



# strategic plan



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# STRATEGIC PLAN

April 15, 2010

## EXECUTIVE SUMMARY

### Background

School of Life Sciences (SOLS) was created in 2003 with four aims: 1) to facilitate collaboration across the range of disciplines covered by the School; 2) to eliminate overlap and consolidate undergraduate and graduate programs where appropriate; 3) to exploit the fact that the key research challenges in the life sciences lie at the interface of sub-disciplines, often involving integration of knowledge from different levels of biological organization and across different kinds of organisms; and 4) to enhance administrative efficiency. In 2008, progress towards meeting these goals was evaluated through a "Septennial Review", following which the Strategic Planning Committee (SPC) was formed: "to produce a vision for the life sciences with a forward horizon of 10 years", and to "plan incremental steps to achieve that vision that are flexible and incorporate plausible contingencies facing the funding of the University and Federal Granting Agencies, and changes in the graduate and undergraduate student bodies".

While the Septennial Review noted significant achievements in a number of areas, and progress towards many of the goals implicit in the establishment of the school, it also identified a number of areas where SOLS needs to improve and made specific recommendations for improvement. One recommendation of the external review committee has been met, the recommendation that SOLS be elevated to the level of a Division in the College of Liberal Arts and Sciences headed by a Dean.

Other issues and recommendations presented by the Septennial Review external review committee, and the self evaluation, were discussed by the faculty at a retreat organized by the Strategic Planning Committee (SPC). This was followed by a faculty-wide survey, and SPC discussions with various individuals. In the light of this information, the SPC prepared a draft Strategic Plan. The draft was discussed in a subsequent faculty retreat. The Strategic Plan was then revised by the Associate Directors responsible for the individual sections, consolidated and redistributed to the SOLS Executive Committee for approval. This Strategic Plan as presented represents the consensus view of the faculty and leadership of SOLS.

## The Mission of the School of Life Sciences

SOLS supports the ASU principles of global engagement, social embeddedness, societal transformation, student-centered growth, and improving access to a college education for Arizonans. It sees itself as fundamentally important in support of the goals of ASU, placing faculty in key positions in institutes and centers that serve as the front line for biomedical, bioenergy, sustainability, and complex adaptive systems initiatives. SOLS is a structure without internal disciplinary barriers, allowing it to plan strategically at the seams of intersecting disciplines and not focus on finding disciplinary centers. Its primary focus, however, is on the principles of excellence in education and research, especially interdisciplinary research that has a real-world impact, and on engagement with those who benefit from both education and research. This broad mission is informed by a number of specific long-term goals for academic program development, student recruitment, capacity for research, investment in infrastructure and facilities, and internal organization. These goals are described in detail in the Strategic Plan.

### Main goals

The following is a summary of the main goals for each of the three areas of activity in SOLS.

#### Education

- to provide rigorous, relevant training for undergraduate students majoring in the life sciences that includes a comprehensive understanding of biological systems and processes, and the tools to effectively apply this understanding to a wide range of problems affecting society;
- to provide a broadly accessible exposure to the life sciences for undergraduate students engaged in other fields of study that enables them to understand the importance and relevance of the life sciences in different areas of activity;
- to provide graduate students with rigorous, well-directed programs of study that enable them to understand the broad range of disciplines within the life sciences, to undertake innovative research into basic principles and applications and to contribute to the solution of problems of significance in the life sciences.

#### Research

- to establish SOLS as internationally pre-eminent in basic and applied scientific research on both enduring and emerging scientific questions in the life sciences;
- to develop the capacity to make path-breaking contributions to science at the interface between existing disciplines and fields of study in order to be able to address issues of social concern;
- to build future research capacity through the research training offered to graduate students and post-doctoral scholars.

#### Outreach

- to engage constructively with society in the solution of social problems in which the life sciences are relevant;
- to enrich public understanding of the importance of living systems and the life sciences to human well-being;
- to promote the life sciences, and to play a leading role in the development of the research agenda in the life sciences;
- to contribute to the development of the international science of global biosphere change.

This Strategic Plan will serve as the guiding document for the School of Life Sciences in its new capacity at a divisional level within the College of Liberal Arts and Sciences.

Robert E. Page, Jr.



Dean, School of Life Sciences

ARIZONA STATE UNIVERSITY SCHOOL OF LIFE SCIENCES

# STRATEGIC PLAN

April 15, 2010

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## 1. INTRODUCTION

SOLS was created in 2003 by consolidating three departments: Biology, Microbiology and Plant Biology. Its faculty is currently organized into seven faculty groups—Biomedicine and Biotechnology; Cellular and Molecular Biosciences; Genomics, Evolution, and Bioinformatics; Ecology, Evolution, and Environmental Science; Human Dimensions of Biology; Organismal, Integrative, and Systems Biology; and Basic Medical Sciences. The motivation for the creation of SOLS had four objectives: 1) to facilitate collaboration across the range of disciplines covered by the school; 2) to eliminate overlap and consolidate undergraduate and graduate programs where appropriate; 3) to exploit the fact that the key research challenges in the life sciences lie at the interface of sub-disciplines, often involving integration of knowledge from different levels of biological organization and across different kinds of organisms; and 4) to enhance administrative efficiency.

In 2007/8 the new school was evaluated through a “Septennial Review”. The review consisted of a self-assessment (Appendix 1) and an assessment by an external review committee (Appendix 2). The main recommendations of the self-assessment were the importance of enhancing the resources committed to teaching and research, the development of a constructive partnership with the Biodesign Institute, and the completion of a strategic plan. Following the Septennial Review, a Strategic Planning Committee (SPC) was formed: “to produce a vision for the life sciences with a forward horizon of 10 years”, and to “plan incremental steps to achieve that vision that are flexible and incorporate plausible contingencies facing the funding of the University and Federal Granting Agencies, and changes in the graduate and undergraduate student bodies”. In addition, the SPC was charged with identifying the core values and objectives of the school with respect to its teaching, research, and outreach missions, identifying matching areas of faculty growth, and developing a corresponding mission statement.

## 2. THE MISSION

The SOLS Septennial Review self-assessment included the following statement:

“Arizona State University, as part of the mission of establishing a New American University, is committed to student-centered growth, research and educational excellence, and improving access to a college education for Arizonans. The design principles of a New American University include global engagement, social embeddedness, societal transformation, and interdisciplinary research that has a real-world impact.... the School of Life Sciences embodies this mission and these design principles with a portfolio of graduate and undergraduate programs, cross-campus research initiatives, community outreach and educational activities, and international research and education efforts across the full range of the life sciences.”

