

**DEPARTMENT OF BIOLOGY**  
**SUMMARY OF STRATEGIC PLAN**

**What we do well**

- A strong inquiry-based, lab-rich curriculum that progressively builds knowledge and skills.
- An emphasis on engaging students with the scientific process by doing research in-class and out.
- Active scholarship that results in publications, presentations, grants and student involvement.
- A commitment to reducing the size of our introductory courses to improve the teaching and learning environment, and increase retention and satisfaction.
- Strong commitment to advising and mentoring students in diverse ways and that lead to fulfilling lives of leadership and service.
- Contribute significantly to campus and local communities, including course offerings in FTS, CII, NASP, IEX, strong interdisciplinary programs and faculty service.

**Where we see ourselves going**

- Continued reduction of class sizes in the four introductory core classes.
- Expanded quantity and quality of student involvement in research experiences.
- Increased emphasis on the connections between sub-disciplines and on fields that bridge biology with other disciplines; increased involvement in our strong interdisciplinary programs.

**Barriers to getting there**

- Insufficient faculty for the number of students we serve.
- Insufficient budgets and technological resources that limit opportunities we envision for students.
- Outmoded, insufficient equipment and instrumentation with no administrative plan for maintenance, service contracts, replacement or new acquisition of integrated technologies.
- Insufficient and inflexible facilities. This includes a simple lack of space (Nobel hall is full) and classrooms or lab spaces that severely limit pedagogical approaches.
- Unsustainable programs, especially interdisciplinary ones.
- The challenge to continue offering breadth of courses for non-majors as well as majors.
- Pace and workload threatens balance as vibrant, professional teachers-scholars

**How Gustavus can facilitate our goals**

- Three new faculty lines, one in Biology alone and one each shared with Biochemistry & Molecular Biology and Neuroscience.
- Additional resources, including increases to department and program budgets to match increases in consumable costs and desired program development, budgets that carry over.
- A fund dedicated for equipment replacement, new equipment acquisition and maintenance.
- A technology specialist, news and advancement liaisons dedicated to Nobel Hall.
- Two rotating endowed chairs among existing FTE to inject time and resources into teaching, mentoring, collaboration building, outreach and scholarship.
- Expanded, modern facilities. Conduct a feasibility study to assess the quality of facilities necessary for the 21<sup>st</sup> century program we envision in biology and its related programs; plan accordingly for building renovation or replacement.

# DEPARTMENT OF BIOLOGY STRATEGIC PLAN

## SECTION 1: Biology Department Description

### 1.1 Mission, Philosophy, Vision and Goals

The mission of the Biology Department is to promote understanding and appreciation of the natural world among all students seeking to study life. We provide an exceptional educational experience by actively engaging students and faculty in biological scholarship at all levels.

We value a diverse learning environment that includes opportunities for faculty and students to: pursue research that leads to contributions in the field; engage in a broadly-based biology curriculum with rich experiential learning; forge connections among disciplines; model professional service and community leadership; and pursue vibrant sustainable professional lives. The Department aspires to be a supportive, innovative, diverse and collaborative faculty that mentors students to value life-long learning and apply biological understanding to their lives.

The Biology Department strives to prepare students for an increasingly complex and technical world, for careers and advanced study in biological fields. We seek to serve those interested in:

1. nurturing a curiosity for life-long learning in biology
2. obtaining a biology major
3. learning how biology intersects with and connects to other disciplines
4. engaging in collaborative and independent research
5. preparing for a career in biology or a related science
6. preparing for professional or graduate studies
7. enhancing a broad understanding of life, within the liberal arts

### Philosophy

The biology department is dedicated to:

- cultivating excitement and interest in biology, and fostering an attitude of life-long learning
- pursuing excellence in teaching
- encouraging and supporting active engagement in scholarship and service
- developing analytical and critical thinking skills, scientific communication and science literacy among students; helping students make connections among disciplines
- establishing a thorough understanding of the fundamental principles in the life sciences
- developing whole persons by promoting intellectual, personal, leadership and social potential of our students, staff and faculty in an environment of respect and cooperation
- supporting collaborative and interdisciplinary teaching, courses and scholarship

### Vision For Our Students

We envision that all students will experience biology as a relevant, empirical and interesting science, and will have the opportunity to understand and become engaged in the process of biological inquiry. We envision a curriculum that serves majors and non-majors that will prepare students to be good citizens, scientists, decision-makers, patients and consumers, and life-long learners of biology. Our major's curriculum will include a core of introductory classes structured to teach content and skills progressively, and a broad collection of inquiry-rich upper-level courses that encourages mastery of biological concepts and promotes critical thinking, analytical and communication skills as well as wonder regarding the biological world. We actively encourage students to link understanding within and among disciplines.

For our students we aspire to:

- Engage students in small classes and research where we can use a variety of approaches (e.g. active learning, problem- and inquiry-based activities) that foster adaptability, curiosity and creativity, and promotes critical thinking, analysis and communication.
- Emphasize interdisciplinary avenues that blur perceived disciplinary boundaries.
- Provide students with hands-on experiences that use contemporary equipment, instrumentation and technological tools in both the field and laboratory, and promotes experiential learning by doing.
- Continue to support a curriculum that encourages retention of all students, especially those with unique backgrounds or learning strategies.
- Establish a peer mentoring program that includes tutoring, lab assistance and supplemental instruction, which ensures success of a diverse student body and builds leadership skills.
- Highlight the importance of biology to everyday life, to current and historical issues, and to help all students make informed choices about individual, social, local and global issues.
- Create and maintain environments where students feel a part of a scientific and social community and are excited to be in college, where students can do science and process experiences in small group gathering places, in discussions and via group projects, and develop as whole persons.
- Encourage experiential learning: international and in-country travel, field and lab work, community and service learning, participating in symposia and internships that foster responsible stewardship.
- Maintain good relationships with alumni and facilitate professional development post-graduation; encourage productive relationships between graduates and current students.

