



**Summary of the Work of the
Task Force on the Life Sciences
The Ohio State University**

September 21, 2009

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Preface

This document provides the supporting information on which the findings and recommendations of the task force are based. It describes and summarizes the activities of the task force and its working groups over the last year. It also gives links to the reports of the working groups and other relevant documents such as internal and external presentations made to the task force. Taken together, the material constitutes the record of task force efforts and provides a base for implementation activities. The findings and recommendations of the task force are presented in the accompanying document.

Introduction

The activities of the Task Force on the Life Sciences stem from clear faculty interests and the results of the Doctoral Program Assessment and Plan carried out by the Graduate School (April 2008), as well as the recommendations contained within the external review of the interdisciplinary graduate programs conducted in 2004. The observations and recommendations compiled in the concurrent review of the Colleges of the Arts and Sciences (April 2008) provide further indication of the special opportunities now in front of Ohio State.

The highest priority finding for Ohio State to emerge from the doctoral program assessment process was that there were critical issues about the organization and administration of the doctoral and research efforts in the life sciences across the university. These issues must be addressed for Ohio State to achieve the enormous potential it has to be a world leader in these fields. By enabling the faculty and their students to work at their full potential, Ohio State has the opportunity to develop unique and cutting edge research and graduate programs and achieve world-class prominence in the life sciences.

In July 2008, the provost established a Task Force on the Life Sciences with the following charge:

- Identify how Ohio State's graduate level education, especially at the doctoral level, and research in the biological and life sciences should be optimally configured.
- Recommend appropriate organizational processes and arrangements to support high-quality doctoral educational and research efforts. The task force will look at overarching research themes, existing strengths, and opportunities for Ohio State.

To do so, the task force will:

- Create an inventory of existing research efforts that also identifies existing strengths and opportunities for Ohio State in the biological and life sciences.

- Invite broad and active participation from faculty and graduate students through working groups.

Co-Chairs and Members

The task force was co-chaired by **Joan R. Leitzel**, Interim Executive Dean for Arts and Sciences and Vice Provost, and **Patrick S. Osmer**, Vice Provost for Graduate Studies and Dean of the Graduate School.

Members include:

Mark A. Bennett, Professor, Department of Horticulture & Crop Science

Kathleen A. Boris-Lawrie, Professor, Department of Veterinary Biosciences

David L. Denlinger, Distinguished University Professor, Department of Entomology

Jeffrey L. Firkins, Professor, Department of Animal Sciences

Michael Ibba, Associate Professor, Department of Microbiology

Bobby D. Moser, Vice President for Agricultural Administration and Executive Dean of the College of Food, Agricultural, and Environmental Sciences

Karin M. Musier-Forsyth, Ohio Eminent Scholar, Professor, Department of Chemistry

Randy J. Nelson, Professor, Department of Psychology and Neuroscience

Matthew S. Platz, Distinguished University Professor and Interim Dean, College of Mathematical and Physical Sciences and College of Biological Sciences

Amanda A. Simcox, Professor, Department of Molecular Genetics

Larry S. Schlesinger, Professor and Director, Division of Infectious Diseases

Wiley W. Souba, Jr., Vice President and Executive Dean for Health Sciences and Dean of the College of Medicine

Caroline C. Whitacre, Vice President for Research

W. Randy Smith, Vice Provost, serves as the Office of Academic Affairs' liaison to the task force

To address the charge to the Task Force on the Life Sciences as presented by the provost, members focused first on three areas: identifying research frontiers and directions; creating an inventory of existing life sciences programs on campus; and reviewing best practices in organizational and administrative structures as found across institutions. A summary of the work of each group follows.

Research Frontiers and Directions

The scope of this working group was purposely broad, looking at what are the big questions in the life sciences, what are Ohio State's current strengths, and what are the areas the university should focus on. The group reviewed the National Institutes of Health Roadmap, Science Roadmap for Agriculture, National Science Foundation's Emerging Frontiers, National Academy reports, and research frontiers identified by *Science* magazine's 'top 25 big questions.'

