DEPARTMENT OF ECOLOGY AND EVOLUTION: TEN-YEAR STRATEGIC PLAN
EXECUTIVE SUMMARY

Ecology and Evolution are central to modern biology and to our understanding of the natural world. Conserving and restoring the support systems that enable us to maintain and improve our quality of life requires insights into the ecological and evolutionary processes underlying the form and function of organisms, their interactions, and relationships between organisms and the environment. Research in ecology and evolution is indispensable to respond to societal challenges such as pathogen resistance to antibiotics, insect resistance to chemical pesticides, emergent and re-emergent diseases, rapid ecosystem loss and fragmentation, conservation of biodiversity and ecosystem services in the face of climate change, overexploitation of natural resources, and threats caused by the dramatic increase of invasive species worldwide.

Our vision is to be among the leading departments in our field in innovative, multidisciplinary research and education in ecology and evolution and regain our top ten status over the next ten years.

Our goals are to:

• contribute research and scholarship of the highest quality in ecology, evolutionary biology, organismal biology, their applications and intersection with other disciplines
• shape future generations of researchers, educators, and other professionals in these disciplines by educating graduate students; and
• contribute to the education of diverse citizens in ecological and evolutionary topics that impact the welfare of society and its environment by training undergraduates.

These goals will enable us to shape and build our disciplines at national and international levels, and help make Stony Brook a leading center of research in ecology, evolution, organismal biology, and interdisciplinary research applications. We envision a vibrant research community that conducts cutting-edge research and educates future researchers so that they have the theoretical and applied foundation to solve the pressing challenges faced by society.

The Department of Ecology and Evolution at Stony Brook is poised to generate the scientific knowledge, innovation and tools necessary to help solve the current and future ecological and evolutionary problems society faces, many of which interface with human health, economics and sustainability. Since its inception, the Department of Ecology and Evolution at SBU has been one of the top departments in the U.S., providing the theoretical underpinnings and quantitative methods currently used in fields ranging from biostatistics to the impacts of climate change on natural systems, from uncovering relationships among living organisms to determining how inherited traits contribute to survival and performance. In recent years other universities have surpassed Stony Brook in national rankings by expanding equivalent departments. Despite being only one third of the size of the two top departments in the country, the Department of Ecology and Evolution has maintained a strong national and international reputation, and includes leaders in our field. Faculty in our department

are highly productive, publish in high impact journals, and have high funding rates in their fields. For these reasons, Ecology and Evolution is one of the strongest academic units in the College of Arts and Sciences.

We will accomplish our goals of excellence in academics, graduate and undergraduate education, and attain leadership in our field and in interdisciplinary endeavors by building on current strengths within ecology and evolution and embracing our cross-disciplinary strengths and ties. Essential to attaining our goals is an increase in our faculty to offset losses, compensate for the large number of faculty nearing retirement, and capitalize on opportunities to create interdisciplinary research programs. To compete with the top departments in the country we must build our faculty to at least 28 members.

We have identified four key areas where faculty recruitment is indispensable to achieve our goals and capitalize on opportunities to create innovative interdisciplinary research programs with other units both on and off campus.

• Quantitative and statistical modeling and analysis, critical to handling the large and complex data emerging from research in fields as disparate as global ecology (e.g., to forecast effects of climate change) and systems biology (e.g., to understand how genes and gene networks affect development and performance);
• Plant ecology and evolution, almost completely lacking at SBU and essential to build interdisciplinary research with Brookhaven National Laboratory on ecosystem response to increased CO2 and higher temperatures (e.g., to predict impacts of climate on food crops over the next century) and with other interdisciplinary groups at Stony Brook;
• Ecology and evolution of global change, an area of current strength where targeted recruitment can facilitate more funding opportunities (e.g., by modeling interactions between useful organisms and their parasites at a global scale); and
• Evolution and ecology of biological function, indispensable for research on behavior, physiology, and cell biology, which in turn informs interdisciplinary questions (e.g., to understand what ecological and evolutionary mechanisms plants and animals can use to cope with new conditions).

Our strategic plan offers a path to maintaining excellence in research and education, and enhancing our national profile by expanding our faculty, serving as a leader in building interdisciplinary research programs, and improving the conditions of graduate and undergraduate students. Our department exhibits the strengths highlighted by the President's goals for a strategic plan for Stony Brook University and is one of the strongest departments in the College of Arts and Sciences. Investment in the Department of Ecology and Evolution offers a rare opportunity to maintain and strengthen the university's national and international recognition, conduct research in an area with growing funding prospects that benefits society, attract the best graduate students worldwide, and educate the growing number of undergraduates in biological sciences, all of which are required to maintain SBU as a leading research university.

DEPARTMENT OF ECOLOGY AND EVOLUTION: TEN-YEAR STRATEGIC PLAN

AUTHORIZATION

This document was written by the Ecology and Evolution Strategic Planning Committee:
Liliana Davalos, Daniel Dykhuizen, Douglas Futuyma, Catherine Graham, Jessica Gurevitch (ex officio) and Dianna K Padilla (Chair). This plan has received unanimous endorsement from members of the Department of Ecology and Evolution, Stony Brook University.