### **Vision For Our Faculty**

We believe that the quality of teaching and learning are improved if faculty are engaged in independent and collaborative research and professional development. Research reinforces a comprehensive understanding of biology and the scientific process, enhances the quality of instruction and mentoring, and provides research or career opportunities for students. Professional development also provides opportunities to grow as innovative and excellent teachers, and to serve a wider community. We aspire to be talented, inquisitive people committed to effective pedagogy and student mentoring, dedicated to the open discussion of ideas and the implementation of a collective vision. We envision for our faculty:

- Funding for high quality lab and classroom space, sufficient supplies, functional, contemporary instrumentation, access to broad journal databases and appropriate current technologies.
- Ability to support active learning pedagogies across our curriculum that require small class sizes, appropriate FTE and spaces to enhance innovative teaching and learning.
- Support for workshop attendance to learn new techniques and ideas, or to improve courses.
- Support for conferences and publications, alone and with students and to interact with colleagues.
- Opportunities to work in the field or lab with students and non-Gustavus collaborators.
- Time to pursue external and internal sources of funding; course releases and reward incentive for significant work related to grant development or curricular innovation.
- A broad definition of scholarship, inclusive of the scholarship of teaching and learning, interdisciplinary (ID) endeavors as well as traditional forms of scientific scholarship (discovery).
- Sufficient staffing to support interdisciplinary (ID) programs so that ID faculty can continue to teach ID courses while contributing to respective Departmental majors and pursuing scholarship.
- Active membership and leadership in professional societies as well as serving the Department as Chairs, in Gustavus faculty governance or as program directors.
- Support for faculty participating in, directing or chairing campus-wide initiatives, programs and committees. Campus service that does not preclude excellent teaching and scholarship.
- Resources for scholarly contemplation that lead to innovation and sustain a vibrant, professional life as teachers-scholars.

## **Vision For The Biology Department**

- A faculty, staff and student body that is diverse and academically strong.
- Resources for department and ID programs including:
  - new lines that allow more flexible FTE
  - sufficient course, lab, travel and research budgets; stockroom and office support
  - new equipment and instrumentation acquisition and repair (including service contracts)
  - new or remodeled facilities
  - supporting collaborative and independent scholarly endeavors
- A collegial department that succeeds by sharing a common mission and recognizing individual expertise. We strive for effective communication that promotes a vibrant intellectual climate.
- A model of shared governance where all members contribute talents toward leadership and stewardship of the Department and its programs; Chairs that effectively lead the department.
- Respectful understanding with other departments and support offices.
- Partnerships with government agencies, other schools and community organizations to support the educational, economic and cultural development of all learners, and to serve the community.
- External recognition that we maintain an exemplary program in biology.

## **Department Goals**

- Goal 1.** Ensure that all majors graduate with rich research experiences.
- Goal 2.** Provide opportunities where students learn about and participate in cutting-edge science.
- Goal 3.** Ensure and promote interdisciplinary avenues of teaching and research related to biology.
- Goal 4.** Continue to provide opportunities for *all students* to become interested in, learn more about and be successful in biology.
- Goal 5.** Foster opportunities for students to experience how biology is relevant to the world and to exhibit good citizenship and stewardship.
- Goal 6.** Cultivate productive relationships between faculty, alumni, and current students that facilitate professional leadership skills and development for all.
- Goal 7.** Ensure that all faculty members are supported as whole persons engaged in a vibrant, sustainable life as teacher/scholars.

### **1.2 Programs**

The Department strongly supports the excellent Interdisciplinary (ID) Programs of Biochemistry and Molecular Biology (BMB), Environmental Studies (ES) and Neuroscience. We communicate with ID Directors, fund ID courses and labs, advocate for additional funding, equipment acquisition and repair, offer courses and experiences for students in ID majors and minors, coordinate faculty FTE to teach both in ID programs as well as in biology, and advocate for teaching realignments when high demand ID courses require more FTE. Over half of our faculty teach in and/or serve as Directors for these ID programs as well as serve in different capacities for the Linnaeus Arboretum. We also offer a comprehensive course of study in the biological sciences with specializations. We provide classes that support HES majors, Nursing, Life Science Education, Elementary Education, General Education (8 NASP), Curriculum II (1/yr), the IEX (8/yr) and FTS (1 to 3/yr). As a department, we are many things to many people. We are proud of exposing so many students at Gustavus to the study of life in a rigorous, inclusive, interdisciplinary form.

### 1.3 Support Relationships

The Biology major relies directly on courses offered by Chemistry, Education, Mathematics and Computer Science. Additionally, interdisciplinary majors and pre-professional students frequently enroll in PHY, ENV, ENG, GEO, GEG, HES (214/234/235), REL (243/253), PHI (109/251) and PSY courses. Our courses and student research rely heavily on the Arboretum, GTS, the Library and the Writing Center. Many of our students study abroad (125 in last eight years), enroll in career explorations or internships (202 students over past five years) or use Center for Vocational Reflection (CVR), Counseling and Advising. We work with the Diversity Center, CICE, and Admissions to ensure recruitment and success of all students. Prospective students are drawn to Gustavus because of our excellent reputation as a high quality biology program that provides a diverse, yet focused experience for students. Our program draws many students to the College, but not all the incoming first year students who cite biology as a potential major remain in the major. Thus we draw in students for other majors and programs. However, none of our majors can graduate without the reciprocal contributions from all academic departments and support offices on campus; we cannot think of any office or department that does not support our mission and vision.