Since student-centered growth, research and educational excellence, and improving access to a college education for Arizonans are not perfectly complementary aims – they involve trade-offs – the SOLS mission statement prioritizes among these university-wide aims.

The mission of SOLS also embodies a number of core values:

- the primacy of the pursuit of knowledge for the benefit of society as a whole and dedication to curiosity-driven research as a cornerstone of effective applied science;
- collegiality in the development and realization of the school’s goals;
- respect for the different disciplines within the life sciences combined with a determination to realize the intellectual gains from collaboration across disciplines;
- a commitment to the provision of rigorous, coherent and relevant training for students of the life sciences;
- a commitment to breadth and cross-disciplinary understanding;
- recognition of the importance of giving all students the opportunity to develop a broad appreciation of the life sciences;
- acknowledgement and respect for the multiple career goals of students;

- recognition of our responsibility to the university community, to the community in which the university is embedded, and to wider society at state, national, and international levels; and
- commitment to enhancing racial, ethnic, and gender diversity in our faculty and staff and in our student body.

### 2.1 Mission statement

SOLS supports the ASU principles of global engagement, social embeddedness and societal transformation, student-centered growth and improving access to a college education for Arizonans. Its primary focus is on the principles of excellence in education and research, especially interdisciplinary research that has a real-world impact, and on engagement with those who benefit from both education and research. SOLS will exploit opportunities in these areas as they arise, but will be guided by the following broad objectives:

#### Education

- to provide rigorous, relevant training for undergraduate students majoring in the life sciences that includes a comprehensive understanding of biological systems and processes, and the tools to effectively apply this understanding to a wide range of problems affecting society;
- to provide a broadly accessible exposure to the life sciences for undergraduate students engaged in other fields of study that enables them to understand the importance and relevance of the life sciences in different areas of activity;
- to provide graduate students with rigorous, well-directed programs of study that enable them to understand the broad range of disciplines within the life sciences, to undertake innovative research into basic principles and applications and to contribute to the solution of problems of significance in the life sciences.

#### Research

- to establish SOLS as internationally pre-eminent in basic and applied scientific research on both enduring and emerging scientific questions in the life sciences;
- to develop SOLS’ capacity to make path-breaking contributions to science at the interface between

existing disciplines and fields of study in order to be able to address issues of social concern;

- to build future research capacity through the research training offered to graduate students and post-doctoral scholars;

### **Outreach**

- to engage constructively with society in the solution of social problems in which the life sciences are relevant;
- to enrich public understanding of the importance of living systems and the life sciences to human well-being;
- to promote the life sciences, and to play a leading role in the development of the research agenda in the life sciences;
- to contribute constructively to the development of the international science of global biosphere change.

SOLS remains committed to its goals of establishment and to increasing the racial, ethnic, and gender diversity for the benefit of society and of its research and education endeavors. Our strategy on student and faculty recruitment, academic program development, investment in infrastructure and facilities, and internal organization will be informed both by these broad priorities and by the goals of the school's establishment.

## **3. UNDERGRADUATE EDUCATION**

SOLS will develop a mix of educational programs to meet its goals for both undergraduate and graduate students, consistent with its goals for research and outreach. The long-term goals and intermediate objectives detailed below reflect both our current assessment of where educational programs in the school are relative to the goals of establishment, the conclusions reached in the Septennial Review, and the recommendations of the 2002-3 Ad-hoc Committee on Undergraduate Education.

Two trends inform the long-term goals for the undergraduate program in SOLS. The dominant trend in the educational program since the formation of the school in 2003 has been an increase in the number of undergraduate students, reflecting the university's goal of open access to education. This has helped to

meet ASU's goals for undergraduate student growth and access but has provided SOLS a number of challenges including an unmet need for more teaching assistants. In spite of that, SOLS will continue to pursue best pedagogical practices, seek creative solutions to resource limitations, and foster teaching innovations to effectively educate life sciences majors and future citizens of Arizona. However, unrestricted enrollment without sufficient resources threatens to compromise the achievement of goals for undergraduate education in the school.

A second trend informing our goals and objectives is the growth of interdisciplinary science. While one of the establishment goals of the school was to enable development of courses to exploit this trend, much of the SOLS undergraduate curriculum has not evolved from the knowledge-based, disciplinary approach inherited from the constituent departments. Relatively little attention has been paid to connections between courses or to the overarching linkages between disciplines within the life sciences and beyond. This trend is not only inconsistent with the goals of the establishment of SOLS, it is not in the best interest of our students.

### **3.1 Long-term goals**

#### **Undergraduate students (majors)**

SOLS first responsibility at the undergraduate level is to students majoring in the life science, for whom it aims to provide a rigorous training that includes a comprehensive understanding of biological system, and the tools to effectively apply this understanding to a wide range of problems. SOLS will coordinate its management of the undergraduate and graduate programs to achieve the following long-term goals:

1. **Student number growth:** Recognizing the potential impact of increasing undergraduate student numbers, SOLS will better balance future growth of undergraduate student numbers with growth in faculty, lecturers, graduate students, laboratory space, equipment, and the other resources needed to assure the quality of the undergraduate program.
2. **Strengthening the undergraduate curriculum:** Consistent with its goals of establishment, SOLS will further streamline its undergraduate program by strengthening and consolidating the core offered to students in the life sciences in the first two years. The core will provide a rigorous, demanding, and

comprehensive introduction to the life sciences with required core courses in chemistry, math and statistics, English composition, etc. This will provide both a shared scientific background and a solid foundation for progression to concentrations in specific fields. Important elements in this broad goal include:

- a. **A rigorous curriculum:** SOLS will build on past developments in the undergraduate program to develop solid core training in principles and methods common to the life sciences, general scientific knowledge (chemistry, physics, etc.), plus important generic skills such as quantitative analysis, critical and scientific thinking, writing and communication skills. This will be combined with higher level specialized training in concentrations in each of the degree programs offered. The curriculum will ensure that generic skills are covered each semester and in most courses of the major, so that expectations are reinforced repeatedly, and skills are sharpened, exercised and expanded each semester.
- b. **Research experience for students progressing to graduate research and professional degrees:** The inclusion of research and other hands-on experience is important to all who wish to go into graduate school or into other forms of advanced scientific education. SOLS has long encouraged and supported its best students in the research programs of its faculty. This practice must continue to be a high priority for SOLS, and faculty members should be encouraged to include support for undergraduate student research in federally funded research grants. However, given the ratio of research faculty to undergraduates intending to pursue advanced degrees, SOLS must develop laboratory components with rigorous, authentic research experiences that are integrated with 300- and 400-level courses.
- c. **Plasticity in specialized training:** An important aspect of the undergraduate curriculum will be the development of specialized training options that are “nimble”. Given the pace of change in the field it should be possible to institute new areas of specialized training based on developments in science, societal needs, and student preferences, and to disestablish those that do not fulfill a distinct purpose or that do

not meet efficiency standards (for example, too few students enrolled).