MISSION, VISION, AND VALUES

The missions of the Department of Ecology and Evolution (E&E) are
(1) to contribute research and scholarship of the highest possible quality in ecology, evolutionary biology, organismal biology, their applications and intersection with other disciplines; (2) to educate graduate students and shape future generations of researchers, educators, and other professionals in our disciplines; (3) to train undergraduates and contribute to the education of diverse citizens in ecological, evolutionary, and other biological topics that impact the welfare of society and its environment, and (4) to shape and build our disciplines at national and international levels.

For many years, the Department of Ecology and Evolution at Stony Brook was in the top ten departments in the U.S. in this field, and was one of the strongest departments in any field across all of SUNY. We intend to regain this status over the next ten years. Our vision is to be among the leading departments in our field in innovative, multidisciplinary research and education in ecology and evolution. Stony Brook University is poised to be a center for the generation of scientific knowledge, innovation and tools necessary to solve the current and future ecological and evolutionary problems society faces, many of which interface with human health, economics and sustainability. This can be accomplished in two ways: by building strength within ecology and evolution, and by embracing our cross-disciplinary strengths and ties. We envision a vibrant research community that conducts cutting-edge research and educates future students so that they have the theoretical and applied foundation to solve future challenges faced by society. Building on the foundation of a strong E&E department we will contribute research and scholarship of the highest possible quality in ecology, evolutionary biology, organismal biology, and their applications and develop cross-disciplinary research centers and initiatives to guide the direction of our science.

Ecology and Evolution are central to modern biology and to our understanding of the natural world. Evolution provides the essential framework and fundamental principles upon which all of biology is built. The principle of evolution – the emergence of all forms of life from a single common ancestor, and their divergence from one another largely under the influence of natural selection – is one of the most important discoveries in human history, with immense implications in almost all fields of thought, from philosophy and theology to agriculture and medicine. The great variety of

evolutionary questions requires a commensurate variety of methods and approaches, ranging from studies of fossils and anatomical structures to genetics and genomics. Evolutionary studies have diverse, important applications. For example, microbial pathogens evolve resistance to antibiotics; modern methods of crop breeding use evolutionary principles and information; evolutionary comparisons of genomes are used to pinpoint important human genes by their similarity to the genes of other species.

The field of Ecology is concerned with the relationships between organisms and their past, present, and future environments. These relationships include physiological responses of individuals, structure and dynamics of populations, interactions among species, organization of biological communities, the exchange of energy and matter in ecosystems and processes underlying patters of biodiversity at landscape, regional and global scales. Ecology provides a scientific foundation for making decisions on how to manage and sustain our natural world. In a world stressed with climate change, increased globalization and transportation of pathogens, non-native species and over-exploitation of natural resources, the science of ecology provides critical information needed to effectively address these threats.

Together, ecology and evolutionary biology provide the foundation for understanding of biodiversity on Earth, at levels from genetic diversity within species to the diversity of species and their associations within ecosystems. Knowledge of biological diversity has countless applications: identifying pathogens, developing technologies based on organisms' adaptations (e.g., underwater adhesive), finding organisms useful for bioremediation of environmental damage, among many more examples.

The Department of Ecology and Evolution, one of the first departments of its kind in the world, gained international notice and respect soon after its establishment in the late 1960's. This respect was based on a strongly conceptual and theoretically informed approach that has now become standard for E&E departments across the country. While our faculty and graduate program have remained strong and widely recognized, since the mid-1990's newer departments at other universities have surpassed E&E, due to much larger faculties, better infrastructure, and more consistent support from their universities. Nonetheless, E&E retains an outstanding reputation, which is based on the research and leadership of its faculty and the accomplishments of those who have graduated from its Ph.D. program (see below).

The E&E faculty span a wide range of sub-disciplines, including ecology at levels from organisms and physiology to populations to ecosystems, evolution from the level of genes and genomes to species and phylogenetic trees, and special areas within these broad subjects, such as conservation and evolution of disease. Ecology and evolutionary biology are inherently interdisciplinary, and many of our research programs are integrative, combine evolution with ecology, or incorporate other disciplines, within and outside
biology. We are committed to training students at all levels in the fundamental principles of both ecology and evolution. This broad training and the question-oriented approach we instill have served our Ph.D. students well. E&E faculty are enthusiastic about and dedicated to undergraduate teaching of both biology majors and non-

majors. We offer a wide range of undergraduate lecture and laboratory courses and provide research training to many undergraduate students. Faculty members in our department are actively engaged in public outreach by delivering and organizing public lectures, interacting with the press, journalists and policy makers, and writing trade books, texts and articles on evolution, ecology, and environmental challenges, in addition to scholarly books and articles. The citation record for research articles by our faculty is exceptionally strong, and the textbooks written by members of the department are standard all over the US and the world.

In sum, E&E is an outstanding department with the vision and motivation to address critical issues in both the basic and applied sciences. Building on the existing strengths of the department, we will move the international reputation of Stony Brook University to the highest levels nationally and internationally.

GOALS AND STRATEGIES

Excellence in academics, leadership and cross-disciplinary research

Current status

Our department exhibits the strengths outlined in the President's strategic plan for Stony Brook University, and has long been considered one of the academically strongest departments in the College of Arts and Sciences. Our faculty includes internationally recognized leaders of their fields, is highly productive and publishes in high impact journals, and conducts both basic and applied research. The funding rate for E&E is high for our field and we are confident that it will increase, particularly given the outstanding faculty hired in the recent past. During this academic year alone, E&E faculty were awarded one new NIH grant and five new NSF grants, as well as other research awards and contracts (see Appendix 1). Finally, we are actively engaged in interdisciplinary research and interactions with diverse other units, on and off campus.