## SECTION 2: STRATEGIC REVIEW

### 2.1 Strategic Issues

Over the past five years, an average of 50 majors graduated from the Biology department, with larger numbers recently (n = 51-64; 20 minors). We serve almost half of each incoming class in our Principles of Biology class (Bio 101; 5-year average enrollment = 253) and we provide courses for many other majors (see 1.3). In 2004, we divided what had been two very large sections (~150) of Bio 101 into five somewhat smaller sections (~55). In 2005, we also divided the next two introductory courses in our core, Organismal (Bio 102; ~45 now) and Cell & Molecular (Bio 201; ~ 45 now) into four and two sections, respectively. These subdivisions entailed a reallocation of faculty effort from upper-level courses to introductory classes. Five consequences of efforts to reduce course sizes have been: 1) improved student experiences in our core classes; 2) increased satisfaction in teaching and opportunities for more active learning pedagogies; 3) increased retention of students; 4) increased student demand on our time because we are more able to invite engagement, and; 5) an increased *inability* to offer research-rich, upper-level courses. When we subdivided our core courses, we also added non-majors and more FTS courses and regularly offer CII (in 2007, 3 FTS, 8 NASP and 1 CII). We maintained strong IEX classes (8 in 2007). The required 'core capstone' (Bio202) remained at 70-90 students. Our affiliated ID programs continued to strengthen and grow (46 BMB majors, 28 ES majors/minors and 32 Neuroscience minors); demand for classes in ID programs challenges the ability of ID faculty to contribute to the introductory core or to general education. Also ID programs struggle to staff their courses because of Departmental needs (e.g. ENV110). Since we changed our core and general education in 2004, average teaching loads went from one quarter or one third introductory courses annually, to one-half of the total load, even with the addition of one new line to the department. At the same time, our offerings of Bio396 (Directed Research) went from four over three years to only once. Also, many upper level courses that were offered annually now must be taught every other year despite demand for diverse biology electives. We have little opportunity for developing new courses including off campus study abroad, interdisciplinary courses or team taught courses. Finally, our workload is compounded by the fact that while the College went to a six course load, we did not (see Section 3.1).

Reduction of introductory course sizes, success of ID programs as well as our commitment to serving the whole campus have shaped the challenges and opportunities we now face. The biology department is many things to many people. We draw in and nurture numerous, diverse students; we contribute widely to the general education mission of the institution; we help to run strong ID programs that are in demand. We offer a variety of courses and high quality experiences to meet the needs of a changing 21<sup>st</sup> century work environment. However, our successes present challenges; as a department we are stretched thin. Outside

evaluators have independently commented on this reality, “The biology department has more students than chemistry, mathematics and physics departments combined while having a similar number of faculty as the chemistry [and the MCS] department. This is a huge burden when trying to encourage undergraduate research” (HHMI evaluators 2007) and when serving the campus in ways that other large departments opt out of (e.g. via CII, IEX and FTS).

## **Strengths**

The strength of the biology department lies in its talented, committed faculty, staff and students who are actively engaged in scholarship and who work well together. We are a collegial department that shares a common, cohesive vision of what we want for our students and ourselves, and we discuss how to implement this vision in regular meetings and retreats. Over the past years we have made great curricular strides, retained a higher diversity of students, reached out to non-majors and succeeded at attracting excellent new colleagues while making significant contributions to the life of the whole college.

What we do very well includes:

- We have a strong core of courses in the major that progressively develops content and research skills. This is complemented by a nice breadth and depth of upper-level, research-oriented courses spanning many subdisciplines within biology.
- Most of our courses (25 of 27) have labs that introduce technical skills and the methodology of science; we teach science by having students do it (especially in upper-level courses).
- We offer three cutting edge ID programs in high demand and relevant to our complex world.
- We strongly support FTS (1-2/yr), CII (1/yr) and NASP (8/yr) courses; we offer non-majors a unique perspective and way of knowing and seeing the world via biology.
- We offer many experiential IEX courses (7-8/ year), including travel and on-campus.
- We have high achieving graduates, who are successful in top doctoral and medical programs, and innovative careers (51% of majors graduate cum laude or higher vs. 41% for all Gustavus students).
- We mentor and engage students deeply via research, our classes, in service and advising roles.
- We prepare students well for an array of graduate and professional schools, careers and service.
- In 2007-08 faculty acquired external grants totaling over \$1.25 million. Our ability to secure significant funding while carrying a heavy teaching and service load speaks highly of the outstanding research trajectories that we have built. We remain committed to collaborative research because we think that engaged scholars make the most effective teachers.
- We are active scholars who model engagement and service in the broader scientific community. Each of us conducts research during the academic year and/or summer with students or colleagues. We publish, we present at local and national meetings, we serve our professional societies, review articles, and serve on advisory boards. In average years, department members present collaborative or independent research at 15 conferences (>23 presentations). Our intellectual work is disseminated in excellent forums and reflects well on the department, and on Gustavus as an institution that values the life of the mind.