- d. **Problem-based learning:** An additional aspect of the undergraduate curriculum will be the inclusion of problem-based learning as adjunct to the development of interdisciplinary training, and as a way to help students acquire a toolbox of approaches that can be applied to a wide range of scientific and other problems.
  - e. **Innovative training at the freshman level:** Models of lecture- and content-based instruction from the last century have limited efficacy with students entering college in the 21st century, and do not provide the critical thinking skills that graduates need in times of rapid socioeconomic change. SOLS will work with other units on campus to develop a year-long sequence in which life sciences, statistics and math, physical sciences and English composition are taught together. The course will be built around student projects that address problems of fundamental interest to students, such as environmental, social, and medical problems, instead of the lectures typical of survey course. Students coming out of this challenging sequence will be better prepared for upper-division coursework and a broad range of career choices.
  - f. **Diversity of training option:** Students enter the life sciences at ASU with a diversity of backgrounds and outlooks. SOLS faculty members must recognize that the primary goal of undergraduate education is not to recreate curiosity-driven professorial elite, but to provide strong training that will foster success in a variety of life science-related careers. To this end, SOLS will develop distinct tracks for students for whom the BS will be a terminal degree, and for those who strive for graduate or professional degrees. The creation of a BA degree in life sciences may also help SOLS to serve diverse student needs.
3. **Placement and progression:** SOLS will implement a placement exam for incoming freshman. The goal will be to identify students who need additional training in scientific reasoning skills and/or who lack high school level knowledge of biology, and have those students take and pass a fundamental life sciences course before progressing to freshman biology sequence for majors. This will ensure that

students who enroll in life sciences as majors have the necessary prior skills and maintain the necessary progress to succeed, and it will allow SOLS faculty members to provide more, advanced upper-division courses.

4. High performing students: Special facilities for especially gifted or motivated students that would include: a) special courses (particularly seminars), b) special breakout sessions of courses, c) extracurricular learning experiences including a role in leading and mentoring entering students, d) the opportunity to host life sciences activities in which advanced students get credit and mentoring experience, and students who take it get advice and inspiration. In addition, SOLS should aim for a stable and committed leadership at the interface of the school and the Honors College.
5. Mentoring and cohesiveness: SOLS aims to develop a streamlined, effective system of undergraduate student mentoring. The SOLS Advising Office must continue to provide academic mentoring at a high level, and increase its coordination with research faculty and the faculty members who oversee each major or concentration. It will include: in the first year, adapting to the university, faculty and resource accessibility, and how to set priorities; career options and undergraduate research strategies in the second year; career preparation and course electives in the third year; advice about careers, grad school etc. in the fourth year. In addition, mentoring and other activities will be designed to promote a learning environment that enhances an esprit de corps among undergraduate majors. This will include peer-mentoring by more advanced students. As part of this peer-mentoring experience, talented junior and senior undergraduates may be encouraged to participate in the educational process of their younger peers as, for example, laboratory TAs.
6. Assessment: SOLS will develop state-of-the-art assessment tools with the goal of quantifying student learning, the effectiveness of faculty teaching, and the success of our teaching innovations. These data will be used to improve student learning and identify SOLS faculty members who could benefit from mentoring by highly accomplished teachers.

### **Undergraduate students (non-majors)**

Service courses, and courses designed to inform non-majors are among the most important elements of the educational program offered by SOLS. They are important for meeting ASU's wider priorities of increasing access and student-centered growth. The broad goals of the non-major courses in SOLS are to provide a broad exposure to the life sciences, to scientific reasoning processes, and to underscore the relevance of the life sciences, but without compromising the quality of the program offered to majors. Specific goals are:

1. Design of service courses: Consultation with users to match content of service courses to the needs of other academic programs, which will also facilitate agreement on the content of service courses offered by other units for life science students.
2. Teaching technologies: Development of a set of service/information courses for non-majors to meet the needs of other programs at the university that apply cost-effective teaching methods (these will change but currently might include lectures on video and a range of on-line learning techniques).

### **3.2 Intermediate objectives**

1. Degree structure and content: Complete the review and implement changes to the structure and content of existing undergraduate degrees to:
  - identify points that require strengthening and closer integration;
  - evaluate current concentrations;
  - explore the potential for enhancing student research experience;
  - assess the current use and potential for problem-based learning.
2. Admissions and progression: SOLS will test several formats for establishing placement exams for incoming freshman
3. Special facilities for promising students: SOLS will establish a mechanism to identify gifted and highly motivated students not in the Honors College, and to identify options for strengthening opportunities for those and Honors students.

4. **Mentoring:** SOLS will encourage faculty members to participate in our excellent workshops on mentoring undergraduates in research, encourage more involvement with the SOLS advisors, and will further develop mechanisms for peer-mentoring by students.
5. **Teaching methods:** Initiate a staged evaluation of the scope for improving teaching effectiveness and productivity through the adoption of modern teaching methods, media, and technologies. Identify courses for piloting new methods, and ensure the training of faculty members and teaching assistants. Many of the lab courses for majors in the school are “cookbook.” SOLS will work to replace a number of these canned lab exercises across the curriculum with more challenging, engaging, and effective labs. To this end, all the lab coordinators will participate in courses designed to facilitate critical thinking and inquiry-based learning. SOLS will also seek mechanisms to increase faculty involvement in redesigning select laboratory exercises. SOLS will seek mechanisms, including federal grant support, to reduce “in-classroom” teaching loads in exchange for developing new courses or redeveloping existing courses. SOLS should consider funding mechanisms to allow faculty members to organize workshops and/or international courses, write textbooks, participate in workshops to improve teaching skills or junior faculty mentoring programs, and other activities that improve the teaching environment in the school.
6. **Administration of the undergraduate program:** One of the top priorities of the Associate Dean of Undergraduate Programs must be to search for more effective mechanisms for assigning faculty members to teach undergraduate courses. Streamlining the curriculum for all majors and concentrations, identifying faculty members capable and willing to teach all the required courses in the curriculum, and implementing a set of transparent guidelines for balanced and equitable teaching loads that will help solve the current administrative problems in the school. However, these reforms will only be effective if the life sciences faculty leaders assume leadership responsibility and abide by the common guidelines when determining teaching assignments with their faculty members.