Findings were condensed into the following categories that represent overarching themes of emerging importance in the life sciences:

- Bioenergy and Bio-based products
- Chemical Biology
- Environmental Quality
- Food Security
- Microbial threats, including human, animal and plant microbiome projects
- Neurobiology and Behavior
- Nutrition
- Sustainability, including climate-related research
- Systems Biology, including all the ‘-omics’
- Translational Science, including plant applications and animal and human applications in cancer and metabolic and infectious disease

This information, along with results of a survey of faculty, postdocs, and graduate students and discussion in three public forums, assisted the working group in identifying the current top strengths at Ohio State as Translational Science, Sustainability, Systems Biology, and Chemical Biology. Imbedded in each of these are further possible targets of excellence, including RNA biology, Genomics, and Plant Translational Sciences.

Lastly, the group identified areas of research which could benefit from more intentional interactions. The first grouping includes Cellular and Molecular Biology, Organismal Interactions and Pathobiology, and Therapeutics and Applications Science and would allow for interactions within and between the three areas. A second grouping of Environmental Sustainability and Neurosciences would offer opportunities for strong interactions within each unit but less between the units.

Inventory of Existing Programs

Identifying faculty in each of the life sciences and interdisciplinary programs is a critical necessity for moving forward. This working group created an inventory of 26 departments and graduate programs and met with chairs to further develop the ‘sense of science’ in each. A one-page summary of each program provides a statement of overall purpose, identifies research themes and research faculty, and lists training grants as well as output data on doctoral graduates over the past three years (Link to [Graduate programs inventory](#), [Output data tables](#)).

Information from graduate student forums revealed that most students came to Ohio State from Ohio and the Big 10 and that they came primarily because of contact made with a specific faculty member. Students expressed an interest in choice across disciplines and some felt that their departmental affiliation restricted that choice. They ask for experiences that are nontraditional and flexible and, in many cases they, rather than the faculty, are the initiators of cross-disciplinary experiences. Career development opportunities are seen as dependent upon

the individual PI, and students expressed a desire for more program-wide activities focused on career development (e.g. resume preparation, alternative career workshops, and grant writing workshops).

Best Practices

A key question for this working group was how organizational arrangements can be structured so as to contribute to, rather than stand in the way of, interdisciplinary research and scholarship. Directors of the Integrated Biomedical Science Graduate Program and the Molecular, Cellular, and Developmental Biology Graduate Program participated in a wide-ranging discussion with the task force on the challenges and accomplishments of their respective programs and IGPs in general. There was agreement among these directors that interdisciplinary research is the best training environment for many graduate students, as it allows for interaction across programs and broadens the student experience.

Major challenges center on budgetary issues and on faculty and dean ownership (or lack thereof) of the interdisciplinary graduate programs. Eight colleges are involved with the four biological and life science IGPs (Biochemistry; Molecular, Cellular, and Developmental Biology; Neuroscience; Biophysics), leading to diffuse buy-in by deans and chairs. It was noted that these programs are 'horizontal structures in a vertical world.' The current expenditure share for the IGPs (including funding for first-year students) is calculated based on the percentage of non-first-year students each department has engaged in the interdisciplinary program. Other issues raised by this group include internal barriers that prevent faculty from participating across life sciences programs. In short, it is not always clear what the dividing line is between some unit graduate programs and the IGPs.

The group identified the university's Center for Microbial Interface Biology (CMIB) as an example of existing interdisciplinary strength on campus. Larry Schlesinger, CMIB director, shared that the focus of the center's establishment was on enhancing scientific productivity through meaningful partnerships and collaborations [Schlesinger presentation](#). There are 11 core faculty and 68 total faculty members from seven colleges affiliated with the CMIB. In 2007, total research funding for grants for core faculty totaled more than \$13 million, and for all CMIB-affiliated faculty the total was in excess of \$60 million. A T32 Training Grant supports three doctoral students. CMIB holds weekly forums and a yearly research retreat and operates with an equipment and supply sharing plan that seeks to maximize the use of research dollars. The CMIB benefits from co-location in the Biomedical Research Tower, and there are discussions underway to support co-locating key RNA faculty from units outside the College of Medicine to the BRT as well. Since many RNA faculty are in the Department of Microbiology in BMPS, this action would contribute to the increased communication and collaboration between the CMIB and the microbiology graduate program.