## **Weaknesses**

Our vision is to provide all Gustavus students the opportunity to engage in the study of biology via experiential, high quality teaching and learning environments. The vision for our majors and minors also includes offering small classes that prepare students with content and skills for specialized, research-rich upper level courses, professions, and research collaborations with faculty who have the time to effectively mentor students without burning out. Our vision for the department is to ensure that faculty can effectively continue to run strong ID programs (BMB, ES, Neuro and the Arboretum), participate in significant faculty governance or development roles, and develop new courses (ID, collaborative or study abroad). We find

ourselves unable to do all of this. We offer smaller introductory courses, but not really small enough to engage in the kind of pedagogy we would like (project or problem-based inquiry-driven and discussion-rich courses). We offer research-rich upper-level courses, but lack the time to mentor more than a few students outside of class; instead we encourage many of them to seek experiences off campus. More majors equate to more advisees and we must set priorities with limited time; sometimes our students get the short straw. When we have time, we produce quality scholarship, but we lack time to read, reflect, write grants, create new research or finish manuscripts. We contribute significantly to service on campus, but do so at costs to teaching and scholarship. Expectations of time and energy are increasing among faculty who serve as Directors, Chairs or who are on significant committees. Our classrooms are dilapidated, noisy and unsuitable for creative teaching, the roof leaks on expensive equipment, and we have no administrative plan for upgrading or maintaining old technologies or acquiring new ones. The danger of burning out and settling for a lesser vision is real. As a hub discipline that studies the beauty of life, our courses and experiences are relevant to many different people; we, like many departments, are proud of the multifaceted role that we serve in a quality liberal arts education, but we are stretched thin. We are first and foremost dedicated teacher-scholars aiming to serve all students who seek to study of life. To continue to serve at this level we need additional resources. Do we want to be a better department than Gustavus can support?

## **Challenges**

Our biggest challenge is that we have a gap between our vision and our reality (outlined above). Others:

*Social trends:* Attitudes toward science in the U. S. present challenges to biology educators, as polls show that 40% or more of the populace do not accept evolution. We see a number of students from this background despite the fact that patterns in biology make no sense without viewing them in an evolutionary framework. Another social challenge has been dubbed “nature deficit disorder,” in which students lack experience with and understanding of the natural world. Both of these trends provide us with opportunities for expanding our students’ horizons.

The frontiers and growth areas of biology tend to be in interdisciplinary areas, and these areas also tend to be rich in applied and ethically relevant questions. Bioethics, bioinformatics, conservation, cognition, genomics and many other fields pose real challenges for society as well as our department. We dabble effectively in many of these areas, but are challenged to engage these fields in a more comprehensive way that would educate students while preparing them to wrestle with and provide leadership on ethical questions raised by these fields. New interactions with Philosophy or Religion can bridge understanding.

*Economy:* Biology is a resource-intensive field and the worsening economy clearly presents a challenge in the context of the College’s overall budgets and tightening of external sources (our course, field travel and equipment budgets have remained static despite a doubling in some costs like vans or consumable supplies). The decline in purchasing power of the department, library and computer budgets has compromised our ability to teach using current technology and experiential pedagogy.

*Technology:* Biology is technology and equipment-intensive, and we must prepare students for complex, technical work environments. Acquiring imaging instrumentation in the HHMI grant is a good start. We have no real reliable mechanism to acquire, maintain or upgrade our large inventory of equipment and instrumentation or cover service contracts. Much of our equipment is old and in need of constant repair. Faculty must maintain and repair the items; technicians won’t touch some of the instrumentation because of its age, or parts are no longer available. Our classrooms and labs are woefully dated and restrict innovative pedagogies, especially relative to comparison colleges. Students regularly complain about our technology and computers. We also are challenged by GTS and IIAC, and do not get adequate help in implementing new and flexible technologies both in the classroom and the lab. A dedicated GTS person who knows about interfacing and biological instrumentation is essential.

## Opportunities

Our vision and associated goals reflect a sense of the opportunities that we face, including:

- To educate students in empirically-based science, especially the ability to learn about and do research in or related to the natural world through observation, inference and experimentation.
- To implement engaging, supportive, and collaborative learning environments through changes in how we can offer courses and research.
- Developing appropriate facilities to support thriving innovative teaching and learning environments.
- To engage and prepare students to use complex technologies and techniques currently in use, and ones that may predominate in the work environments 10-30 years from now.
- To develop innovative infrastructure and program support that results in a more visible, vibrant community of learners that continues to attract high quality prospective students.
- To continue preparing students for lives of leadership and service while excelling in their chosen discipline by having more time to mentor students in enhanced curricular or extracurricular settings.
- To engage students in ways of thinking about and addressing issues that lie at the intersection of many disciplines; to prepare students well for careers that transcend disciplinary boundaries and to nurture development of a truly integrated liberal artisan hungry to seek out new connections.

## 2.2 Barriers

The barriers to becoming the department we envision can be distilled to:

- Insufficient faculty for the number of students our department serves.
- Insufficient dedicated funding, stagnant budgetary, technological and library resources to provide our students the education we envision for them.
- Insufficient, outdated and inflexible facilities. This includes a lack of space (Nobel hall is full), and spaces (classrooms and labs) that aren't easily adapted to flexible, innovative pedagogies.
- Insufficient time or opportunity to pursue endeavors that sustain our creative professional lives as scholar-teachers.

## SECTION 3: STRATEGIC INITIATIVES AND RECOMMENDATIONS

**3.1 General Recommendations** To overcome the barriers listed in Section 2.2 we recommend:

**Three additional faculty lines** would allow us to dedicate the time and energy necessary to making our vision a reality. We propose that two of these positions would be shared (one each) with the Biochemistry & Molecular Biology (BMB) and Neuroscience programs, with the third entirely in Biology. These positions would help sustain these currently unsustainable, but critical ID programs and support our goal of interdisciplinarity. The new hires could contribute to rapidly growing fields such as bioinformatics, biomechanics and systems biology. Together they would allow more flexibility in teaching assignments (e.g. one person wouldn't be required always to teach a particular course) as well as a reduction in teaching load. The six-course load has not translated into a reduced teaching load in biology; rather it has codified an existing load of 12 contact-hours per semester. Our major is one of the three largest on campus (~230 students). In 2007, we instructed 1,060 students (excluding BMB and Neuro courses); this number does not account for the fact that, on average, we teach all these students 6 hours per week (3 hours lecture and 3 hours lab). We teach ~50% of the incoming class. Compared to many departments, we teach more hours. For example, Psychology counts lecture and labs as separate courses; using this metric we teach an 8-course load, and other departments teach only nine contact hours while we teach 12. We request 9-10 contact hours, which seems more in line with the rest of the College. Additional FTE would provide time that would support all our stated department goals.

