

OVERVIEW, STRATEGIC PLAN, SCHOOL OF BIOLOGICAL SCIENCES,

This document is based on the Strategic Plan adopted by the School of Biological Sciences in February of 2009. It gives an overview of the goals and long-term objectives of SBS. The plan is based upon three inter-related priorities of SBS: to provide high quality undergraduate and graduate education while continuing to be a leader in biological research. Our plan proposes increasing support for the undergraduate program while facilitating integration of the Life Sciences curriculum, increasing the size and quality of our graduate programs, thus supporting both undergraduate education and research, and moving SBS forward as a cutting-edge place for biological research.

Long-Term Vision

Our Vision of the Future of Biology: The last three decades have seen dramatic advances in biological science, including the revolution in cell and molecular biology, the emergence of genomics and proteomics, the maturing of sophisticated, quantitative evolutionary biology and the emergence of new tools and approaches to understanding ecological communities and ecosystems. Many of these advances originated in single subdisciplines of biology, but their emergence sends a crucial strategic message: biology has become integrative. Understanding biological systems requires investigation at multiple organizational levels, from genes, cells, and physiology through organisms to populations, communities, and ecosystems. Most experts agree the future of biology will be characterized more by integration than specialization. The distinctions between traditional areas of biological research will become blurred and biologists will regularly integrate knowledge and methodologies taken from fields outside the realm of biology, including mathematics, engineering and computer science. Biologists must increasingly focus on understanding how individual units interact and how these interactions give rise to the function and behavior of systems. Integrative system approaches will become increasingly necessary to solving important problems such as the biology of human health and disease or understanding how biological systems adapt and influence global processes related to climate change. One of the biggest obstacles to realizing this vision is finding an effective way to integrate disciplines by promoting collaborative approaches to research and education in the life sciences and related disciplines.

Our Educational Vision: This integrative future of biology has implications for the education of undergraduate and graduate students. Today we need physicians who know molecular and evolutionary biology; conservation biologists who know bioinformatics and molecular techniques; evolutionary biologists who can read and interpret microarrays. Undergraduate and graduate training in Life Sciences must become more integrative. This affects the SBS curriculum, and could also provide a strong intellectual rationale for integration of the Life Sciences curriculum.

Our Educational Challenge: The intellectual challenge is clear; so is the practical challenge. With the increased popularity of Biological Sciences and the increased size of the UNL student body in recent years, demands on the SBS instructional program have increased substantially. The likely development of Life Sciences curriculum coordination may well increase those demands. Meeting these challenges will require increases in faculty and staff support for SBS instruction and increases in teaching space, most crucially teaching laboratory space.

Meeting Strategic Priorities: The steps we propose are fully consistent with College and UNL priorities, especially those related to propelling Life Science research and graduate programs to the levels of excellence of *Vision 2020* while enhancing the undergraduate experience in large lectures, recitation sections and laboratory classes. These goals will be accomplished by increasing graduate student support for instruction, adding faculty expertise that will be devoted to

both instruction and research, and improving the number and quality of classrooms and laboratories for faculty and students.

Action Plan for Meeting the Challenges

Faculty Hiring Plan: The integrative perspective mandates a new approach towards building a cutting-edge unit of biologists working at multiple levels. The most important challenge in developing multi-level understanding is identifying the links between levels; it is primarily through such integration that critical questions in biological complexity can be addressed -- questions in areas such as human health, ageing, disease, complex behavior, biodiversity, global climate change and invasive species. SBS is well-positioned for this effort as the majority of faculty recruitments of the past several years have had an integrative emphasis and have begun the process of building strength in key focus areas of integrative biology. Our hires have also been strategically consistent with CAS signature program priorities in bioinformatics, biological modeling and virology as well as with Programs of Excellence in Population Biology and in Microbiology. Our current plan builds on these successes with the goal of firmly establishing SBS as the campus leader in 21st century basic life science research and instructional programs.