The working group also contacted peer and aspirational peer institutions in the life sciences. Michael Culbertson, chair, department of Genetics in the School of Medicine and Public Health and in the College of Agriculture and Life Sciences at the University of Wisconsin-Madison, met with the larger task force for a discussion on optimal organizational structure [Culbertson presentation](#). He explained that his department is housed in two colleges (medicine and agriculture) and that for this system to work, chairs cannot see walls around their departments and must be able to invest in the discipline. He suggested that a first step is the merging of graduate programs. At Wisconsin, this has resulted in some fully merged graduate programs and some that are merged administratively.

Culbertson endorsed the notion of laboratories having a mix of students from various graduate programs, allowing and encouraging students to learn from each other. He noted that the organizational structure in place at Wisconsin—programmatic rather than departmental—was driven by the requirements of NIH. Wisconsin has 32 NIH Training Grants supporting 300 graduate students (compared to 16 such grants at Ohio State) [Training grants](#). This tradition of attention to securing Training Grant support is seen as critical in the growth and high quality of Wisconsin's life sciences graduate programs. The clear metrics required for NIH Training Grants provide a template by which Ohio State can evaluate and improve its life sciences graduate programs. As summarized below, an expectation of this restructuring process is that each of the four IGPs obtain a funded training grant or other significant programmatic support within five years.

Susan Ross, associate dean for graduate education in the School of Medicine and director of Biomedical Graduate Studies (BGS) at the University of Pennsylvania, also spoke with the task force about best practices in the administration of life sciences graduate programs [Ross presentation](#). The BGS program provides centralized leadership for 13 graduate groups with 728 graduate students and 628 faculty. Initially, most of these 13 graduate groups were associated with an academic department of the same name. A core curriculum and strong administrative oversight of a wide range of areas including recruitment, admissions, career development, and data management are the hallmarks of the BGS program. Ross' office also coordinates the review of each graduate group which occurs on a six-year cycle. Faculty are appointed to a graduate group for a three-year period, during which they must provide an average of 50 hours/year to BGS, 15 hours of which must be in teaching or service on academic committees. Further requirements are set by each graduate group. Ross said that implementation of these best practices has led to an improvement in student quality and training and more investment by the faculty. At Ohio State, the proposed reorganization of the Biochemistry graduate program into a Center for Biochemistry will allow for such investment by Biochemistry in BMPS and by Molecular and Cellular Biochemistry in Medicine. This

reorganization also will give respective chairs more control and oversight as well as the ability to reward IGP service.

The majority of funding for the annual BGS budget at the University of Pennsylvania is provided by the School of Medicine (home of 76% of BGS faculty). As the program has matured, these dollars have been offset by extramural funds generated by research and training grants. The executive director manages the budget, with the stated purpose of ensuring “strong administrative oversight and support across the graduate groups.”

Additional Input from Faculty and Students

Faculty, postdocs, and graduate students were invited to a series of forums on the life sciences held winter quarter. Comments shared at these sessions and in emails informed the discussion of the task force. Individuals expressed these perceptions:

- The current funding model at Ohio State is a roadblock to collaboration and ownership. While research has taken a more interdisciplinary approach, programs and faculty do not get support for interdisciplinary work. And, because IGPs are not centrally funded, they are more easily cut by college deans when budgets are tight.
- Graduate programs are organized in departmental structures, yet the broad themes identified by NIH/NSF are not classified in this way. An interdisciplinary approach to graduate programs is called for.
- There must be a mechanism by which faculty and students can share research interests and establish collaborative partnerships. It is difficult for faculty to connect with colleagues in different disciplines who have similar research interests.
- Students have very different educational experiences, depending upon whether they are enrolled in a departmental or an interdisciplinary graduate program. Students in large departments may not be informed of educational or research opportunities in their own department while students in IGPs feel they have two ‘homes,’ one in the department and one in their program.