**Expanded, modern, flexible facilities** to allow pedagogies that transform introductory, ID and upper-level courses (See Goals 2-4). A feasibility study is required to see if Nobel can be remodeled with an addition or if a new science building is warranted to support the program we envision. All attempts to address future science facilities should be driven by programmatic goals for student learning, the curriculum and environmental stewardship (Keck Consultancy report). Nobel Hall is full; we've been cannibalizing space for so long that no open space remains for offices, classes or storage. The building is old, noisy, leaks and is in need of significant modification to enhance learning and research environments. Labs lack storage space for specimens or teaching materials, and technology. Expanded, modern facilities would further enable us to use innovative pedagogies and offer varied experiences instead of relying so heavily on lecture in fixed seating. We could use more case-based teaching or discovery labs that benefit from moveable furniture in an open room with computer-equipment interfaces. Second, a building with welcoming spaces retains students inside of it and emphasizes science as a social endeavor. Well-designed buildings can transform the intellectual climate of a campus. Third, it helps with College recruitment; the sciences are a draw for prospective families. For example, St. Olaf and Luther both opened new science facilities recently. We offer excellent experiences, but perception matters and science buildings can impress or turn away prospective students. *Contemporary science facilities would be a visible manifestation of the vibrant program we have and would demonstrate institutional commitment toward the sciences; they are imperative for Gustavus to remain competitive.*

**Additional dedicated resources** sufficient to support student use of techniques, instrumentation, technology and literature relevant to the evolving state of the field. This includes:

- Department budgets that increase and reflect the increased expenses of field (e.g. van per-mile costs) and lab (e.g. consumable and instrumentation), overload or research-based IEX classes, and new courses that emerge from HHMI program development.
- Department budgets that do not expire every year, to allow long-term budgeting.
- Dedicated funding to acquire instrumentation, maintain, replace and service instruments. From the greenhouse, to the 20-year old autoclave and frequently-repaired incubators or jury rigged equipment, much of the major instrumentation in Nobel is old or damaged and carries no plan for replacement. Maintaining functional and contemporary instrumentation is our best strategy to mitigate challenges in the interim before new science facilities can be built.
- A full-time, dedicated technology specialist to serve our diverse and complex needs, especially as technology and instrumentation continues to change at a rapid pace.
- Two rotating endowed chairs among existing FTE to fund student-faculty research expenses and inject resources into research, similar to the Sponberg chair; 4<sup>th</sup> year leaves for faculty.
- Increased budget for journal acquisition in the library to maintain and expand journal access (especially electronic) for student and faculty scholarship.

## 3.2 Strategic Initiatives

### Goal 1. Ensure that all majors graduate with rich research experiences.

Initiative 1.1: *Encourage research in classes that place high demands on technical and analytical skills, especially at the introductory level.* We enhanced inquiry experiences and our courses build analytical skills sequentially. We now want to offer even smaller classes, which allow real engagement with new techniques, technology and instrumentation (core class sizes no more than 25 rather than 45-90) and would increase student confidence with independent research design and analysis. Further reducing class sizes will require the additional FTE and budget increases

also requested in this strategic plan. New and upgraded instrumentation, and a dedicated technology specialist would help us maintain instrumentation that faculty currently maintain.

Initiative 1.2: *Implement a capstone experience.* Given current staffing and teaching obligations we cannot offer capstone experiences regularly and consequently only serve a small subset of students. We envision offering a diverse set of capstone courses regularly (e.g. Directed Research; Seminar-discussion-based upper-level courses; honor's theses).

Initiative 1.3: *Garner institutional support that will allow us to expand the research offerings without compromising parity in lower division or general education classes.* Current schedules limit our ability to do intensive research in upper level classes while teaching large lower division courses. Faculty note, "we're short-changing student research experiences because of lack of time." This is especially true for those involved in ID Programs because they are involved in more than one department and find it difficult to participate in general education or core classes. By sharing two new FTE with BMB and Neuroscience, those involved with ID programs will have increased capacity to contribute to gen ed or biology core courses. This will also provide redundancy in expertise for elective classes and contribute talents to service endeavors. This also allows the ID programs like ES to plan for course offerings more reliably. Parity in who regularly teaches general education or core classes is compromised when only a few faculty are able to teach specialized courses in high demand. There is inequity in which faculty must give up upper level or research courses to teach general education or in the core.

Initiative 1.4: *Develop more independent and collaborative research opportunities*

- Two rotating endowed chairs among existing FTE to fund research expenses (lab purchases, student stipends, travel) and course releases like 4<sup>th</sup> year leave (ala Sponberg Chair).
- Teaching-load credit for semester research collaborations with students and funding to support semester research. Reduced contact hours acknowledge that research requires significant development time and generates large grading loads (written and analytical).
- Research immersion during summer and IEX with funding for both students and faculty (2-4 each year in addition to existing Presidential collaborations; increase faculty stipend).
- Encourage and support experiential research projects like the Big Hill Farm, the Coneflower Restoration and the Solar Energy Services Model Initiative.