Our department has an impressive professional profile and reputation. Our faculty members are invited speakers in this country and abroad. The 16 current (active) faculty members include one member of the National Academy of Sciences, four Fellows of the American Association for the Advancement of Sciences, three members of the American Academy of Arts and Sciences, and at least six who have served as officers in professional societies, including the presidency of at least five major scientific societies. Four of our 16 members have been named Distinguished Professors, and in 2008, E&E succeeded in hiring two faculty in a campus-wide competition for applicants to the CIDER (Consortium for Inter-Disciplinary Environmental Research) program. Our department was invited by The National Science Foundation to submit a proposal for a 2009 symposium to mark the bicentennial anniversary of Charles Darwin's birth – the only such invitation that was issued. The result was a highly successful meeting and a book, now in press, that will stand as a landmark.

Although most research in E&E concerns basic ecological and evolutionary processes, faculty and their graduate students have contribute actively to the applications of our fields, including the genetics and evolution of disease organisms, human population

genetics, evolution and ecology of insect pests of crops, population dynamics of endangered species, causes of biological invasions and impacts of invasive species, and restoration of essential species for ecosystem-based management. Members of our faculty have developed widely-used statistical methods for analyzing ecological and evolutionary data, ecological and genetic consequences of environmental contaminants, and prospective ecological and evolutionary effects of global climate change. Faculty and their students do research on every continent and include subjects ranging from yeast genomics to oceanic nutrient fluxes. E&E provides an unusually interactive and congenial intellectual environment to its faculty and graduate students, with well-attended weekly colloquia, speaker receptions, and reading groups. E&E faculty contribute to and appreciate the stimulating and collegial milieu, as well as the opportunity to attract excellent graduate students.

From January 2006 to January 2010, current E&E faculty published 10 books and 172 articles (mean = 10.9, median = 9, see appendix). Most research support available in our disciplines is from the NSF, although several faculty members have long-term NIH funding. Other federal support has been granted from US EPA, US Forest Service, NASA and NOAA. Over the past 4 years 14 of our faculty have been awarded a total of 52 grants, with an average total of $1,283,647 (see Appendix 1). A majority of our grants are collaborative with colleagues outside Stony Brook University, a mark of the strong engagement of our faculty with national and international colleagues, but also indicative of our small size. With a larger department it would also be possible for more faculty to generate collaborations both within the department and across the university. We are currently exploring a range of highly promising multidisciplinary, interdepartmental research and teaching initiatives.

E&E faculty have also established diverse local collaborations and intellectual interactions, many of an interdisciplinary nature. . These collaborations are the foundation to pursue the large-scale inter-disciplinary problem solving increasingly encouraged by federal funding agencies. For example, CIDER brings together the two E&E faculty who were hired through this program with colleagues in many other departments, including History and Public Health. E&E ecologists and evolutionary biologists are associated with colleagues in SoMAS (in which three E&E faculty hold joint appointments), and Brookhaven National Laboratory (BNL) in the Center for Climate Change. A seminar series in Evolutionary Functional Genomics has been established with researchers from E&E, SoMAS, BNL, Cold Spring Harbor Laboratory, and the Departments of Biochemistry & Cell Biology and Neurobiology & Behavior. Several faculty collaborate and/or have affiliations with the American Museum of Natural History and the Wildlife Conservation Society in New York City. As noted below, E&E has been working with the Department of Anthropology to institute an undergraduate major in Human Evolutionary Biology.

Goals and Strategies

Our goal is to be one of the most outstanding departments across all SUNY campuses, and to be in the top 10 E&E programs nationwide. This goal requires that we add critically needed faculty members, retain our outstanding junior and mid-career faculty members and strengthen our interdisciplinary and inter-unit interactions.

The addition of faculty is critical for conducting cutting-edge research within our discipline, for capitalizing on opportunities to create vibrant interdisciplinary research programs, address the broad array of challenges that face our society, and to build the internal collaborations needed to regain our status as a top 10 department.

Our greatest needs are:

(1) Quantitative and statistical modeling and analysis. Mathematical modeling of evolutionary and ecological processes, and statistical and bioinformatics analysis of increasingly complex and massive datasets are critically important in our field, and indispensable for graduate training. Expertise in this area is needed for addressing questions about probing genomes for information on emerging diseases, for examining the effects of local and regional climate variation on critical habitats and species, and for dynamic modeling needed to forecast how climate change might influence biodiversity and ecosystem processes or how invasive species will likely spread into fragile ecosystem. With the loss of faculty and recent and prospective retirements, we do not have sufficient depth in quantitative and statistical modeling and analyses, relative to other leading departments in our field.
(2) Plant ecology and evolution. Plants are the basis for most ecosystems on earth and their inhabitants (including humans). Plant science is almost completely lacking at SBU; there are currently two faculty whose work focuses on plants on our campus (one of which is in E&E). This is an area of very high priority that impacts our reputation in the field, our ability to attract and train graduate students, our ability to offer many of our undergraduate biology courses and our ability to create inter-unit research initiatives. If we are to conduct interdisciplinary research in fields such as climate change science or conservation biology with other units on campus as well as other local institutions (e.g., Brookhaven National Laboratory), strength in plant ecology and evolution is essential.
(3) Ecology and evolution of global change. Research on the ecological and evolutionary consequences of climate change is critically needed and in recent years has increased greatly. This is an area in which E&E can shine and can strengthen the interactions with other units described earlier. This research area will overlap with other areas of need, including quantitative modeling and analysis, and plant biology, and will facilitate many connections with other groups on campus and at BNL.
(4) Evolution and ecology of biological function. Evolutionary and ecological analysis of at the organismal scale, including behavior, physiology, and, increasingly, cell biology. This are of research concerns the ability of organisms to respond to short-term changes in the environment, deal with increasing threats of emerging diseases and develop resistance, and the consequences of environmental treats and disturbance. These critically important areas offer opportunities for interdisciplinary interactions, and are increasingly emphasized in most leading departments of ecology and evolutionary biology.