## 4. GRADUATE EDUCATION

The Septennial Review highlighted the fact that while undergraduate student numbers have expanded since the formation of SOLS, graduate student numbers have remained more or less constant, leading to a decline in the relative size of the graduate program. This partly reflects the fact that changes in the cost of PhD students (due to changes initiated by the NSF and ASU) has altered their attractiveness relative to post-doctoral scholars. Because the cost of PhD students has risen relative to the cost of post-docs, many faculty members are currently reluctant to take on PhD students. The overall trend is problematic, given the importance of the graduate program both to the achievement of research goals (excellence in graduate education is part and parcel of research excellence) and to our aspirations in the recruitment of both faculty members and students to the school.

### 4.1 Long-term goals

Specific long-term goals for the graduate program follow:

1. **The size of the graduate program:** Assuming current faculty size, the graduate program should be increased in size by at least 50 percent in ten years. This would generate a minimum target of 300 graduate students, 80 percent of whom would be in PhD programs. This would result in an average of fewer than three students per faculty member. Increased numbers will require a commitment on the part of graduate faculty to quality graduate education in their labs and a commensurate willingness to support graduate students as RAs on research grants. This increase in financial support for graduate students through the faculty should be matched by an increase in financial support of students through ASU and SOLS. SOLS will also try to find private donors to support graduate education.
2. **Quality of students recruited:** SOLS aims to achieve a substantial improvement in the quality of students recruited into the graduate program, and especially to the PhD programs. We would like to accept only graduate students who are in the top quarter of applicants as indicated by GRE scores. While ASU has always had a modest fraction of students in the top 10 percent nationally, this is limited by the research status of the faculty. Improving the caliber

of applicants requires an organized, concerted recruiting effort based on best recruiting practices and the ability to make competitive financial offers.

3. Time to completion: SOLS will seek a significant reduction in the time to degree, currently approaching eight years for PhD students and over three years for master's students in the life sciences, with target completion times of 5-6 years for PhDs and 2-3 years for MS degrees. The existing completion times are far too long, especially given that many graduates do additional post doctoral training. Efficiently run programs coupled with attentive mentoring can reduce the time required to earn degrees and will increase our rate of output without changing the size of the student body.
4. Elimination of degree programs that are not viable: Faculty members in SOLS may simultaneously belong to several graduate faculties across ASU since the establishment of new multidisciplinary graduate degree programs. The goal of the new degree programs is to increase the number and quality of graduate students mentored by SOLS faculty, however, the large number of degree programs also puts them in competition with each other for the new graduate students. Currently, it is doubtful that we will have enough students to sustain all of the programs. SOLS needs to undertake periodic reviews of graduate programs and assess them for their viability and sustainability and move to “sunset” those that are no longer able to compete for quality graduate students.
5. Increased coordination of PhD programs: The large number of graduate programs serviced by SOLS requires an increase in coordination.
  - a. Graduate teaching delivered by SOLS faculty to students in the diverse graduate programs available to our students needs to be coordinated to maximize the efficiency of the time and teaching efforts of our faculty. The content of many new core courses overlap partially or are of interest for students from other programs. Modularization and joint offering of courses can help to increase student participation and avoid redundancy and duplication in graduate courses delivered by our faculty. The graduate committee of SOLS and the AD for Graduate Studies should develop a two-year course plan that insures all courses are offered that are necessary for graduate students to pass their comprehensive exams and gain a solid understanding of their field and skills (e.g. writing, presentation, research ethics) needed to succeed in their own PhD research.
6. Strengthen training for graduate students whose goals are not research: SOLS aims to strengthen graduate programs designed for students who aspire to careers other than at research institutions. In reality, many of our students aspire to teach in two and four year teaching institutions, to work in museums or biotechnology laboratories, or to use advanced training in biology in science policy, business, government, or NGOs. This is expected to involve two types of degrees:
  - a. PhD degrees for those intending to pursue a career in teaching colleges, currently a high proportion of SOLS graduates. While our PhD degrees will still be built around research training, SOLS aims to include additional training in pedagogy, ethics and science policy for students who do not plan a career in a “research 1” university. Some of this can be done in cooperation with other campus units.
  - b. Professional Masters degrees for students – often mid-career professionals – who need to acquire specific skills relevant to their career. Although experience with professional masters programs has not been encouraging to this point, the SOLS Graduate Studies Committee will keep the issue under review,
7. Programs like the BS-MS (Bachelor of Sciences – Master of Science) currently available for Biology and Biology and Society help recruit excellent bachelor students into our degree programs and can also be used to recruit underrepresented minorities. These programs should be more actively promoted and expanded.
8. SOLS faculty need to get more involved in graduate education and graduate education needs to become a fixed component in the teaching plan of SOLS. Teaching core and elective graduate courses need to be acknowledged as significant teaching loads and SOLS needs to find an adequate way to honor the offering of graduate seminars. Currently, graduate seminars are offered on top of the regular teaching load of our faculty.

and will consider the need for additional professional programs. No professional Masters program will be introduced without a clear scientific case, evidence of demand from fee-paying students, and a business plan that demonstrates the financial viability of the proposal. A simple solution would be the resurrection of the MNS program and modify it into a professional Masters degree.

7. Breadth requirements: Graduate programs and the research groups they mirror should continue to stress breadth and connectivity with other groups on and off campus. Innovative techniques such as requiring diversity on supervisory committees, breadth and “stretch” requirements for dissertations, and graduate seminar series that purposely explore interfaces among disciplines can ensure this. Other options include first-year lab rotations for research directed PhD students, as a way of cross-disciplinary training that fosters collaborations between labs (with the graduate students making the linkages).
8. Mentoring: A concerted effort to develop mentoring skills among the faculty is needed. This will attract students, will enhance student success, and will decrease attrition. While SOLS has several excellent mentors, this important function is too often left to individual predilection and tradition. Mentoring workshops involving faculty members and graduate students will enhance mentoring here and will prepare graduate students for mentoring in their later careers.

#### **4.2 Intermediate objectives**

1. Degree structure and content. Initiate a review of the structure and content of existing graduate degrees to:
  - a. Identify commonalities in course content, concepts and methods to determine whether there exist a set of core concepts and skills relevant to all life sciences that might be made generally available;
  - b. Make recommendations about graduate degrees and course structures.
2. Mentoring: Initiate a review of mentoring requirements in the light of the long-term goals for both undergraduate and graduate

mentoring, and develop a supporting program of mentoring workshops to enhance mentoring of graduate students, and meet other goals of the graduate program.