Initiative 1.5: *Raise the profile of research currently being done by biology students.*

Promote peer learning by encouraging to present research in classes and research symposia. Display student posters in different venues on-campus. Fund presentations at regional and national meetings. Encourage community outreach with lay audiences. Support ways for faculty to have time to mentor these endeavors. A dedicated liaison to Marketing and Communication, and Advancement could help us do a better job telling our good stories.

Initiative 1.6: *Encourage students to conduct research at institutions and agencies that can provide a critical mass of researchers and state-of-the-art facilities.* This is possible through better advertising and advising when we are not able to currently serve all the students interested in conducting collaborative research.

## **Goal 2. Provide educational opportunities where students learn about and participate in cutting-edge science.**

Initiative 2.1: *Dedicated annual budget line and ultimately an endowed fund to maintain, repair and replace equipment and purchase new, cutting-edge instrumentation.* Cutting-edge research requires new, upgraded and maintained instruments and equipment at all scales (from pipetters

and microscopes to autoclaves and imaging instruments). We constantly request funding just to repair our old instrumentation; faculty spend an inordinate amount of time maintaining old equipment; the college has no real plan for replacement, maintenance or repair let alone new purchases. These issues have been identified in the strategic plans for every department and program in the natural sciences division as well as Psychology. A line in the College's annual budget should be established immediately to begin to address this acute need and diligent effort should be expended to increase the funds in this line sufficient for the need. Ultimately an endowment should be established, but need cannot wait. Today, we envision a \$5 million endowment which would provide ~\$225,000 annually, which is an amount our peer institutions spend. Half of this could be distributed in an annually rotating manner to a program or department, while the other half could be divided equally among remaining departments to support purchase of intermediate priced instruments (\$50,000 per item).

*Initiative 2.2: Hire a dedicated technology specialist to assist faculty with technical and instrumentation needs.* As we use more technology and instrumentation, the needs for support increase. Instruments are complex. Support needed includes timely and proactive maintenance of all computers, peripheral device interfacing, discipline-specific software applications, programming, and computer-controlled data acquisition. Expanded and flexible computer technology is needed for classrooms and labs (not necessarily fixed stations).

*Initiative 2.3: Establish and equip an ID Imaging Center to provide student access to current and emerging technology.* This was part of the successful evolving HHMI proposal, but it still requires development funds to support purchase of instruments such as confocal microscopes, visualization workstations and a regular budget for operations, software, equipment maintenance and supplies to effectively support teaching and research. In addition, the college did commit in the HHMI proposal to staff the center with a full-time director.

*Initiative 2.4: Encourage pursuit of significant extramural funding or high profile scholarly endeavors by providing release time to faculty.* Cutting-edge science requires significant monetary inputs and a high research profile. Gustavus cannot provide everything we need so we must pursue extramural grants and multi-institutional collaborations, both of which require time and resources. We are excellent scholars and grant writers, but need time to obtain preliminary data, read, travel to conferences, and collaborate with other scientists so we can stay competitive. We propose course releases and leaves when we have opportunities to develop large grants or edit journals. A rotating endowed chair among existing FTE or new lines can also free FTE for individuals engaged in these significant endeavors.

*Initiative 2.5: Bring in scientists active in frontier disciplines.* We propose: one term position that would bring specialties we do not house (Rydell-like position in ethics, science policy, energy), an expanded seminar series (fused with other departments and Midstates faculty, Nobel and Linnaeus Symposia attendees), and increased honoraria or travel funds for speakers.

*Initiative 2.6: Increased budget for journals and journal databases* strengthens student information literacy, broadens students' horizons by connecting what they read in textbooks and do in lab with rapidly changing discoveries, and allows faculty to keep current. An external library review found that, "an overall increase in the library budget is the only solution...to maintain a quality science program." Unfortunately, since then the library budget has *decreased* by \$50,000.

### **Goal 3. Ensure and promote interdisciplinary avenues of teaching and research in biology.**

Initiative 3.1: *Sustain our interdisciplinary programs (Please refer to strategic reports by Neuroscience, Biochemistry & Molecular Biology, Environmental Studies and the Arboretum).* Three additional FTE, two shared with BMB and Neuroscience will help to support ID programs that are currently unsustainable, to mentor and do research with the large number of students involved, to support current faculty overwhelmed in these programs, and to allow these excellent teachers to teach in core and general education classes. We need enhanced ID budgets to provide instrumentation and technological resources. We also propose:

- Enhanced communication between all ID program directors and the administration; regularized conversations among departments and programs in and across divisions.
- One rotating term position (Rydell-like) that would bring in specialties unrepresented in Biology as well as MCS, Physics, Philosophy, Geology, Geography, Chem and ES.
- Consistently replacing positions when ID program faculty go on leave.
- Co-teaching interdisciplinary courses by allocating contact hours more flexibly.
- Establishing new ID collaboration grants like RSC; increase Presidential grant stipend.
- Establishing course and instrumentation budgets, new equipment acquisition and maintenance funds; ensure budgets increase with costs of emerging technologies.
- Ensure access to journals and journal databases.
- Sharing the rotating endowed chair position (Initiative 1.4) with ID programs (eg. Neuroscience, Environmental Studies, Linnaeus Arboretum).
- Having time and resources to develop deeper associations with alumni and friends of the college that work in interdisciplinary fields associated with biology.

Initiative 3.2: *Develop more interdisciplinary courses, research opportunities, and an ID seminar series (Initiatives 1.2, 2.3).* We have excellent ID courses, but would like to offer capstone ID classes that draw more majors and minors. Additional faculty lines and resulting FTE flexibility would allow us to develop new courses, engage in more ID research and offer an ID seminar series. Endowment for a communal ID seminar series would help to interact with ID leaders, and be an important networking opportunity for everyone. Courses could be team-taught with faculty across disciplines and collaborative ID research would promote gain of different kinds of skills. We also want time to develop more associations that are community based and interdisciplinary in nature (e.g. environmental research and outreach like Big Hill Farm or Solar Energy Initiative and the Mayo Scholars program).

