NIGMS Symposium on Catalyzing the Modernization of Graduate Education

April 11, 2016

Abstract Book

Table of Contents

The abstracts are in five broad categories:

- National Issues in Biomedical Graduate Education
  - Topics that extend to or impact the system as a whole
- Career and Professional Development
  - National or institutional efforts to enhance the preparation of Ph.D. scientists for a wide variety of scientific careers.
- Skills Development
  - Local efforts to enhance the scientific and professional skills of Ph.D. students.
- Curriculum Reform
  - Experiences with reforming coursework and other programmatic activities for Ph.D. students.
- Institutional Approaches to Transformation
  - Institutional philosophy to promoting the modernization of graduate education.

We recognize that some abstracts are be able to fit in multiple categories. We made our best effort to assign each abstract to the category we felt best reflected its content given the overall abstract pool. **Abstracts in bold will be featured as short talks during lunch.**

7	The BEST Consortium (presented by Roger Chalkley)	The Broadening Experiences in Scientific Training (BEST) Program	Career and Professional Development
8	Avery August, Chris Schaffer, John Parker, Susi Varvayanis	Integrating career development and graduate training at Cornell University: A BEST example	Career and Professional Development
9	**Nathan L. Vanderford**	**Preparing Future Professionals: A Career Development Course to Enhance Work Readiness**	**Career and Professional Development**
10	John H. Russell	Student-Led Groups as a Model for Non-Academic Experiential Training	Career and Professional Development
11	**Terrance R. Mayes and Latishya Steele**	**Empowering Bioscience PhD Students: An Integrated Academic, Professional and Personal Development Approach**	**Career and Professional Development**
12	Richard A. Kahn and Keith D. Wilkinson	Use of a Grant Writing Class in Training PhD Students	Skills Development
13	**Ralph L. Keil and Jong Yun**	**A Concurrent PhD/MBA Degree Program Prepares Biomedical Science Graduate Students for Careers in Business and Finance**	**Skills Development**
14	Patricia Kovatch, Andrew Sharp, Luz Claudio	Innovations in Practical Computational and Data Science Training for Biomedical Science	Skills Development
15	C. Taylor Gilliland, G. Sitta Sittampalam, Philip Y. Wang, Philip E. Ryan	The Translational Science Training Program at NIH: Introducing Early Career Researchers to the Science and Operation of Translation of Basic Research to Medical Interventions	Skills Development
16	Catherine I. Dubreuil, Timothy Mitchison, and David E. Golan	Engineering Innovative Training in Applied Biology: the Harvard Graduate Program in Therapeutics	Skills Development
17	Lisa M. Kozlowski and Kristy Shuda McGuire	Mentored Teaching Experience in Health Professional Courses	Skills Development
18	Michael T. Ashby	Advancing Graduate Education in the Natural Sciences with a Modularized Curriculum	Curriculum Reform
19	Janet V. Cross and Amy H. Bouton	Five Years Under the Umbrella: Integration and Evolution of the Biomedical Sciences (BIMS) Graduate Program at the University of Virginia	Curriculum Reform
20	**Johanna L Gutlerner, Ronald Jason Heustis, Yan Liu, David Van Vactor, David E. Golan**	**The Harvard Medical School Curriculum Fellows Program: an Education Lab as Catalyst for Innovation in Graduate Training**	**Curriculum Reform**

21	David Van Vactor, Christopher Wood, Theodore Feldman, Jason Heustis, Wade Harper	Cell and Developmental Biology Training at Harvard Medical School	Curriculum Reform
22	**Kurt A. Thoroughman**	**Cognitive, Computational, and Systems Neuroscience: Training Interdisciplinary and Independent Brain Scientists**	**Curriculum Reform**
23	Louis B. Justement, Daniel C. Bullard, Scott Wilson	Enhanced Preparation of Undergraduates For Success in Graduate Training and Career Selection Through the Creation of Undergraduate Biomedical Majors	Curriculum Reform
24	Deepak Vashishth	An integrated and multidisciplinary training program in biotechnology: Preparing for careers at the interface of biology, chemistry and engineering	Curriculum Reform
25	Kimberly Duncan, Arhonda Gogos, Caroline Pounds, Peter Espenshade	Recent Innovations at Johns Hopkins University School of Medicine	Curriculum Reform
26	**Lillian Zwemer and Christopher V. Nicchitta**	**Complement and Collaborate: A Boots on the Ground Revision of Graduate Education**	**Institutional Approaches to Transformation**
27	Robert Duvoisin, Steven Bedrick, Allison Fryer	Creating the PhD of the future at Oregon Health & Science University	Institutional Approaches to Transformation
28	Mary Ellen Lane and Anthony Carruthers	Engaging Faculty in Modernizing Graduate Biomedical Education	Institutional Approaches to Transformation
29	Charles F. Delwiche and Michelle M. Brooks	Implementing and tracking innovations in graduate education	Institutional Approaches to Transformation
30	Alissa Ewer, Eileen Callahan, Amy Fruchtman	Strength in Numbers: A Collaborative Approach to Graduate Student Career and Professional Development	Institutional Approaches to Transformation
31	James B. Turpen	Development of a Student Pipeline to Graduate School	Institutional Approaches to Transformation