3. Student funding: The AD Graduate Studies is already charged with developing a strategy to increase the number of training grants, endowed research assistantships/fellowships, and other sources of financial support for graduate students. Further efforts in this direction will be supported

### **5. RESEARCH**

The research undertaken by SOLS faculty supports and is central to both of the major undertakings launched by ASU in the last decade– Sustainability and Biodesign. It is also central to recent initiatives in “Origins,” “Complex Adaptive Systems,” and “Lightworks”. SOLS will continue to be a primary source of faculty, innovation, and enabling resources for major initiatives and challenges. SOLS is currently well positioned to develop as an internationally recognized source of scientific expertise in microbial, genetic, and genomic research that is expected to drive biomedical science in the future, and in the broader scale interactions between the biotic and abiotic components of the global system that are expected to drive the science of environmental change. Applications in microbiological science are expected to trigger many technological changes and advances in biomedicine, while applications in ecology and evolution are expected to drive better understanding and management of human impacts on the physical environment at multiple scales.

Our research strategy identifies the long-term goals and intermediate objectives needed to realize SOLS’ potential in this regard. The strategy aims to build on current strengths, but recognizes that these may be enhanced not just through appointments within those areas of strength, but also through the identification of integrative opportunities – opportunities for integrating across disciplines and fields to generate better understanding of systems level properties of the phenomena being studied. This was one of the establishment goals of the school, and remains an essential part of our research strategy.

## 5.1 Long-term goals

1. **Building on strength:** Recognizing the value of building on strength, SOLS will further develop its capacity in a number of research areas identified by the Septennial Review as offering significant potential for growth: ecology (including biogeochemistry and ecosystem ecology, community ecology, microbial ecology, urban ecology, conservation biology), bioenergetics (bioenergy and photosynthesis); disease biology (vaccine science, infectious diseases, cancer immunology), evolution (systematics, organismal and integrative animal biology, evolutionary genetics and development), and the human dimensions of biological change (the social, political, and economic aspects of environmental change, bioethics, and the history and philosophy of bioscience).
2. **Integrative opportunities:** Building the capacity to address many of the most challenging research questions in the future will require the capacity to work across disciplines and fields. These exploit a unique attribute of SOLS - its capacity to explore the human dimensions of individual life sciences and the intersection between them. Five integrative opportunities have been identified that would exploit current strengths:
  - a. **Bioinformatics:** Today's scientists routinely analyze large volumes of data to find patterns, develop hypotheses, and test predictions, which makes bioinformatics critically important. Beyond a technology for analyzing data, discovery-based bioinformatics is of central importance in synthesizing across large-scale datasets produced by novel genomic/biological techniques in basic biology and biomedicine. It is not difficult to foresee a time when big-science biology will move from individual investigator laboratories such that different laboratories will specialize in large-scale data acquisition, data management and dissemination, and discovery-bioinformatics. Such efforts are already underway in profiling the human genome, sampling the diversity of ecosystems, and generating embryonic gene expression en masse. SOLS has a unique opportunity to grow the area of discovery-bioinformatics at the intersection of traditional sub-disciplines, including ecology, evolution, genomics, microbiology, neurobiology, development, ecology and microscopy. It can do this by building bioinformatics laboratories that develop novel methods and synthesize information across levels of biological organization and genome to illuminate patterns and processes.
  - b. **Bioenergy:** The bioenergy field focuses on solar energy conversion by biological systems to form energy-rich compounds which may be converted to or used as fuels or as petroleum substitutes in a carbon-neutral manner (e.g. fuel-producing photosynthetic systems to microbial fuel cells generating electricity from biomass). The field integrates areas of basic science (e.g. genetic engineering and molecular biology: as these applications usually have not been selected for evolutionarily, metabolic engineering can enhance the process), process engineering and bioreactor design, green accounting, and socio-economic impacts. Here SOLS will contribute substantively to the university-wide Lightworks initiative.
  - c. **Synthetic biology:** The design and implementation of new functions in organisms as a consequence of introduction/deletion of specific DNA sequences or the creation of new life forms by expression of synthetic genomes allows for the generation, combination and regulation of entirely new functions in an organism. This provides an unparalleled opportunity for having organisms produce "new" compounds. In addition, synthetic genomes provide opportunities for biomedical applications such as vaccine production and –in the longer term – therapies. Biohybrids may be envisioned as well. Synthetic biology builds on a number of different areas in basic science and engineering (metabolic engineering, regulation biology, biochemistry), but also requires a socio-economic/bioethics component.
  - d. **Biosocial systems:** Researchers in SOLS are already leveraging expertise in areas as diverse as the ecology of social insects, the metabolism of cities and the behavior of coupled ecological-economic systems to develop an integrative science of biosocial systems. The approach brings together an understanding of general equilibrium analysis, complex systems and numerical/computational methods to forge a new understanding of biosocial

systems at multiple scales. Future research at the interface between the ecological and social sciences offers both the promise of deeper understanding of biosocial processes, and a training opportunity in the conceptual and methodological breadth of research on biosocial systems.

- e. Evolutionary dynamics: This is both a common theme of much current research in SOLS as well as the university-wide initiatives on Origins, Complex Adaptive Systems, and Sustainability. Evolutionary dynamics offers an integrative research opportunity with the potential to link a number of existing strengths in systematics, microevolutionary processes, biological conservation, molecular phylogeny, evolutionary genomics, disease dynamics, developmental evolution, the science of environmental change, coupled human and natural system dynamics and the history and philosophy of science. It also offers a natural link with researchers in a number of other academic units on campus.
3. Emerging areas: In addition to developing areas of strength and the intersections between them, SOLS will identify emerging research fields and research technologies that have the capacity to alter the scientific landscape. SOLS will develop strategies (such as appointing a special task force to identify hot new areas or attractive hiring targets) that allow us to embrace these research fields and technologies both systematically and opportunistically, particularly where they offer significant synergies with established strengths.
4. Supporting technologies: Recognizing that many of these areas of research will be strengthened through the development of appropriate supporting technologies, SOLS will build its DNA sequencing and database technologies along with its capabilities in metabolome and proteome analysis. DNA sequencing (and sequences) are seen as tools for profiling species' composition of ecosystems (within human bodies and of environments), whereas metabolome and proteome analysis provide information on how organisms function in that environment. Together, these technologies are instrumental in establishing the evolutionary tree of life, elucidating genetic correlates of behavior, and tracing the effects of nutrient limitation on the blueprint of life. In genomic analysis, genome-wide association studies, use of evolutionary biology for functional element

determination, and the role of epigenetics in infectious disease modeling and behavior appear to be interesting. SOLS will continue to develop a cyber-infrastructure that integrates the natural sciences, social sciences, and humanities, taking advantage of the synergies resulting from its expertise in bioinformatics.