Although these are the areas in which we perceive the greatest need, several other areas should be strengthened, including community ecology, microbial ecology and evolution, and evolutionary developmental biology. In each of our focal priority areas, we require at least two new faculty to bring us up to competitive strength and to

provide the critical mass needed for the development of expanded programs, research grants, and inter-unit research initiatives.

To attain and keep top 10 status nationwide also requires that we retain our outstanding junior and mid-career faculty members. In recent years, several outstanding young and mid-career faculty members in the prime of their productivity have taken positions elsewhere. None departed because of dissatisfaction with the E&E department; some moved for personal reasons that could not have been countered, but others might well have been retained if circumstances and inducements had differed. These include issues of salary (relative to the high cost, especially of housing, on Long Island), graduate student T.A. support levels, opportunities for spouses or partners, and the quality of facilities and library resources. We must maintain and improve on factors that will help faculty retention, but many of these factors are beyond E&E's control. These same issues affect our ability to recruit top-level young faculty, although, happily, we have been highly successful in this respect. But given recent faculty losses and retirements, we need to add faculty both in order to encompass emergent and critically important research areas and in order to provide adequate undergraduate and graduate education (see above).

To be in the top 10 programs nation-wide also requires that we expand our interdisciplinary and inter-unit interactions. One such promising initiative is the proposed undergraduate major in Human Evolutionary Biology. This program will provide a unique research and educational opportunity between E&E and the Department of Anthropology. Genetic and genomic data on humans and other primates are increasing exponentially. These databases are gold mines for testing evolutionary hypotheses, and conversely, inferences from these data depend crucially on evolutionary analysis. Such inferences include finding genes that affect human health and disease. Essential to this major is obtaining new faculty members in primate and human evolutionary genetics and genomics, areas of very high current importance for both fundamental and applied research, and in which SBU lacks faculty. Appointments made to serve the Human Evolutionary Biology major need to be in addition to those required to rebuild our numerical strength and diversity.

Interdisciplinary and inter-unit interactions among SoMAS, BNL, Cold Spring Harbor Laboratory, ANMH and the Departments and Centers on campus, will be trengthened by hiring faculty in the areas we have identified as our greatest need. For example, increased strength in plant science is essential if we are to form strong collaborative research partners with the Environmental Science Department at Brookhaven National Laboratory where research focuses on plant uptake of CO_2. At SoMAS atmospheric scientists use inputs from plant ecology to parameterize future climate change models.

Further, we are excited about and actively involved in the development of new interdisciplinary units such as the proposed GIS Center at Stony Brook University. This center will facilitate research and education across departments such as public health, SoMAS, political sciences, geosciences and anthropology.

Challenges

Our most important current challenges lie in three major areas:

- Failure to replace faculty and to build the faculty in critically important new areas
- Deteriorating physical plant
- Limited institutional support for equipment replacement and pilot studies

The limitations with regard to faculty stem from our small size:

- Far fewer faculty members than in the most highly rated E&E departments
- Loss of key faculty members
- A top-heavy age structure

At present, E&E has 16 active faculty, down from a peak of 19 in the 1990's. Compared with UC-Davis (with 28 active faculty), Berkeley (45), Michigan (45), Harvard (38), Arizona (31), or Connecticut (30), all of which have grown steadily, we are not in a strong position to claim continuing leadership of our field. We have made several excellent appointments of new faculty in recent years, but they have not compensated for the loss of faculty due to retirement and departure. Budgetary constraints have made it difficult to compensate for these departures. Ten of our 16 active faculty hold the rank of Professor; seven are over sixty and of these, four could soon retire. While other institutions have lured away our mid-level faculty at the height of their productivity, almost all our appointments have been at entry level, with a consequent delay in rebuilding the collective reputation of the department as our young faculty build their professional stature. With respect to both retention and the possibility of luring established scientists from other institutions, the most important obstacles to achieving these goals lie outside the Department, and are surely shared by many other departments on campus. With additional faculty we could create a unique and exciting research and training environment that would lead the country in both rigorous, theoretically based research in ecology and evolution and provide unique inter-disciplinary research aimed at combining expertise across disciplines and institutions.

A second major area of concern is the dilapidated state of our facilities. As noted by Provost Eric Kaler in his visit to the department last year: our facilities are far worse than those of other Biological Sciences departments at Stony Brook. In addition, the university bureaucracy and short-handed building staff result in very long delays before repair and renovation projects are approved and executed. Labor charges by the Facilities department are high and in most cases unaffordable. The cost estimates they produce are rarely itemized and cryptic, making it difficult to determine what may or may not be feasible. Life Sciences Complex building and maintenance staff are capable but severely overextended, and have recently had an entire new building added to their responsibilities with no additional support.