Taking into account instructional and scientific needs, likely retirements and space constraints, we envision up to 9 new faculty hires by 2015 (6-7 FTEs allowing for probable joint hires with other departments/programs), including the specific hire described below for possible recruitment during 2010/11 academic year. The specific number will depend upon several factors including retirements, Manter space renovations, construction of additional Life Sciences research and teaching space (e.g., “Beadle 2” or Manter addition) and successful partnering with other units/centers. At the current time, the following generic descriptions are consistent with the overall programmatic direction outlined above but sufficiently non-specific to permit taking advantage of emerging opportunities:

Recruit two positions in plant biology, emphasizing expertise at the organismal, ecological and evolutionary levels. (There is an active search for one of these positions underway this year). These positions would replace retirements and expand the breadth of expertise campus-wide in the basic plant sciences with an emphasis on systems approaches. Descriptions could include Evolutionary Ecology, Population or Evolutionary Genomics and/or Genetics. These would create opportunities for potential partnership with PSI, SNR or agronomy.

Recruit two positions focusing on global change. One area would focus on the effects of global change in emerging diseases in natural plant, animal or human populations. This could create collaborative opportunities with the Virology Center or an IANR unit. The second would focus on evolutionary and/or ecological consequences of global change or ecoinformatics. This could involve partnership with Geosciences or SNR or the climate change PoE developing in SNR.

Recruit four positions in integrative biology, with expertise in areas that link to our existing strengths. One might involve neurobiology or endocrinology/behavior because behavior is a phenotype which heavily involves interaction of different levels of analysis (genes/ environment). A second might involve synthetic biology with an emphasis on gene regulatory networks in microbial systems or a joint hire on bioenergy with the Nebraska Center for Energy Research. Another might focus on biomedical areas taking a systems approach using a model organism. Finally, because developmental processes are so important, SBS could bolster its expertise in this area with a position taking an “evo-devo” approach using comparative genomics.

In order to ensure the cohesion of our long-term hiring plan, we propose a four pronged approach for achieving the long term goal:

1) Focus our hiring on biologists who either work at understanding living systems at multiple levels of analysis or who have expertise in the new tools and techniques that are driving biological integration, e.g., genomics, proteomics, mathematics, phylogenetics, or eco-informatics.

2) Because many of these tools and approaches involve academic disciplines other than biology, take advantage of opportunities to encourage strategic interdisciplinary hires outside of the traditional boundaries of biology (e.g., mathematics, physics, chemistry, computer science).

3) Because SBS is a relatively small unit in comparison to most biology departments at similar universities, making strategic hires in partnership with established Research Centers (e.g. NCV and PSI) can be an effective way to further our goals. Two of last year's hires and two current searches involve collaborative hires with NCV or PSI.

4) The long term vitality of UNL life sciences requires the effective integration of basic with applied research aligned to the needs of the biomedical (UNMC) and agricultural (IANR) communities of Nebraska. Strategic inter-departmental hires as part of our longer term hiring plan will promote broader integration of the Life Sciences across City and East Campus and with UNMC and position SBS as a leader in the transformation of the broader life sciences community. These goals are consistent with the commitments of UNL and the College to continue to propel us towards the research goals of the 2020 report.

Implications of Proposed Future Faculty Hiring for Instruction: SBS provides the largest number of credit hours of life science instruction of any department at UNL. Overall demand for such courses will continue to increase because of both general enrollment increases and the ever increasing influence that the biological sciences are having on all of the other STEM disciplines as well as many areas in the humanities and social sciences.

Currently, SBS has multiple responsibilities for life science instruction above and beyond meeting the needs of SBS majors. These include providing basic life science instruction for health pre-professionals, future teachers, agricultural science majors and a variety of other biology-related majors, as well as educating a biologically-informed citizenry. SBS delivers a rigorous set of lower division courses (service courses and the SBS core for majors) and a spectrum of upper division courses. We can continue to meet these basic instructional obligations while meeting the focused set of research priorities outlined above. To do this we are proposing two overarching goals and a variety of new strategies to address them.

The first goal will be to improve the quality of the learning experience in the lower division core courses for all 1st and 2nd year students in the life sciences. Strategies to meet this goal include: (a) increasing number of faculty directly involved in lower division instruction; (b) proactively seeking increased cooperation with other UNL life sciences units to deliver a well defined set of core courses in life sciences; (c) involving faculty from units outside of SBS in lower division life sciences instruction; (d) providing additional resources to facilitate and implement course delivery, particularly for laboratory and large lecture courses; and (e) convincing UNL to invest in enhancement of life sciences laboratory teaching space (construction of an addition to Manter Hall is likely within 3-4 years).

The second goal will be to enhance the size and quality of the SBS graduate program to benefit both the graduate as well as the undergraduate program. This will require enhanced graduate recruitment, stipend increases and offering more graduate-level courses of all types.