 square foot greenhouse space can no longer accommodate both research and teaching needs. In addition, the existing greenhouses were constructed 40 and 25 years ago, respectively, and while adequate for maintaining teaching collections, they do not provide the facilities and controlled environments that a modern research greenhouse requires.

   We propose that the size of a new research greenhouse be 4000 square feet, at least equivalent to that of the existing greenhouses, thereby doubling UMD's greenhouse space, with an additional 3000 square feet for the headhouse and controlled environmental rooms. This will allow sufficient space not only to accommodate existing experiments but for additional needs as the research programs grow and involve more undergraduate and graduate student research. A new greenhouse of this size will also allow for segregation of teaching needs from research. Not only are these quite different, but the current accommodation of both needs under one roof presents

potential problems to experimental materials when large classes and public groups use and tour the existing greenhouses. It will also free up space in the existing greenhouses on campus which could then be used for expanded teaching exercises in undergraduate courses.

We believe that the greenhouse at the Duluth Vo Tech will serve our research purposes for the near future, provided that renovations to the glass and environmental controls as well as the headhouse space are completed. We will prepare a plan for this renovation for the administration's consideration.

In addition, there are two rooms in Swenson Science Building (SSB 45 and 62) which were built as controlled temperature rooms. These can be easily outfitted with high intensity grow lamps with controllable photoperiods and light intensities as well as relative humidity control. We have begun informal discussions with the former manager of the greenhouses on the St. Paul campus about the possibilities for renovating these rooms. A plan for these renovations will be developed.

Finally, research in plant biology generates large numbers and volumes of samples which need to be prepared and dried for further analysis. Sample sorting and preparation could be done in the new greenhouse headhouse space. Standard laboratory drying ovens are insufficient for the volumes of plant samples already being collected. Room SSB 83 was originally designed as a warm room for incubations, but could also serve as a large drying room if it had adequate ventilation to remove the moisture from plant samples. Retrofitting this room with adequate ventilation would allow it to serve as a large plant sample drying room when not needed for incubations.

2. Additional laboratories, including renovation of Life Sciences 307

The laboratories of the Swenson Science Building and the renovated third floor of the Life Sciences Building are now completely full. Our ability to hire additional faculty is therefore seriously limited by lack of laboratory space. However, Life Sciences 307 was not renovated during the Life Sciences Building renovation but needs to be if it is to be available for a future hire after the current faculty member who occupies this room retires.

Beyond Life Sciences 307, we will begin discussions with the college and campus administration about expansion of laboratory space for the Biology faculty, either on campus or elsewhere.

3. Additional office space for graduate students and visiting scientists

The IBS graduate program has now grown to be one of the largest graduate programs in the Swenson College of Science and Engineering and on campus. Approximately half of the students in this program are advised by Biology faculty and many students advised by other faculty still require office space for office hours when they are supported by GTAs allocated to the Biology Department. With the addition of the new Chemical Biology emphasis in IBS, we expect the IBS program to grow even larger. We need to find additional office space for graduate students, especially those who are GTAs that require accessible office space for office hours.

In addition, Biology faculty members now have extensive national and international research collaborations. When we visit these colleagues, we are provided with office space and, on occasion, even laboratory space, but when our colleagues visit us we rarely have empty office space where we can house them. Our national and international colleagues then often share office space with us or with our graduate students or use cubbyhole desks built into lab benches. This is nothing short of an embarrassment to UMD. We need to provide adequate office space for visiting scientists to enable them to write papers in collaboration with faculty and to meet with our own graduate and undergraduate students.

4. Storage

Faculty members in Biology, particularly ecologists, need storage space for large and bulky field equipment and boats, especially during the non-field season. Discussions have begun with facilities about building storage cages in the penthouse in Swenson Science Building, but there has of yet been no resolution. Boat storage is needed over the winter to prevent deterioration of boats and engines and vandalism. Furthermore, proper storage of boats is a safety issue. Boat storage will probably have to be off campus, either at the UMD Farm or at the former Duluth Vo-Tech. Current storage at the farm is currently inadequate and would require a new building.

5. Farm field lab

For the past several years, we have been discussing the construction of a small field station laboratory at the UMD farm to accommodate four major projects funded by several millions of federal dollars. Research at the farm is expected to grow in the coming years, especially with the two new faculty hires in genetics and evolutionary biology. Buildings at the farm are old barns from when this was part of the University Experimental Station System. These barns are dusty (dirt floors) and grossly inadequate for even the simplest field equipment such as balances. Restroom facilities are limited to one porta-potty which has to serve up to two dozen students, approximately 6 technicians, and 4 to 5 faculty members during the field season.

We have drafted plans for a simple field station that would be shared among the faculty with research at the farm and their students and technicians. This facility would include a sample preparation room and a relatively clean room to be used for routine analyses typically done in the field as well as restroom facilities. It may be possible to accommodate boat storage (above) and experimental aquatics facilities (below) into an expanded version of this building. This plan for a field laboratory station was part of a larger plan for the farm as a whole, including needs of Facilities and Management and activities conducted by faculty members in other departments. These plans were put on hold pending the completion of the campus-wide plan. We are not sure where things stand with the campus-wide plan but we would like to reopen discussions about the possibility of constructing this farm field station.