In 2005, the External Review Committee (Appendix 2) wrote:
"The greatest challenge to the department's ability to be productive is the deterioration of the physical plant. Breakdowns of critical equipment have resulted in major losses of research productivity, which has ramifications for both future funding

(see funding) and the ability to attract and retain excellent junior faculty members." The Committee added that "the marginal to poor quality of facilities, especially animal and plant care facilities, jeopardizes SBU's present research efforts and future ability to secure funding," and that "the E&E faculty needs the support of colleagues in the central administration to develop new facilities and sustain the current facilities needed for research and training".

Little has changed since 2005. Although minor improvements have been made, including rehabilitated laboratory rooms for new faculty, the greenhouse is still inferior, there are almost no reliable incubators or environmental control chambers, and there is no reliable distilled water system. Our physical space is deteriorated (e.g.. crumbling floor tiles, 30 year old furniture) and many labs and offices have not been renovated or refurbished since the building was opened in 1974. Many of the leading departments in our field are in universities that maintain field stations (which SBU lacks) and provide infrastructure support. Although the SBU library has a dedicated staff and an extensive and relatively convenient library exchange program, the library facilities may well be the weakest among major research universities – a weakness that affects the research effort of the faculty and students. All these conditions lessen the attractiveness of SBU to established scientists we might wish to hire, if that possibility were open.

Research in ecology and evolution requires complex and expensive equipment. E&E has twice been successful in obtaining equipment and support from the NSF panel on Major Research Instrumentation. However, this Program funds large single items almost exclusively, not medium-cost items such as ultracold freezers, and it does not support equipment repair or replacement (for example, of computers).

Another challenge concerns opportunities to compete for small university grants that can be used to seed new faculty research and increase the chance of success in obtaining outside funding. Such programs are available at many of the other universities with outstanding departments of ecology and evolution, but are conspicuously limited at Stony Brook. Seed grants are especially important for developing new skills and areas of research expertise in rapidly changing fields, and provide an important safety backstop for established researchers in times of extremely low funding rates and reduced avenues for research funding. A program of this kind would help retain young, promising faculty, and has been used effectively in other institutions to retain productive scientists and allow faculty to develop new research areas and increase funding. Also, other major research-universities have grant service personal in the departments where the members are submitting grants. Dedicated staff that assist faculty with submitting grants, grant budgets, and grand administration once funded would likely increase the number of grants we could submit and increase research funding.

Actions

We should build our faculty to at least 28 members. With additional faculty we will create a unique and exciting research and training environment that would lead the country in both rigorous, theoretically based research in ecology and evolution and

unique cross-disciplinary research aimed at combining expertise across disciplines and institutions. Increasing faculty numbers is a long-term goal that obviously depends on circumstances beyond our immediate control. It is clear that a faculty size of 28 is necessary if we are to approach the strength of most peer departments. It must be noted that growth beyond replacement of departed and retired faculty will require additional office and laboratory space.

We will establish a committee to explore possible solutions to the problems of equipment and infrastructure, both within and outside of the University framework. We will contact the office of the Vice-President for Research and solicit suggestions and useful information, especially regarding reasonable prospects of repeating our past successes in obtaining facility improvement grants. We will actively pursue all likely routes of obtaining such funding.

We will continue to strengthen and broaden our interdisciplinary ties to other departments and institutions on campus and in the Long Island/New York City area. In particular:

Center for Regional Climate Change with BNL and SoMAS. We will continue our participation in this center with BNL and SoMAS. We will hold an annual one-day meeting, focusing on research and collaboration develop collaborative grant proposals to address cross-disciplinary research questions, and provide unique training opportunities for graduate and undergraduate students in the form of cross-disciplinary courses and seminars.

Human Evolutionary Biology Major with the Department of Anthropology. When the Human Evolutionary Biology major is established, we will organize a seminar series on this theme, focusing initially on local speakers. Within two years of the implementation of this undergraduate major, we will explore the possibility of a graduate degree program or concentration in human evolutionary biology that could include faculty in Anthropology, the Genetics program, and Health Sciences.

Laufer Center for Computational Biology and Genome Science. The Laufer Center serves as a center to form interdisciplinary interactions in the fields of computational biology, bioinformatics, systems biology, and genomics. It is housed in the Chemistry Department at SBU and includes scientists from Cold Spring Harbor, Brookhaven, and many Stony Brook departments, including Ecology and Evolution. We shall continue to participate in this center and become more active.

Biodiversity Science, Conservation and Sustainability. We will build on our relationship with the American Museum of Natural History by inviting Museum scientists to speak in our colloquium program, and continuing to respond to requests to give occasional lectures in the Museum's new Gilder Graduate School. We will again reach out to the Bronx Zoo and the Brooklyn Botanical Garden to build a working relationship in shared areas of concern.

We are in the process of developing other environmentally focused multidisciplinary, interdepartmental initiatives on campus within the social and natural sciences.

By increasing our faculty size, these interdisciplinary activities will provide important avenues for new initiatives for both research and education, as well as large interdisciplinary funded research programs. To establish new initiatives and expand our faculty size will require increased office and laboratory space for our department. We currently have sufficient space only because of recent faculty losses. We can accommodate a maximum of 2 additional faculty members. The amount of research and office space available to our faculty and graduate students is approximately half that of other biology departments at SBU, per capita of active research faculty.