#### **Goal 4. Provide opportunities for *all students* to become interested in, learn more about and be successful in biology.**

Initiative 4.1: *Continue developing a rigorous, integrative curriculum that reflects the wonders and possibilities of the field, and that nurtures a passion for life-long learning.* Support and enhance innovative, student-centered pedagogies and active learning environments by reducing introductory core class sizes, maintaining upper-level offerings and FTS, CII and Gen Ed courses. Resources and facilities appropriate to pedagogies of engagement require an institutional commitment that includes:

- Funding three new faculty lines to allow further size reduction of high-demand classes. New lines also allow reconfigured FTE to ensure continued involvement in FTS, CII, NASP courses, IEX, ID programs and the major.
- Faculty continuing to develop innovative pedagogical approaches to the scholarship of teaching and learning, and other faculty development endeavors.
- Two rotating endowed chairs that support collaborative faculty student research.

- Facilities renovation or addition to enhance classroom and lab flexibility. Noise abatement (ventilation noise exceeds OSHA standards); facilities that encourage communal spaces for study and discussion.
- Allowing departmental budgets to carry over to encourage long-term planning.

Initiative 4.2: *Enhancement of tutoring and implementation of peer-mentoring, supplemental instruction* will require appropriate staffing and time for faculty participation; these new programs will be training students to become effective mentors.

Initiative 4.3: *Garner resources and better facilities to allow for innovative pedagogy* (see general recommendations).

## **Goal 5. Foster opportunities for students to experience how biology is relevant to the world and to exhibit good citizenship and stewardship.**

Initiative 5.1: *Promote service learning opportunities in classes and research.* Additional lines would provide flexibility in teaching schedules for development time and provide time for the mentoring that service opportunities require.

Initiative 5.2: *Encourage international and diverse cultural perspectives.* Advise students to study abroad; continue to offer international or cultural IEX courses; include global perspectives and encourage ID exchanges in courses. These types of courses often get cut when attempting to meet the basic needs of our majors and in our ID programs. New staffing would ensure that innovative, intercultural courses can be developed and taught regularly.

Initiative 5.3: *Encourage students and faculty to serve as community resources on biological topics.* Use additional time that new faculty lines would provide to mentor students interested in serving in outreach capacities, work more with Education faculty and students to facilitate an understanding of how we can connect our interest in community action with community needs.

Initiative 5.4: *Model and encourage connections between biological, economic, policy, resource stewardship, ethics, faith and vocation.* Have time and resources to incorporate issues and research into courses; partner with CVR, Johnson Center, the Linnaeus Arboretum, the Diversity Center, Education and other campus entities to do research and outreach, and to teach.

## **Goal 6. Cultivate productive relationships between faculty, alumni, and current students that facilitate professional development and leadership skills for all.**

- Initiative 6.1: *Maintain better contact with alumni and offices on campus.* Continue publishing a department newsletter, enhancing social networking websites (Facebook or blogs) and updating alumni boards. Enhance databases of graduates in department and with the Office of Institutional Research; better publicize the activities of current and recent majors by meeting regularly with a dedicated liaison from Marketing and Communication; make time and have resources to encourage alumni to return to campus to share their stories with current students. Establish and enhance liaisons with Alumni and Advancement as a way to further develop networks and resources. Closer relationships with alumni, the Offices of Alumni, Marketing and Communication and Advancement will allow us to:
  - encourage financial giving.
  - solicit responses or feedback from alumni.
  - create more opportunities for career mentoring and networking.

- sponsor alumni advising panels that discuss applications to and experiences in graduate and professional schools, in careers and at outreach or service activities.
- continue to support alumni via post-graduation mentoring.

Initiative 6.2: *Facilitate student leadership development through effective advising of and participation in student groups and the biology honor society.*

Initiative 6.3: *Establish outreach partnerships with other institutions, local schools and community groups that could provide opportunities for our students.* We will expand activities associated with the Nobel Conference by adding displays, interactive kiosks, demonstrations and experiential activities. In conjunction with the Education department and the HHMI grant we will support outreach activities with K-12 teachers during Nobel week and summer training workshops. Other connections we intend to further cultivate include the Minnesota DNR, MN Environmental Protection, MN Pollution Control Agency, Pew Midstates Consortium, Mayo Clinic and other agencies.

**Goal 7. Ensure that all faculty members are supported as whole persons engaged in a vibrant, sustainable life as teacher-scholars.**

Initiative 7.1: *Continue to encourage faculty excellence in teaching, advising, service, leadership and scholarly endeavors which include collaborations with students, research with colleagues and the scholarship of teaching and learning, endeavors.* Fund creative ways to support and reward these multifaceted endeavors by reducing teaching loads and developing mechanisms to more effectively use faculty time. Each of the following items outlined elsewhere in our strategic plan would support our desire to engage in a vibrant sustainable life and would enhance or improve the way we allocate our time.

- Equitable teaching loads to those throughout the College.
  - Reduce teaching loads to 9-10 contact hours
  - Additional and flexible FTE
- Support effective use of faculty time.
  - Increased technician support.
  - Cover instrumentation repair, replacement and acquisition so faculty can actually do work instead of working on old equipment, and so faculty can write grants to support scholarship rather than write for equipment.
- Support faculty scholarship.
  - Rotating endowed chair and fourth year leave to increase time to write grants and publications, attend conferences, read, reflect, mentor, do outreach and develop new collaborations.
  - Acquire and support library resources and journal databases for literature.
  - Institutional recognition of our success and enhanced reward. For example, release time to write paper or grant renewals from funded activities.
- Obtain AAUP salary and benefit goals as a way to recruit and retain great faculty.