Meeting with Sasaki & Associates

Sasaki & Associates are engaged in a major and comprehensive facilities planning project for the university, and the task force met with the Sasaki planners concerning best ways to facilitate and support interdisciplinary research and educational efforts in the life sciences. Major points of discussion included:

- Sasaki has recommended that campus planning proceed with the assumption that little or no net new building space will be built on campus.
- Ohio State has a critical need for collaborative work space as well as quiet space for faculty, students, and postdocs to think and write. This space should be available across campus and in many buildings. Sasaki especially emphasizes the need to incorporate collaborative space in each major scientific unit within the existing lab space on campus. Further discussion of this concept appears below.
- There is an opportunity to widely incorporate video conferencing in labs across campus and to promote the use of videoconferencing for routine communication between multidisciplinary labs on campus as well as beyond the campus borders.
- There is a lack of common space. There must be the opportunity for daily interactions among faculty and students. This 'intensity of collisions' can lead to new collaborations and research partnerships and provides an opportunity for collegiality and community. The strategic placement of broadly accessible cafés would assist in promoting such 'collisions' among and between PIs, research staff, and trainees.
- Attention must be paid to the different needs of researchers, some of whom may need only a laptop and do not need to be in the same physical environment.
- Researchers work nationally and internationally as well as locally. Ohio State must build research environments that work for the individual and provide the maximum potential within a group dynamic. To increase the pace of science at Ohio State requires coming together as larger groups.
- The quality of current lab space in some areas is suboptimal to the extent that it limits research productivity.
- There should be equal quality space across disciplines.

Overarching Issues

The reports of these three working groups, survey results and comments from faculty and students, meetings with internal stakeholders and external consultants, as well as task force discussions over the past academic year resulted in identification of six overarching issues concerning the current status of the life sciences at Ohio State. The task force agreed these issues required additional consideration prior to any substantive recommendations concerning future organizational processes and arrangements of the life sciences. The issues requiring action include:

- A need to change the financial and administrative structure for the interdisciplinary graduate programs. The IGPs and college/department programs at present compete for both financial and human resources. The conflict issues that have been uncovered among departments and programs must be addressed.

- A need to ensure that department chairs develop written agreements with faculty who participate in cross-disciplinary centers and/or in IGPs. This expectation has been set by Provost Alutto in his March 20, 2009, memo to the faculty. The goal is to change the culture of deans, department chairs, and faculty members about the expectations, annual goals, and reward structures for faculty regarding their work within departments and without, e.g., on interdisciplinary programs.
- A need to design a process to periodically review and update the curricula in the graduate programs (both departmental and interdisciplinary) with the expectation that this will also strengthen and broaden the research programs.
- A need to expand forums, trans-university information and networking tools, and knowledge management efforts and to develop, enhance, and maintain web-based portals and new mediums of communication in support of interdisciplinary research and educational efforts and to attract prospective students.
- A need to establish that a main goal of broad university initiatives and investments in the life sciences is to provide a way to attract major external support. Internal support is not the end point.
- A need to identify space requirements and establish flexible, responsive administrative structures to enhance interactions, strengthen existing groups, and promote formation of new interdisciplinary grouping and initiatives.

Three additional working groups were formulated to address these issues. A summary of their work follows.

Working Group A

This group addressed the issues regarding the financial and administrative structure of the IGPs and the reward structure for faculty engaged in interdisciplinary work.

The current expenses for each of the four interdisciplinary graduate programs (Biochemistry; Molecular, Cellular, and Developmental Biology; Neuroscience; Biophysics) include one month's summer salary for the director, one administrative assistant, \$30,000/year for office expenses, and funding for all first-year fellowships. Each college pays for its students in subsequent years based on its percentage of the IGP enrollment. This structure minimizes the ability of a dean to invest in or divest from the program.