6. **Facilities for increased K-12 STEM Education and Outreach**

   One of the major goals of the UMD Strategic Plan is to "Strengthen ties with Duluth and surrounding communities in an intentional, visible, and mutually beneficial partnership" (2011 UMD Strategic Plan, Goal 5). Faculty in the Department of Biology and other departments in the Swenson College of Engineering have or are already leading several outreach efforts to local K-12 schools to improve science education. For example, the Biology Department and the Integrated Biosciences Program were key participants in a 5-year, $2.6 million grant from NSF in GK-12 Education where we, along with the Depts. of Mathematics and Geology, supported 40 graduate students with annual stipends to spend a year assisting K-12 teachers and serving as mentors for K-12 science students. Expansion and continuation of these efforts are limited by lack of facilities that are safe and appropriate for grade school students. Additional facilities, potentially in the building that used to house Central High School, wound enable us to establish outreach and service learning courses that give our students leadership opportunities and build long lasting partnerships with our community. Faculty in the Dept. of Chemistry have indicated that they would be willing to co-sponsor this request for a K-12 Teaching Laboratory.

7. **Experimental aquatics facility**

   UMD is well known for aquatic ecology research with the UMD Biology Dept., LLO, CWE-NRRI, and the Water Resources M.S./Ph.D. graduate program. Space in Swenson Science Building for controlled aquatic biology experiments is limited, however, to two small aquarium rooms. Kiddie pool experiments are being done at the UMD farm behind a chain link fence with mesh roof for protection from predators. Additional aquatics facilities for large aquaria and artificial streams would greatly enhance our aquatic biology program. Space at Duluth Vo-Tech could easily be renovated as a large experimental aquatics facility.

FACULTY HIRES AND FLEXIBLE EXPECTATIONS

Two biology faculty members with joint appointments with LLO are expected to retire this year. A minimum of two additional faculty members will retire within the next 5-6 years. Additional retirements are expected with the next 5-10 years. Most of these immanently retiring faculty members teach at least one large undergraduate course and also offer popular elective courses with enrollments of 50 students or more apiece. These faculty lines need to be returned to the department as they become open from retirements. In addition, to fulfill our strategic plans outlined above for curricular and research directions, we need to grow the department faculty further beyond simply replacements because of retirements. Based on the above outline of new curricular and research directions, we propose the following possibilities for additional new future faculty lines with the next 5-10 years.

<u>Top Priority Faculty Hires with the next 1-2 years</u>

- Vertebrate biologist - In the past, the department had faculty members in both ornithology and mammalogy. Both of these positions were lost in the 1980's and early 1990's either because of losing a faculty line by retrenchment or internally reallocating a faculty position because of a greater perceived need of expertise in another biological discipline. Currently our vertebrate

organismal courses such as Mammalogy (Biol 5764) and Ornithology (Biol 4763) are popular and useful for students seeking careers in natural resource management. However, they are taught by people hired from outside the department. Because these courses are central to the Biology degrees as well as the Natural History Minor, they should be taught by tenure track or term faculty with regular contracts.

- Molecular biologist - Many students currently taking both the Genetics (Biol 2201) and Cell Biology (Biol 2101) courses would be better served by one 2000 level cell and molecular biology course that would integrate these topics. This course could be an alternative course for biology BA, education majors, exercise science, and other non-biology majors. This could reduce the numbers of students taking cell and genetics, thereby removing some of the strain from these courses and allowing the development of a more student centered classroom. This would require a new hire to teach the new course. In addition, a previous faculty member who taught the upper division Molecular Biology course (Biol 4231) has left, leaving us with a deficit in faculty with expertise to teach this course which is required by both the Cell Biology BS and the Biochemistry and Molecular Biology BS. Finally, molecular techniques are becoming heavily used in ecology and evolutionary biology to develop phylogenetic. A molecular systematist could bridge the department's ecology, evolutionary biology, and cell biology faculty and also be able to offer the above undergraduate courses.

Faculty Hires in the next 2-3 years

- Biostatistician or computational biologist, perhaps joint with Dept. of Mathematics and Statistics. Justification for this position was given above in point 4 of Curricular Issues, Improve our Biostatics Offerings. We will begin discussion with the Dept. of Mathematics and Statistics about defining a faculty line which would serve our needs as well as replace one of their statisticians who are expected to retire in the near future.
- Plant physiologist – A faculty position occupied by a plant physiologist was lost in a retrenchment five years ago when the faculty member left to take a position elsewhere. Our plant physiology course is currently taught by a non-tenure track faculty member whose expertise is in genetics. Given the department's expansion into plant biology in the recent past (see above), the lack of a research plant physiologist is a serious hole in our expertise. Our ability to recruit a plant physiologist will be enhanced by progress made in 2012-2013 on resolving the issues which were raised above in the discussion of facilities for plant biology research.

Faculty Hires in the next 3-10 years

We also want to think ahead 3-10 years about potential faculty hires which the department may wish to consider to keep us current with new research directions and which will help bring us into alignment with the NSF-AAAS Vision and Change in Undergraduate Biology Education recommendations, which guided our discussions on curricular issues discussed above. A number of possibilities were raised during the informal meetings of the two committees which produced the bulk of this Strategic Plan and also at our annual retreat in August 2012. Some of these include a paleontologist (possibly joint with Geology), a mycologist, a biological ethicist (possible joint with Philosophy), a historian of biology (possible joint

with History), and a science writer. These are in no order of priority nor is this an exclusive or exhaustive list. We will pursue these discussions further in future department meetings and retreats. We will explore the possibility of joint hires with other departments where appropriate.

Flexible Faculty Expectations

We will also consider the implementation of flexible faculty expectations in teaching, research, and service along the lines of that recently proposed by the EVCAA. Important in this will be the hiring of non-tenure or term faculty to absorb some of the increased teaching loads posed by the expanding student body. We also note that we cannot formulate a sustainable long range plan without guaranteed support in the form of staff and long-term faculty hires. Growing the research program of the department, revising the curricula of the two B.S. and one B.A. major, and doing assessment of all three curricula require excellent staff and non-tenured faculty to help the tenured and tenure-track faculty grow the department.