## 5.2 Intermediate objectives

Intermediate objectives relating to (a) hiring strategies and (b) infrastructure and equipment are discussed in section 7 below.

## 6. OUTREACH

SOLS fully subscribes to ASU's general principles of global engagement and social embeddedness. As a publicly-funded state university it has an obligation both to the urban community within which it is embedded, and to the residents of the state of Arizona. But as a collection of scientists engaged in research on topics that span the globe, SOLS has a much wider set of obligations. These include obligations to the scientific communities represented in the school, to the policy communities concerned with the phenomena investigated within the school, to the communities potentially impacted by that research, and to the subjects of that research. Our strategy for outreach reflects this set of obligations. At the same time, it reflects the fact that an effective outreach program is a pre-requisite to realizing many of the school's other goals, particularly those relating to research and graduate education. This is especially true of outreach to the scientific communities with which SOLS faculty members are connected.

As ASU strives to develop its mission as the New American University, SOLS has an opportunity to play an even more active and visible role. ASU's emphasis on interdisciplinary approaches, and university-wide research initiatives in sustainability, origins and complex adaptive systems, provide important openings for the school. SOLS aims to show that it is not just a broad collection of biological sciences disciplines with some related fields, such as history and philosophy of science, environmental economics, science policy or bioethics thrown into the mix, but rather that it is the very model for such an approach: a model based on actual work

rather than empty phrases. By more effectively building its outreach efforts especially in the context of alumni relations, we expect SOLS will be more effective in building philanthropic commitments to SOLS that can further support SOLS'S educational and research programs.

## 6.1 Long-term goals

Our long-term goals are (i) to strengthen SOLS standing and contribution within ASU through constructive engagement with other academic units; (ii) to enhance our role in servicing the metropolitan community including involvement in strengthening K-12 education; (iii) to take a leadership role in scientific support for policy development in metropolitan Phoenix and Arizona; (iv) to establish SOLS as a major participant in shaping the national research agenda in the life sciences; (v) to place SOLS faculty members in leadership roles in the science-policy interface nationally and internationally; (vi) to develop a solid philanthropic base for SOLS that can enhance our educational (graduate and undergraduate) and research activities. The ultimate goal of all these outreach activities is to establish SOLS reputation as internationally pre-eminent in (selected areas of) biological sciences research and education. Achieving these goals will yield a number of benefits including a higher level of support for research activities, attracting better qualified undergraduate, graduate, and postdoctoral applicants and in the recruitment of faculty members of the highest caliber.

1. Coordination with other academic units on campus: There is currently an inconsistency between the vision of the New American University and its implementation. This has led to a patchwork of hires and initiatives, some of which adversely affect SOLS. To implement the vision that informs its strategic plan, SOLS intends to communicate the new directions it has developed for research and education to the university at large, and to engage with like-minded academic and research units to press this vision. Simply put, we have to make it clear that we can do where others talk.
2. Interaction with ASU research centers: SOLS will develop a coordinated strategy of interacting and utilizing those research centers with which its faculty members are affiliated and to also explore options to take advantage of the expertise within these centers when designing innovative interdisciplinary graduate and undergraduate courses. SOLS will also work

more closely with the Barrett Honors College to design courses and tracks that will bring those student into our laboratories more efficiently, whether through a specific honors track or through more visibility and support for honors activities.

3. Local educational outreach: SOLS will build and develop relationships with local organizations, including educational organizations, by volunteering and/or serving on boards and committees for local organizations (e.g. the zoo, botanical garden, arboretum, wild-life agencies, etc).
4. Outreach to the scientific community: SOLS will encourage all faculty members to join relevant scientific societies and volunteer to serve on committees, editorial boards of journals published by societies, organize symposia at meetings of the society, etc.
5. Research collaborations: SOLS aims to increase the level of collaborative research with scientists at other institutions.
6. Publicity: SOLS currently has an effective (award winning) public relations and outreach unit to map out and implement a strategy to communicate these activities of SOLS to university and local audiences. We are doing a good job at highlighting individual accomplishments and initiatives, but we are less visible and vocal about our vision. Over the longer term, the school will develop an enhanced capability to inform the wider community about research activities, educational opportunities, and faculty and student accomplishments in SOLS by, inter alia, providing annual reports to collaborators and affiliates.
7. Fundraising: We recognize that SOLS needs to be actively engaged in fund raising to achieve its objectives. A fundraising committee will be established that will work closely with development offices on campus to build a strategic plan for development.

## 6.2 Intermediate objectives

1. Engagement with ASU: As a first step SOLS will seek more direct involvement of SOLS faculty and administration with university-wide affairs.
2. Local outreach: Faculty members will be encouraged to engage constructively with local organizations,

including giving talks to local schools, civic organizations, the Arizona Science Center, etc. and to advise news media on science issues of biological relevance. They will be encouraged to train high school students and teachers in SOLS laboratories or provide science day retreats at ASU or in the Greater Valley area.

3. Outreach to the scientific community: Given the expanding population of scientists, we should encourage attendance of faculty members, postdoctoral, and doctoral students at smaller research focused conferences to establish credentials among a relevant smaller group of peers. The planning, organizing, and hosting of science conferences at ASU will be particularly effective. Faculty members will be encouraged to volunteer to serve on grant and fellowship review panels and SOLS leaders will facilitate getting faculty members selected to serve on national grant review panels, editorial boards, etc. In all these endeavors SOLS faculty members and leadership need to be pro-active.
4. Outreach incentives: SOLS will develop new mechanisms to recognize faculty members and students for their accomplishments in performing outreach activities. SOLS leadership will also play a more active role in nominating or arranging the nomination of eligible faculty members and students for awards given by scientific societies and for election as Fellows of learned societies.
5. Winter program: Consideration will be given to the development of outreach activities that could position SOLS as a leading knowledge community at a regional, national or international level, potentially by galvanizing our link with the Biodesign Institute. Just as Woods Hole is a spring/summer reference for scholarly activities that attract students from around the globe, SOLS-Biodesign could generate such activities in the winter and attract bright graduate students and colleagues.
6. Research collaboration: Research collaboration will be factored into annual reviews. In addition, we will consider granting of adjunct appointments in SOLS for collaborating faculty members from other institutions.
7. Publicity: Aside from the development of the SOLS website to make sure that it is easily accessible and is up-to-date in regard to outreach material, SOLS will provide information to high schools

highlighting research activities and special events occurring at SOLS. Wikipedia and YouTube sites on faculty members are also useful modern means to communicate our presence and activities in science.