Working Group A made recommendations for a new structure for the IGPs going forward; the proposed structure has the following broad characteristics:

- Co-location of the administrative staff of the four life sciences IGPs (to be renamed the Life Sciences Interdisciplinary Graduate Programs) in renovated 105 Biological Sciences.

The possibility exists that other interdisciplinary programs (e.g., Nutrition and Integrated Biomedical Graduate Program) could someday relocate administrative staff to this site as well, furthering cross-disciplinary interactions.

- The success of the restructured Life Sciences Interdisciplinary Graduate Programs will require strong administrative support across the IGPs, which can be provided by a central executive director that reports to the Dean of the Graduate School and has a joint appointment as an Associate Dean of the Graduate School. This leadership would leverage and enhance the ability of the IGPs to recruit high ability students and to compete for programmatic support. The executive director would be expected to have a strong record in graduate student mentorship and programmatic leadership. The deans of the life sciences colleges would provide an oversight and consultative role.
- The executive director should have day-to-day budget authority for the IGPs. In addition to hiring and supervisory responsibilities, the executive director could be expected to coordinate the work of the IGPs, coordinate a unified IGP grant resource for program directors to support faculty efforts to prepare funding proposals, and organize a review process on a four-year cycle composed of internal and external scholars and members of prestigious organizations such as the National Academy of Sciences. Additionally, with the four program directors, this person should develop and execute written agreements for faculty about the expectations, annual goals, and reward structures of IGP membership, and allocate budgets to coordinate efficient use of resources.
- The co-location of the four IGPs would provide an opportunity for a professional staff with responsibility across the IGPs for student recruitment and application processes; communications, web development, and life sciences portal; and grant proposal writing. Admission procedures would make it possible for a prospective student to apply to more than one graduate program with a single application form and a single fee. The executive director should be given flexibility in hiring and in achieving efficiencies by redirecting the efforts of existing staff where possible.
- Several options were discussed and the consensus was that each of the four current IGPs would continue to be headed by a program director. In addition to responsibility for students in their respective program, directors could execute annual review of IGP members, spearhead training grant and other major external funding applications of the program faculty, assign teaching resources, and coordinate a periodic external programmatic review. It is suggested that program directors be subject to reappointment, on a three-year interval.

The proposed Life Sciences Interdisciplinary Graduate Programs would be funded in the following manner:

- Funds would be requested from the Office of Academic Affairs and the Graduate School for the new staff positions and work of the office for five years.
- Life Sciences deans would be expected to continue to support 45 first-year fellowships per year for five years for the four IGPs. These fellowships would be distributed (Biochemistry, 12-14; MCDB, 16-18; Biophysics, 6-8; and Neuroscience, 8-10), eliminating the perception of competition for these fellowships.
- Support would be reviewed annually and continued support beyond this five-year period would be contingent on each IGP attracting major external support, specifically one or more T32 training grants or program project grants, and in attracting a diverse pool of high-quality students, approximately 60% or more of whom would be domestic students and 40% or less may be international students who play an important role in the diversity and global competitiveness of the university.
- The Council of Life Sciences Deans should appoint a program dean for each IGP. The program dean should work with the chairs of related departments to give oversight to the IGPs. The working group suggests that program deans be appointed to serve a three-year term.
- A major responsibility of the program dean would be to recommend to the Council of Life Sciences Deans the budget to support the IGPs. Instructional subsidy for each course taught will flow to the budget unit of the instructor.

The guiding principle going forward is that research priorities and quality of the doctoral program will dictate the continued existence of each IGP as well as the resources directed to each. Accordingly, faculty membership in each IGP is a privilege rather than an entitlement and will be limited to those faculty with a defined threshold indirect cost return, for example one or more grants with full or partial indirect costs. Members will be expected to contribute to the work of the IGP, either by teaching or service to the interdisciplinary program, and these contributions will be acknowledged as equivalent to teaching and service provided to academic departments.