Abstract 1

Title: Advancing Graduate Education in the Chemical Sciences

Author: Bassam Z. Shakhashiri

University of Wisconsin-Madison Department of Chemistry, 2012 President of the American Chemical Society

Abstract: In 2012 the ACS Presidential Commission on Graduate Education in the Chemical Sciences was formed. One major task of the Commission was to consider fundamental, comprehensive, and systemic changes suitable for graduate education in the chemical sciences. A second major task was to suggest actionable approaches for enhancing the quality of graduate research and education at all institutions. The outcome of the Commission's deliberations was a set of recommendations for a coherent strategy for improving graduate education in the chemical sciences and provides choices among viable models that can be adopted by a variety of institutions. For any particular institution, some models are more appropriate than others. The choice among them and the distribution of these choices affect research universities, comprehensive universities, graduate students, industry, and funding agencies, such as NSF, NIH, DOD, DOE, and NIST, as well as private foundations. The educational issues addressed by the Commission are common to other fields in both the sciences and engineering, and the Commission's work has not only influence on graduate education in the chemical sciences, but other disciplines as well.

The Commission was charged specifically to address two central questions: 1) What are the purposes of graduate education in the chemical sciences, and 2) What steps should be taken to ensure that they address important societal issues as well as the needs and aspirations of graduate students? The Executive Summary can be found here. This summary includes the five major conclusions reached by the Commission, each accompanied by specific recommendations and suggestions. The Commission's views are summarized in two charts.

National and local implementation, as well as other follow up to the Commission's Report, will be discussed.

References: See links included in abstract above.

Executive summary: http://scifun.org/BZS_bio/GradEd_ExecutiveSummary.pdf

Charts summarizing commission's views: http://scifun.org/BZS_bio/grad-ed-chartsI-II.pdf

Abstract 2

Title: Mapping Biomedical Graduate Education to the Development of Specific Competencies

Authors: Wayne T. McCormack[1], Victoria H. Freedman[2], Lisa M. Kozlowski[3], Michael F. Verderame[4]

[1]University of Florida College of Medicine, Gainesville FL, [2]Albert Einstein College of Medicine, Bronx NY, [3]Jefferson College of Biomedical Sciences, Philadelphia PA, [4] The Graduate School, Penn State University, State College PA

Abstract: The skills associated with earning a PhD have historically been passed from teacher to student much like a traditional apprenticeship, but have not been well defined. To ensure that our predoctoral and postdoctoral trainees are thoroughly prepared in terms of scientific knowledge, research expertise, and problem-solving for today's complex and competitive environment, we are proposing a new competency-based approach to graduate education. Increasingly employed in health professions education, competencies can be used to define the knowledge, skills and outlook required to successfully meet the needs of a profession and of society. In addition, well-delineated competencies can provide tangible standards for performance assessment during the educational process.

We have utilized the Dreyfus model for longitudinal development to posit five developmental stages of graduate research education: (1) Beginning PhD student (novice); (2) Advanced PhD student (advanced beginner); (3) Graduating PhD/beginning postdoc (competent); (4) Advanced postdoc (proficient); and (5) Early professional (expert). We then mapped specific Core and/or Professional Competencies to each of the five developmental stages. We defined Core Competencies as those essential elements necessary to earn the PhD degree, the highest scholarly degree. In addition, we defined Professional Competencies as important skills that would be valuable for the broad array of biomedical careers (both academic and non-academic) now open to our trainees.

Simply defining the Core Competencies is not sufficient, however. Using an approach similar to that adopted by the ACGME, we are identifying milestones that define more specific expectations of knowledge, skills and attitudes for each Core Competency. We are also developing a rubric for competency-based assessment throughout the stages of training from novice to expert. This assessment tool incorporates observable learning outcomes and will help learners and mentors identify competencies that require further development, as well as improve overall performance assessment of biomedical research education, both on individual and programmatic levels.

References:

Dreyfus HL, Dreyfus SE. 1986. Mind over machine: The power of human intuition and expertise in the era of the computer. New York, NY: The Free Press.

ACGME Accreditation Council for Graduate Medical Education https://www.acgme.org/acgmeweb/tabid/430/ProgramandInstitutionalAccreditation/NextAccreditationSystem/Milestones.aspx

Abstract 3

Title: Labor and Skills Gap Analysis of the Biomedical Research Workforce

Authors: Julie L. Mason[1], Elizabeth Johnston[2], Sam Berndt[2], Katie Segal[2], Ming Lei[1], Jonathan S. Wiest[1]

[1]Center for Cancer Training, National Cancer Institute, National Institutes of Health, [2]ICF International

Abstract: The United States has experienced an unsustainable expansion of the biomedical research workforce over the past three decades. This has led to a myriad of consequences, including imbalance in the number of researchers and available tenure track faculty positions; extended postdoctoral training periods; rising age of investigators at first NIH R01 grant; and exodus of talented individuals seeking careers beyond traditional academe. Without accurate data on the biomedical research labor market, challenges will remain in addressing these issues and in advising trainees of viable career options and necessary skills to be productive in their careers. Herein we analyzed workforce trends, integrating both traditional labor market information and real-time job data. We generated a profile of the current biomedical research workforce, performed labor gap analyses of occupations in the workforce at regional and national levels, and assessed skill transferability between core workforce occupations and complementary occupations. We conclude that although supply into the workforce and the number of job postings for occupations within that workforce have grown over the past decade, supply continues to outstrip demand. Moreover, we identify technical and foundational skill gaps in the workforce through analysis of real-time job postings. Addressing these skill gaps could potentially equip trainees for multiple career pathways beyond academic research and lead to a more sustainable workforce.