8. Outreach to alumni and other potential donors: Working with the ASU Alumni office, SOLS will develop a fund-raising brochure and a focused alumni giving program that will endow several graduate fellowships and undergraduate research scholarships.

## 7. FACILITIES

SOLS recognizes not only the necessity of facilities to fulfill its mission, but also the many benefits that it derives from their nimble and efficient management under its own administrative jurisdiction. Successful administration and upkeep rely on the immediacy between problems and solutions, from a sense of SOLS ownership of the process, and from an expectation of shared beneficial outcomes. Local organization of the facilities and common resources within SOLS is exemplary at ASU, in areas that range from timely package delivery to the efficient implementation of bio-safety regulation, to the upkeep of laboratory space and common instrumentation, or to the development of research facilities and biological collections. SOLS thus aspires to maintain and enhance its facilities and their local administration as a strategic cornerstone of its roadmap for the future decade.

### 7.1 Short-term goals

Recent economic developments have resulted in a loss of direct state income to SOLS facilities, which is currently operating under restricted budget funds derived from overhead recovery. This situation represents an untenable state of affairs in that only minor upkeep can be supported. Unless this is corrected, accumulation of unattended repairs will result in a noticeable degradation of common facilities, from autoclaves and ice machines to greenhouses, in the short term. As an immediate goal, SOLS should aim to recover sufficient, stable funds from the University administration to guarantee the proper management of facilities in support of its mission

The present state of research laboratory security in the core of SOLS buildings is clearly insufficient, and not at a par with that available in other research-intensive buildings at ASU. SOLS should work to bring to

fruition present plans to increase safety by minimally 1) implementing a card-based access system to all research areas, and 2) strategically directing space assignments to separate research from teaching areas.

Supporting the research mission in SOLS requires maintenance and improvement of core facilities and common research services. Some of the facilities have been built through the years with the effort and dedication of SOLS faculty and staff to true centers of excellence, and provide an added value to our educational mission through training in state of the art analytical procedures. Likely because of financial incentives, there has been a recent trend to transfer administration of some of these facilities outside of SOLS. We view this trend as counterproductive to all, in that, as state above, it removes the administration from the stakeholders, weakening the perception of faculty ownership and consequently the desire to work for its improvement. SOLS shall seek to revert common research services back to the school, whenever possible.

SOLS and its personnel should strive to improve and expand its portfolio of facilities in support of research. A mechanism should be set up through the Facilities Committee to identify targets of opportunity and leadership for strategic improvement in shared facilities. In consultation with RTI, Facilities should spearhead yearly applications for shared facility improvements through appropriate programs (e.g., NIH and NSF). Leadership in this regard should be incentivized. Targets for general improvement include:

1. DNA sequencing lab expansion to support comparative, population, and ecological genomics investigations by incorporating new high-throughput technologies (e.g. incorporate pyrosequencing, acquire an additional ABI 3730xl sequencer, illumina beadstation, extend microarray capabilities, and robotic automation). A recent survey of SOLS personnel shows this to be the single most important improvement we could make.
2. Animal and greenhouse facilities need to be revised and upgraded.
3. Bioinformatics core that provides services that support general statistics and data analysis including microarray and SNPs
4. Bioimaging core to enhance microscopic visualization of cells and subcellular structures. New instrumentation to be considered include a cryo-electron microscope and an X-ray microscope.

5. Proteomics and metabolomics core to enhance functional genomics and metagenomics research. This may enhance the current proteomics and protein chemistry core lab.
6. Information technology support consistent with research demand (e.g. SOLS IT does not currently support Linux/UNIX systems, the actual Windows base support aims toward computers involved in teaching or administration but is not appropriate for computers that are going to be used in intensive calculations or managing complex computer processes).

## 7.2 Long-term goals

1. Teaching laboratory and classroom facilities: SOLS own evaluation of its needs, prepared for the Septennial Review showed that resources are needed to deliver high quality education to a growing student population. It argued that additional teaching labs would be needed as more lab sections are added, and that new and renovated lab space would require equipment, computer support and media support. It was argued that labs are a critical component of life science education that differentiates a university education in the life sciences from on-line offerings. Although there is some scope for covering at least the variable cost of additional labs from lab fees, the fixed costs will have come from central funding or infrastructural support. Large lecture halls are already a limiting resource in our teaching duties, and will only become more so. It will be incumbent upon SOLS to lobby the administration proactively for increased facilities in this area, which is crucial to ASU inclusiveness goals.
2. Research infrastructure: SOLS' self-evaluation also noted that growth and diversification of the research portfolio can not be supported without an adequate research infrastructure. The two issues that need to be addressed are that there is little lab space to meet laboratory requirements for new hires and the space is in serious need of renovation. Life Sciences A-wing and C-wing are more than 40 years old and many laboratories require significant upgrades. Renovation of these facilities will be a priority for short-term external funding under the stimulus package, but this is unlikely to meet all of the school's needs. SOLS accordingly aims to construct a new building with advanced laboratory

facilities exploiting the fact that Life Sciences E wing (built in the early 1990s) was constructed so as to allow a dedicated laboratory building to be annexed to it on the east side. SOLS should work to develop a new state of the art building to replace space in LSA and LSC. In the meantime it is imperative that major structural renovations be undertaken in those to building to guarantee their functionality.

3. **Biological collections:** Collections serve as taxonomic and systematic libraries documenting global and regional biodiversity and provide fundamental documentation for all research in the life sciences. SOLS has major international collections of lichens and vascular plants and unique regional collections of insects, fish, other vertebrates, and fossils. ASU is also a national leader in the development of cyber floras and faunas. Currently, collections are understaffed and underfunded; they are consequently also underused as far as their scientific educational and societal potential. Collections should be a resource, not a mere repository. SOLS should seek the expansion of the current collections to serve as a functional resource for research and education, as a magnet for new funding in systematics, and as a tool to anchor the embeddedness of SOLS in the Southwestern community because the natural environment has been identified by Lattie Coor's state-wide committee on the "Future of Arizona that Arizonans want" as a major value. Investments in faculty and staff will be required, as will be the securing of support funds. In this context SOLS proposes, anew, that the collections become part of an integrated ASU museum (virtual and exhibitory). SOLS should identify and recruit to the task individuals ready to provide the necessary leadership, incentivize it, and reach out to potential partners in State agencies and other institutions of learning.