Excellence in graduate training

Current status

E&E faculty take pride in our outstanding graduate program, which presently has 50 PhD students and 11 MA students. The environment our department provides for intellectual growth is superior to that in many other departments in our field, as confirmed by former students who earned their PhD's in E&E. We insist on broad, conceptually oriented training across the fields of both ecology and evolution. We require all students to take a special-topics seminar course every year; faculty members have an open-door policy and can be readily approached by any student in the program; all faculty members are generous in allowing students from other labs to use specialized equipment; and the entire faculty meets every semester to review and discuss the progress of every student. Students from different labs, with very different emphases, readily interact and often take seminar courses together, and help to educate each other. Increasingly students from other departments, such as microbiology, genetics and SOMAS participate in E&E seminars and lab groups. Importantly, most faculty members allow their Ph.D. students wide latitude in choosing and formulating a dissertation topic. This practice, which is the norm in our field, differs from that in most other biological fields, in which a student is expected to take on (or is assigned) part of his/her advisor's research project. This freedom carries risks and sometimes the necessity to secure independent funding, but it encourages creativity, enhances maturation as a scientist, and gives students invaluable experience in learning how to develop active independent research programs, preparing our students for academic research positions. Our Ph.D. students also receive rigorous training as undergraduate instructors, and are generally regarded as the most outstanding Graduate Teaching Assistants on campus; many go on to make extraordinary contributions in university education in their careers as university faculty members.

Our past Ph.D.'s have taken faculty positions at top universities, including Yale, Stanford, Chicago, Pennsylvania, and Michigan, among others. Others hold leadership and research positions in agencies such as the USDA and the US Fish and Wildlife Service, and in NGO's such as The Nature Conservancy. One former Ph.D. student was Director of the Environment Division of the White House Office of Science and Technology Policy, and is now the Co-Director of the World Development Report 2010 on Climate Change. Although applications to biology Ph.D. programs have declined throughout the country, we continue to receive many highly qualified applicants, and

almost annually are able to offer at least one Graduate Council Fellowship. The quality of applicants (and of admitted students) suggests that our professional colleagues are recommending our program to their most promising students.

Finally, as suggested by The External Review Committee and strongly supported by the administration, we have expanded our Masters Program. We now offer a MA in Applied Ecology and in Applied Evolutionary Biology. We are in the process of expanding this program, and will continue to evaluate this program to determine the best ultimate size of the program. Our past MA students have been highly successful; they have obtained positions in state and federal government agencies, NGOs, consulting firms and PhD programs.

Goals and strategies

We will maintain our reputation for producing outstanding Ph.D.'s by continuing the main elements of our graduate training program, and by providing students new opportunities to students through our interdisciplinary initiatives. It is critical that our ability to train students keep pace with the rapid changes in our field as in the rest of biology. For example, in ecology, important new approaches that integrate extensive datasets ranging from remote-sensing of environmental variables to the genetics of populations are now possible, including the use of metagenomics of environmental samples. In evolutionary biology, a wide and growing variety of genomic methods pervade contemporary research. Both ecology and evolutionary biology are undergoing continuous, rapid transformation by the development of new statistical, model-based analytical and bioinformatic methods. Existing E&E faculty will continue to train students in some of these advances, but new faculty will be indispensable to train E&E students to capitalize on new technologies, approaches, analyses and synthesis.

We have always encouraged our students to undertake interdisciplinary research often combining theory and tools from somewhat disparate fields, such as ecology and genetics. A broader interdisciplinary view is increasingly necessary to address current challenges in ecology and evolutionary biology, and future students will profit from collaborations across departmental and institutional lines, including links to the BNL, Cold Spring Harbor Lab, American Museum of Natural History, Wildlife Conservation Society, and New York Botanical Garden. Field experience in natural and human-altered environments remains important, and we expect to reinvigorate our long-standing association with the Organization for Tropical Studies (which offers tropical ecology courses in Costa Rica), the Friday Harbor Laboratories (University of Washington) for marine ecology and evolutionary biology, and similar institutions. These ties are particularly important because unlike many similar institutions, Stony Brook does not have a field station.

Given the increased funding in the department, we are able to support more students in research positions, allowing them to expend their breadth of knowledge and skills in research. We also train our students in grantsmanship and encourage them to apply for competitive national fellowships. At present we have 4 students supported by NSF Graduate Fellowships and one on a NASA Graduate Fellowship.

Challenges

The major challenge to maintaining and improving the graduate program is the TA stipend level. Many of our students are supported as TAs for much of their careers at SBU, and are actively involved in teaching undergraduate laboratories and courses (see undergraduate teaching). As emphasized by the External Review Committee in 2005: "The one issue, however, that was on everybody's mind, both faculty and students, is the level of the stipend. ...This is now in a critical state and requires urgent action. Students cannot afford to live on Long Island with the current TA stipend levels and are taking out loans of $6,000 to $7,000 per year to supplement their stipends." We are aware that the New York State SUNY budget has a large role in driving the level of stipends, but SBU must develop creative ways to address the problem. We must continue to recruit top-quality graduate students and provide excellent TA support to the growing undergraduate biology major.

Other than the stipend level, the major challenges to maintaining a first-rate graduate program are those that affect student research, namely, the issues of facilities, equipment, and library resources that affect faculty research, and the failure to replace critically-needed faculty.