**SECTION 4: ASSESSMENT**

As a way to address all goals, we intend to establish an Alumni advisory board and use Midstates Consortium consultants to begin developing a comprehensive assessment plan.

**Goal 1 ( Ensure that all majors graduate with rich research experiences)** will be demonstrated when we see an increase in the number of students participating in and talking about independent and

collaborative research projects here and in other venues (to 100% with >50% of the experiences being offered on campus). Currently we keep track of the number of students involved in research (here and elsewhere) as well as quantify research-related outcomes (e.g. journal articles, presentations and involvement in public education) among our majors and faculty, thus we can use historical and future assessments to assess this goal. We also intend to track specific research-related learning objectives with SURE assessments. We also would see if the number of directed research and capstone courses increase from the current rate of one per four years and zero times, respectively. This goal is only possible with increased staffing and reallocated FTE so new lines would also measure success.

The success of **Goal 2 (Provide educational opportunities where students participate in cutting-edge science)** will be examined by evaluating the number of students that are admitted to competitive, high quality graduate or professional programs. We currently administer an ETS biology field exam each spring to all seniors and here we ask all our graduating seniors what their future plans entail. We also send questionnaires out to alumni and keep in close contact with our alumni so this allows us to know of new career tracks among students. We also supplement the ETS exam with a questionnaire that assesses understanding and mastery of currently employed and cutting-edge skill and techniques across all biological sciences subdivisions. We will continue to modify this instrument to assess if students understand and can perform important new techniques. We also will examine the number of alumni that gain employment in companies that are at the frontiers of science (e.g. environmental and health related technologies) through tracking methods that examine employment and post-baccalaureate studies among our majors (via the Alumni newsletter, Dept blog and Facebook). Additional funding for seminar series, rotating term positions, and technology improvements and support are also essential to reaching this goal. As a result we will see more students talking about and engaged in scientific endeavors that are at the forefront of their respective field.

**Goal 3 Gains in interdisciplinary avenues** require sustainable, interdisciplinary programs as evidenced by higher levels of staffing, increases in budgets and instrumentation acquisition, flexibility in FTE. We currently track numbers for all students enrolled in, majoring or minoring in ID programs or courses. We have used increased resources well if we continue to see stable or increasing student demand for the ID programs, and if students are conducting more interdisciplinary research as measured by numbers of theses, publications, grants, independent study proposals and presentations (at Sigma Xi, Creative Inquiry, the Linneaus symposium or other venues). We also would see an increase in the ability to offer and sustain new courses that transcend disciplinary boundaries. We currently are sponsoring two honor's theses that are ID in nature (w/ MCS and PHI) and we would see an average number of ID honor's theses steadily increase. We would see a variety of students attending our ID seminar series that transcends disciplinary boundaries (e.g. Biology majors at biochemistry, biophysics, neuropsychology or environmental policy-related talks). Finally our alumni will be working in interdisciplinary careers. We will acquire and compile quantitative data via the ETS surveys, senior and alumni surveys as well as through electronic or continued one-on-one methods.

**Goal 4. Ensure access by providing opportunities for all students to become interested in, learn more about and be successful in biology** via infrastructural modifications or additional faculty lines that allow us to teach innovative 21<sup>st</sup> century pedagogies (rather than limited by a 1960 science building built for 1960s pedagogies). We track enrollments and grades by ethnicity in our courses, and retention among majors and supported ID programs. If we see increased retention and grades earned, especially among under-represented groups, our efforts to enhance experiences for all students are being addressed. We will work with the Diversity Center, LSAMP coordinators and via the HHMI program to track the numbers of and success of minority, non-traditional, first-generation and under-represented students. Recently we have seen a slight increase in the diversity of students retained and successful in our major (as measured by retention/completion, number of research or other projects that students are engaged in such as working for or in the Department). We will be even more successful if these numbers continue to increase. We will

track student perception via surveys administered at the end of our core classes and among the seniors (first, second and final year students). We only are able to offer sufficient FTS, CII, IEX, NASP, ID courses and classes for our large major if we receive additional faculty lines.

**Goal 5. Foster opportunities for students to experience how biology is relevant to the world and to exhibit good citizenship** would be achieved if we see an increase in the number of service learning opportunities in classes because of additional staffing and reallocated FTE. We also would continue to see sustained interest in study abroad. We would track the number of community service and outreach projects via our ETS field exam supplemental questionnaire. We would document participation in local schools and agencies, in national and international settings and see students leveraging their experiences here to initiate new endeavors post-Gustavus. For example, one of our majors recently initiated a holistic health program in India after taking an IEX course there and doing a public health program in Brazil and medical research with the NIH.

**Goal 6. Cultivate productive relationships between faculty, alumni, and current students that facilitate professional development and leadership skills** can be measured via stronger relationships with the Offices of Institutional Research, Marketing and Communication, and Corporate and Foundation Resources. A liaison from each of these offices will regularly meet with the Department to discuss successes, needs and our vision. They would record and promote stories about successful students, faculty and staff. For example, we would see much more understanding of and advertisement associated with major grants (HHMI grant has been undersold by the Administrative Offices to date). We would see many more stories about our research symposia, students, unique classes and scholarship in various news venues. We would be working more closely with Advancement to acquire new instrumentation. We will see increased interactions with alumni, more giving and more alumni on campus. If this goal is met, faculty will have time to contribute to professional societies, ID programs, major committees and cross-campus initiatives.

### The Biology Department 2008-2009

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