The president and the provost have spoken to the importance of interdisciplinary work, many of our most productive faculty are engaged in interdisciplinary work, and graduate students are seeking more opportunities to work across disciplines. This plan seeks to resolve the financial and organizational barriers to this important work, assure that faculty efforts are recognized and rewarded, and develop and establish clear standards for evaluation and accountability.

Working Group B

This group addressed the issues regarding interdisciplinary curricula and the use of technology and innovative methods in support of research, education, and graduate student recruitment.

Some interdisciplinary life sciences graduate programs underwent an external review in 2004, and many of the findings of that review regarding the curriculum remain relevant. It is suggested here that the IGPs cooperate in defining a unified curriculum in at least the following three areas, which are in place in various programs at present but remain to be unified into a coordinated program appropriate for implementation in training grant applications:

- A responsible-conduct-of-research course is required for funding by national agencies. This course will provide instruction in research ethics through web-based instruction and through group studies and will assist in promoting collegiality and networking among graduate students. Faculty drawn from different programs will direct the course.
- A writing course taught in the form of a workshop will teach skills for writing papers and proposals to promote effective scientific communication.
- A careers course will engage students in exploration of diverse career paths possible with a degree in the life sciences. This may be taught as a symposium or seminar and will draw on speakers from Ohio State as well as from external agencies and other employing institutions.

The University of Pennsylvania model suggests a central curriculum committee with representatives from each of the interdisciplinary groups meeting periodically to monitor the quality of courses, promote the development of new courses, and review the academic performance of graduate students in their first two years of enrollment. It is recommended that the Life Sciences Interdisciplinary Graduate Programs, led by the Executive Director, convene a faculty panel to assume this role as well as to review the curricula in departmental and interdisciplinary programs with the goal of eliminating redundancy. This process must be done in coordination with the upcoming calendar conversion to semesters.

It is of critical importance that a dynamic life sciences web site be developed for use by prospective and current students as well as by faculty and postdocs. Prospective students searching for information about graduate programs in the life sciences would be well served by having all relevant information available for comparison and review. A life sciences 'front page' which allows prospective students to apply for multiple programs at the cost of a single application is essential. Similarly, a professionally designed web site would allow for shared information across disciplines and provide an electronic bulletin board for postings of seminars, speakers, and other life sciences community events. The current IBGP portal is a start in this direction. A well-developed example is the University of Pennsylvania BGS web site <http://www.med.upenn.edu/bgs/>.

Finally, the life sciences must support ongoing initiatives to host forums, workshops, and symposia that improve the quality of research and of the student experience on campus. The Mathematical Biosciences Institute in BMPS (<http://www.mbi.osu.edu/upcoming.html>), the

Comprehensive Cancer Center (<http://www.osuccc.osu.edu/iacrird/>), and the OSU Center for Clinical and Translational Science (<http://cts.osu.edu/drupal/>) are hosts of successful events that invite broad participation and nurture interdisciplinary research and international recognition of the university.

The priorities identified by working group B mesh with the administrative structure outlined by working group A and are enacted through coordination by the executive director.

Working Group C

This group addressed issues relating to attracting major external funding support and identifying space requirements to enhance interdisciplinary work.

To attract training grants and program project grants, the life sciences interdisciplinary programs must focus on and reward a culture of excellence. The overall progress of an Ohio State graduate training program will be judged in part by the performance of students and faculty compared to very specific input and output measures.

One goal is to continue to improve over time the quality of applicants, particularly domestic applicants, and enrolled students according to university fellowship minimum standards. These include an undergraduate grade point average of at least a 3.6 on a 4.0 scale, a 75th percentile average on the GRE verbal and quantitative sections, and a 4.0 on the analytical writing section. While not every admitted student is expected to meet these standards, the metrics are recognized as an indicator of strong academic potential. For graduating doctoral students, expectations should be consistent with minimum standards for competitive NRSA post-doctoral fellowships, including a minimum of two to three papers, at least one of which is first authored and represents original science.