Actions

We propose the following specific actions:

• Raise the base stipend levels to those of competitive with peer departments (adjusted for cost of living)
• Aggressive pursuit of training grants
• Form multi-departmental co-operative groups that will be competitive in the pursuit of interdisciplanary training and student support
• Continue to expand our MA program in Applied Ecology and Applied Evolution
• Clerical and administrative support for faculty members who want to pursue major training grant initiatives."

Although as a department we do not have the power to control each of these, we recognize each as being important for our long-term success. TA stipends absolutely need to be increased. While we have been successful in recruiting excellent graduate students, raising stipend levels is critical if we are to continue to attract the brightest, most qualified students in our field. TAs are essential for running the undergraduate Biology program. Further, the TA experience provides important teacher training for our graduate students, who are generally acknowledged to be by far the most superior graduate student teachers in the biological sciences undergraduate courses. Many of the best students who are offered admission to our program go elsewhere because of the low stipend available to students who are not fully supported on faculty grants or national fellowships. We have taken steps to obtain better information on reasons for students' declining offers to our program, and will track trends and evaluate responses and trends annually.

We will pursue training grants of various types. In the past, we successfully obtained

GAANN (Graduate Assistance in Areas of National Need) training grant support from the Department of Education, and intend to pursue this possibility again. We will form a committee and submit a proposal for the December deadline. We will work with the Graduate School and the Dean of Arts and Sciences to develop a robust proposal that will increase our chances of funding.

Submission of an NSF IGERT (Integrative Graduate Education and Research Traineeship) proposal depends on a level of interdisciplinary collaboration that we hope to achieve in the future. However, for some areas, such as ecological or environmental science, integration with social scientists actively engaged in ecological issues and environmental economists is essential for these grants, but the SBU faculty does not include social scientists in these areas. We will explore the most likely interdisciplinary areas for such a proposal, and we will work with NSF Program Officers to determine the elements needed for a successful proposal. We expect to submit a proposal in the next three years. Development and success of such a proposal depends on significantly more clerical support than we have access to at this time.

We are actively involved in interdisciplinary collaborations and initiatives both within and outside of Stony Brook University and will encourage our students to become more interactive in integrative cross-disciplinary research and problem solving. Students have the opportunity to attend and participate in joint seminars and meetings between E&E and institutions such as Cold Spring Harbor or the American Museum of Natural History. The proposed campus GIS Center would provide advanced training to our MA and PhD students in spatial statistics, analyses and spatial experiment design. It would also provide advanced students in our program the opportunity to TA in GIS courses offered to undergraduate students. GIS skills are essential for research and employment in almost all disciplines from public health, to city planning to ecosystem restoration.

The expansion of our Masters of Arts Program in Applied Ecology and Applied Evolutionary Biology will take effect in the fall of 2011. We will offer new courses specifically designed for these new students. This new effort will provide important training for students interested in addressing applied issues, such as sustainable use of resources, control of invasive species, conservation genetics, and the transport and evolution of emerging diseases. Further, training of MA students will provide needed supplementary income to the department, which we intend to use to support Ph.D. student research, course work, and attendance at national meetings.

Excellence in undergraduate education

Current status and Goals

Our goal is to maintain and improve our undergraduate teaching to provide rigorous, cutting-edge education for SBU undergraduate students. E&E faculty thoroughly enjoy teaching, and several have received teaching awards, including the Chancellor's Award for Excellence in Teaching. E&E provides essential teaching for the undergraduate Biology major. The Biology major is the largest major on campus with

1875 majors and 160 minors. The majority of majors aspire to a career in biomedicine, health care, or medicine, although a considerable number are interested in science teaching, biological research, and careers in conservation and environmental issues.

Biology majors are widely regarded as the strongest undergraduate students at Stony Brook, as demonstrated, for example, by garnering the lion's share of university-wide awards. The faculty in E&E teach a large fraction of these students, who constitute Stony Brook's brightest and most highly motivated students. The quality of the Biology major profoundly affects Stony Brook's ability as a university to attract the most competitive undergraduates, who increase the intellectual standards throughout the curriculum. If the Biology major declines (due to current faculty shortfalls and other financial challenges) many of Stony Brook's best students will go elsewhere, which will have profound consequences for the quality of undergraduate students at SBU.

Undergraduate biology teaching at Stony Brook is jointly operated and staffed by the departments of Ecology and Evolution, Biochemistry and Cell Biology, and Neurobiology and Behavior in coordination with the Undergraduate Biology program. Curriculum decisions are the responsibility of a joint committee that is supervised by the Undergraduate Program Director. E&E faculty represent 28% of the total faculty in the three departments responsible Biology, is responsible for BIO 201 (Introductory Biology, Organisms to Ecosystems), and for a large variety of undergraduate non-major and major courses in ecology, evolutionary biology, biological diversity, and their applications. Based on course listings for spring 2008, spring 2009 through spring 2010, and fall 2010 (projected), E&E faculty offered 23 different courses, 49% of the courses offered by the three biology departments. Of the 23 courses we offer, 10 include a laboratory; these constitute 2/3 of all laboratory courses offered in Biology. All the courses for which E&E is responsible are ordinarily taught by tenured and tenure-track research faculty.