## 8. HUMAN RESOURCES

### 8.1 Long-term goals

1. **Faculty hiring priorities:** The strategic hiring plan in SOLS has six main elements: a) to build on areas of existing research strength, b) to develop new integrative research opportunities, c) to build capacity in emerging fields of inquiry, d) to include hires of opportunity when appropriate, e) to enable us to implement our undergraduate and graduate teaching strategy, and f) to replace faculty members where that is necessary to meet priorities in teaching and research.
  - a. **Building on strength:** To meet the goal of building on existing research strengths, SOLS will undertake a number (in the order of 15) of new searches in the period 2009-2015 in ecology, disease biology, bioenergy, evolution (including systematics) and the human dimensions of biological change. These will include both targeted hires of high profile scientists in specific fields at senior levels and open searches at all levels.
  - b. **Developing new integrative opportunities:** To meet the goal of strengthening research capacity by building at the interface between fields and disciplines, SOLS will undertake a number of new searches (in the order of 10) in the period 2009-2015 in biosocial systems, evolutionary dynamics, bioenergy, bioinformatics and synthetic biology. Since these integrative opportunities involve novel combinations of existing fields it is expected that hires will mainly be by open search.
  - c. **Building capacity in emerging fields of inquiry:** To enable the school to exploit emerging fields of inquiry that offer synergies with research undertaken by existing faculty, SOLS will initiate a procedure for identifying such fields of inquiry and for undertaking new blood searches on terms that will attract the best available candidates.
  - d. **Hires of opportunity:** Recognizing that spousal and other hires of opportunity are an important route for attracting outstanding faculty members in all fields, SOLS will maintain a policy of making hires of opportunity where appropriate. These are not expected to comprise more than 10 per cent of all hires.

- e. Teaching priorities: Where the development of a coherent course structure identifies a gap in teaching competence, this will become one criterion for making hires – and will be specified as a “desirable attribute” in searches.
  - f. Replacement: Where the resignation or retirement of existing faculty members leave a gap in core teaching or research advising competence, the school will make replacement hires.
2. Growth in the number of faculty members: The main drivers of faculty growth are expected to be student growth. SOLS will maintain a ratio of full time faculty to full-time students that is consistent with its quality goals in both undergraduate and graduate training. While educational technologies are expected to increase the efficiency with which students access course material, and hence class sizes, SOLS will ensure that faculty/student ratios are limited to those required to deliver excellent training at all levels, and that protect the effort that faculty members are able to give to research, research supervision, service, and outreach. Projecting forward from recent growth in student numbers and goals for the graduate program in the school indicates that something in the neighborhood of 25 new faculty lines may be required in the period 2009-2015.
  3. Joint appointments: Given the nature of Life Sciences and the pursuit of integrative opportunities, a number of appointments may be made jointly with other ASU academic units. SOLS will be proactive in this process and will facilitate research initiatives across ASU academic units by leading recruitments in multidisciplinary thematic areas. SOLS will seek synergies with other ASU units and lead the process of requesting clusters of joint appointments across campus that strengthens its position as an academic unit. We will make sure that in this process we protect the resources for upkeep of SOLS facilities by sharing any associated facility expenses with other units in a fair manner.
  4. Faculty retention and professional development: Recognizing that hires, particularly at the assistant professor level, represent a major investment in the long-term capacity of the school, SOLS aims to develop a strong program of professional development for younger faculty, and to develop a competitive faculty retention program that matches those in the best peer institutions. It is important to recognize the value of facilities in retention and recruitment of excellent faculty.
  5. Financial resources: Recognizing that recent trends in both SOLS and ASU more generally have been heavily influenced by state funding for undergraduate students, and that these trends don’t support SOLS goals for research and graduate education, a major long-term objective of the school is to identify and develop revenue streams that will offer more scope for realizing its research and graduate training goals.
  6. Graduate training: Funding for graduate training via the block grants disbursed by the Graduate College is insufficient to support the expansion of the graduate program identified as a principal goal of the school. In addition, support for graduate students in the form of fellowships is insufficient even to maintain current student numbers, let alone allow for growth. Since ASU lags very significantly behind peer institutions in this respect, there is a strong argument for a substantial increase in support for graduate training through fellowships. There is also scope for SOLS faculty to do more to increase the flow of resources into graduate training through grant-funded research assistantships, NSF pre-doctoral fellowships and dissertation improvement grants. SOLS will, in addition, seek to increase the number of endowed research assistantships available to students registering for graduate programs in the life sciences.
  7. Funding for research: SOLS aims to increase the flow of research funding from traditional sources such as the National Science Foundation and the National Institute of Health. We also aim to increase the flow of research funds from less-traditional sources such as the private research foundations, and from innovative partnerships with research-oriented private and non-governmental organizations. More generally, a greater entrepreneurial effort to attract training grants and to develop other sources of funds for graduate students is needed, for example through named fellowships.

## 8.2 Intermediate objectives

1. Hiring strategy: The priorities that inform long-term goals in SOLS require different mechanisms for their implementation. Proposals for replacement hires and hires in core areas would be expected to come out of faculty groups, but proposals for hires to develop integrative opportunities or to build capacity in emerging fields come from a school-wide process. Proposals for hires of opportunity would be expected to come from the Dean of SOLS. Balancing hires of different kinds and ensuring consistency with strategic goals for both teaching and research is a responsibility of the Dean in consultation with the Executive Committee. To bring greater clarity to the process, a rolling three year hiring plan will be published annually that specifies areas in which proposals will be invited. The plan will address hires in areas of programmatic growth, areas of integrative opportunity and emerging areas in relation to undergraduate and graduate teaching demands, and to changes in faculty strength due to resignations and retirement.
2. Professional development of younger faculty: SOLS will initiate a formal in-school mentoring program beyond the “new faculty orientation”. The program will provide information and support to junior faculty members in order to assist them with the tenure process, and will include the following elements:
  - a. Assigning mentors and organizing workshops to improve grant writing skills (involving tenured faculty members who have participated in study sections) and encouragement to the junior faculty to participate in teaching workshops.
  - b. Promoting participation of the junior faculty in processes such as file review, ad hoc committees, and discussion of personnel cases (to demystify the process and reduce unnecessary stress contributing to the retention of junior faculty).
  - c. Developing a “SOLS Faculty Handbook” online with a list of the right person to call for different needs, information about available resources for professional development, and detailed descriptions of the grant routing process and other administrative procedures.
  - d. Nominating junior faculty members for invited talks at major conferences, participation in study sections and grant review processes etc.

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