The quality of training faculty would be improved by developing minimum standards for eligible participating faculty in the IGPs similar to standards established for extramural training grant programs. Examples include a minimum of two years of active national-level peer-reviewed extramural grant funding going forward, the ability to pay both stipend and tuition for a graduate student, experience as a member of thesis/candidacy committee, and evidence of ongoing scientific productivity. This requirement would be waived for newly recruited faculty (for four years for junior faculty and one year for senior faculty).

Successful training programs are judged in part on how successful former trainees are in seeking further career development and in establishing productive scientific careers. It is of paramount importance that each IGP track evidence of subsequent fellowships and/or career

awards for their graduates, further training appointments, and similar accomplishments. Evidence of a productive scientific career would include successful competition for research grants, receipt of special honors or awards, a record of publications, receipt of patents, and promotion to scientific positions.

The availability of seed money for interdisciplinary groups (akin to innovation groups) that have a goal of obtaining external funding is critical as is developing a program by which investigators can receive funding to pay for outside consultants to review grant proposals and advise on key issues. Such a relatively small investment has the potential to reap big rewards.

Following on the discussion with representatives of Sasaki & Associates, it is important that the university pursue a 'research hotel' concept for both dry and wet bench space. This concept provides open wet and dry laboratory space for collaborative group interaction as well as space for personal endeavors. Creating flexible space within existing research buildings (where cutting-edge scientific platform technology already exists) would allow investigators from different disciplines to pursue new collaborative projects in order to enhance competitiveness for extramural funding. This space could particularly emphasize projects with translation potential and also facilitate commercialization. Examples of such space utilization can be found at Johns Hopkins, the University of Canberra, and the University of Nottingham. In addition, flexible research space for innovative interdisciplinary projects could emphasize incubator projects with translation potential and would foster public/private partnerships.

Closely tied to the goal of raising the bar for graduate education and providing pilot research funding is the expectation that we will enhance the quality, breadth, and national standing of scientific programs at Ohio State. Metrics for faculty excellence in these programs will include closer tracking of extramural grants received, academic performance in terms of the number and quality of papers published, invitations to join editorial and extramural review boards, and national and international reputation as measured by honors and awards (e.g. society awards and memberships in the NAS or HHMI).

Report from the National Academies of Science

In 2003 the Keck Foundation and the National Academies began a joint *Futures Initiative* aimed primarily at strengthening opportunities for interdisciplinary research and education in the nation's universities. The initiative brought together leading researchers, educators, and administrators from universities, national laboratories, and industry at a convocation held in 2004; the resulting publication *Facilitating Interdisciplinary Research* (link?) presents the collective experience and wisdom of the participants. The report has been a useful resource for the task force. For example it provides a definition of "interdisciplinary research."

Interdisciplinary research (IDR) is a mode of research by teams or individuals that integrates information, data techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or field of research practice.

The findings and recommendations of the NAS report clarify both the barriers to and the requirements for successful interdisciplinary research in universities. They have served as external validation of the task force's findings and proposed solutions for Ohio State, several of which the task force identified independently and then learned are common issues in research universities.

Conclusion

To reiterate from the Introduction: "By enabling the faculty and their students to work at their full potential, Ohio State has the opportunity to develop unique and cutting edge research and graduate programs and achieve world-class prominence in the life sciences." The Task Force on the Life Sciences has focused its work on identifying changes that will, simply put, remove current barriers and move the university to prominence in the life sciences. These changes range from rethinking how Ohio State structures research experiences for graduate students to redesigning space for its most productive scholars. The task force has proposed small steps and large leaps. The overall aim is to better position the university in attracting high ability students and faculty and in garnering a more significant share of external funding. At its core, this document proposes a cultural transformation in how interdisciplinary work in the life sciences moves forward at Ohio State.