The Biology curriculum is based on an understanding, shared by all faculty members in the four biological science departments, that a sound foundation in the core areas of biology is essential for all biology majors, including organismal biology, ecology, and evolution. Exposure to the full specturm of biology at an introductory level is provided by the required trio of introductory courses and laboratories. Majors are required to take more advanced courses in at least three of four "track" areas. Students are also required to have at least two upper division laboratory experiences with course credit, a requirement satisfied by courses that include a laboratory component or by extended research experience in faculty laboratories. Few formal courses with lab are offered, and faculty cannot begin to place all of the many biology majors in their research laboratories. There is, in addition, an upper division Biology writing requirement. Many Biology majors satisfy this requirement in courses taught by E&E faculty; very few (or none) of the courses offered by faculty in other departments require enough writing (e.g., term papers) to satisfy this requirement.

Challenges

Because of increased enrollment and a reduction in the size of the E&E faculty, it has become increasingly difficult to cover many crucial courses and critically important

portions of the introductory courses. This is a result of the small number of faculty in E&E, and the lack of faculty with critical expertise in several essential areas in our discipline (see faculty needs above). This problem is exacerbated when faculty members who teach key courses take sabbatical leave.

Periodically, it is necessary to rethink the curriculum and develop new courses as the field of biology progresses and changes, and as social needs change. For example, in the last few years we have taken over or developed new laboratory courses in Bioinformatics, Landscape Ecology, Conservation Biology, and Aquatic Pollution in Living Systems, all of which respond to both students' interests and growth areas in biology. In addition, E&E and the Department of Anthropology, working together, developed and submitted a proposal for a new undergraduate major in Human Evolutionary Biology that has been favorably received by the Administration. For this major, E&E will be responsible for courses in topics such as human evolutionary genetics, comparative primate genomics, and behavioral ecology. This major cannot be realized until new faculty members are added to both departments. As noted earlier, the need to add faculty in certain key areas of Ecology and Evolution is critical to our education mission.

Actions

Our goal is to provide excellence in undergraduate teaching and prepare students for careers in 21st century Biology. We will continue to develop intellectually stimulating courses for the Biology major that will enable students to address the research and applied needs of society. To meet this goal we require additional faculty and increased collaboration among the faculty across the departments responsible for the Biology major. We look forward to working with the new administration in Undergraduate Biology to meet the needs of our students and maintain quality education and training.

We will work with the new Undergraduate Biology administration to initiate a thorough review of the curriculum for Biology majors, to determine if student needs, as well as scientific progress and social needs and opportunities, warrant reconfiguration of course offerings and requirements. We recommend such a review every three years, to reflect the changing scientific and social landscape. With additional faculty and cross-unit research centers and programs we can provide new and cross-disciplinary course and research opportunities for undergraduates in the future.

At present, laboratory course offerings are extremely insufficient to meet student demand. Students are in dire need of more offerings; currently students are compelled to take summer courses or delay graduation to satisfy requirements in the Biology major. E&E faculty already provide research training to as many students as they can accommodate. Resolving this problem will not be simple, and will require coordination and cooperation among the three departments. We urge the Administration to give careful attention to issues that concern all three departments of biological science, especially the undergraduate Biology major.

CONCLUSIONS

The E&E department is nationally and internationally recognized as an outstanding faculty and graduate program. E&E faculty interact with members of many other units, both on and off campus. Because of a decline in the number and the diversity of research themes of its faculty, departments at other universities have steadily grown and now rank above our department. Retirements and departures have not been fully replaced, and the existing faculty have a top-heavy age structure. Our goal is to regain our position among the top 10 departments in our discipline by increasing our numbers, disciplinary diversity and strength, and by strengthening and increasing our interdisciplinary ties and collaborations.

E&E offers a highly successful Ph.D. program that attracts many outstanding students and has an excellent record of placing its graduates in leading universities and government agencies. Currently, we have difficulty competing for many superb applicants, chiefly because of the very low stipend for teaching assistants. In addition, the poor state of facilities, shortage of some critical equipment, and an inadequate library are handicaps disincentives in recruiting both graduate students and new faculty. Our chief goal is to maintain and enhance our graduate program by obtaining increased financial support, improving research facilities, increasing the disciplinary diversity of the faculty, and enhancing collaborative and interdisciplinary research opportunities.

E&E staffs a large variety of undergraduate courses, including a large fraction of laboratory courses that serve the largest undergraduate major and the most talented students at Stony Brook. Because of our reduced size, it is increasingly difficult to offer all the necessary courses. Our goals are to maintain the quality and diversity of undergraduate instruction, to continue to offer research experience in faculty laboratories, and to respond to changes in biological disciplines, in student needs, and the needs of society by updating our curricula and developing new courses as needed.

Our goals are:

- To rebuild faculty in specified subject areas, aiming toward a department of at least 28 members. Strengthening E&E will invigorate cutting-edge, cross-disciplinary research essential for addressing pressing research questions and finding solutions to societal problems.
- To actively build on existing interactions with other departments and with off-campus unite such as BNL and Cold Spring Harbor, and to further such interactions and collaborations
- To pursue funding opportunities in order to improve research infrastructure and equipment
- To apply to graduate training programs to increase financial support for graduate students
- To gradually increase the number of Masters students, while assessing the effectiveness and impacts of doing so

• To respond to changing needs of the undergraduate Biology majors' curriculum, especially as we add new faculty
• To implement the proposed Human Evolutionary Biology undergraduate major, together with the Department of Anthropology Investment in the Department of Ecology and Evolution will pay enormous dividends in the national and international stature of Stony Brook University as a center of research excellence. Our department will continue to contribute greatly to the strength of undergraduate education at Stony Brook, and will provide training for a new generation of leaders in this discipline in areas of the highest national and international need.