Abstract 4

Title: Institutional Approaches to Tracking Research Trainee Information

Authors: Jodi Yellin[1], Anurupa Dev[2], and Naomi Rosenberg[3]

[1]Scientific Affairs, Association of American Medical Colleges, [2]Tufts University School of Medicine

Abstract: Biomedical PhD, MD-PhD, and postdoctoral trainees enter a wide range of careers in academia, government, industry, and other sectors. In 2012, a National Institutes of Health (NIH) Advisory Committee to the Director Biomedical Research Working Group found that information on career outcomes for biomedical PhD graduates and postdoctoral researchers is limited. An Association of American Medical Colleges (AAMC) study was undertaken to better understand what institutions and their PhD, MD-PhD, and postdoctoral programs are doing to collect research trainee information and to help institutions develop and enhance their own data-collection systems.

The Graduate Research, Education, and Training (GREAT) Group is a professional development group for faculty and administrative leaders of biomedical PhD, MD-PhD, and postdoctoral programs within AAMC-member medical schools and teaching hospitals. In 2012, a subgroup of the GREAT Group Steering Committee identified, through surveys and discussion, the types of data most institutions collect or would like to collect on their graduate students, postdoctoral researchers, and alumni. The subgroup then chose 12 representative AAMC-member institutions to participate in a study of their processes for collecting and disseminating information. The institutions reported using different strategies for data maintenance, and they varied in which trainees they collected data about and the type of software used. Respondents provided data on 20 databases in all.

Institutions identified which PhD, MD-PhD, and postdoctoral program fields were collected across six categories: program characteristics, faculty characteristics, incoming trainee populations, publications, career outcomes, and public information. Most databases collected program characteristics and incoming trainee population data, whereas other categories were less frequently tracked. Additional data acquired during interviews with seven of the institutions serve as the basis for the seven profiles in the study report. The profiles include information about data-collection systems, data use, tracking career outcomes, and data maintenance.

References:

Report available for download at: www.aamc.org/publications

Abstract 5

Title: Yale Ciencia Academy: Leveraging a Hispanic science network to enhance graduate biomedical training, career success and diversity

Authors: Giovanna Guerrero-Medina[1] and Mónica Feliú-Mójer[2]

[1]Yale Ciencia Initiative, Provost Office, Yale University, [2]iBiology, University of California, San Francisco, [3]Ciencia Puerto Rico

Abstract: Higher rates of attrition of women and minorities from scientific paths at the doctoral level are an ongoing concern. Several factors contribute to this drain of talent: (i) socio-cognitive stress (e.g. feelings of isolation); (ii) limited access to career advice networks, particularly during academic transitions; and (iii) tension between personal values and perceived culture & expectations of academic research. Studies show that minority-serving institutions and undergraduate programs that offset the sense of isolation can increase persistence in science. Applying these interventions at later training stages and at research-intensive institutions presents obvious challenges. Through the NIH-supported Yale Ciencia Academy, we have leveraged a large and dynamic Hispanic science network, the Ciencia Puerto Rico community, to enhance the training and retention of minority graduate students in science. Specifically, we: 1) create online learning communities that close the geographic gap between graduate students and role models, mentors, and peers from similar cultural backgrounds; 2) provide training that addresses common gaps and provides skills for professional development; and 3) enable trainees to contribute through their science to their community of origin. In its initial year, the Yale Ciencia Academy has recruited 60 scientific role models and 34 life and behavioral sciences graduate students from 21 universities in Puerto Rico and the U.S. We are examining the impact of the program with respect to (a) enhanced feelings of competency in science and positive expectations for a scientific career; (b) larger and more focused individual professional networks; (c) competency in important academic and professional skills; and (d) awareness of social value as scientists. Preliminary results will be presented with respect to baseline measures of students' perceived graduate school environment; career interests and expectations; experience with mentors and networks; professional development experiences and attitudes; and scientific and social identity.

Abstract 6

Title: Progressions of Skill Development in Biology Doctorates—Findings and Ongoing Analyses

Authors: David F. Feldon[1], James Peugh[2], Michelle A. Maher[3], Josipa Roksa[4], Soojeong Jeong[1]

[1]Department of Instructional Technology & Learning Sciences, Utah State University, [2]Department of Pediatrics, University of Cincinnati, [3]School of Education, University of Missouri—Kansas City, [4]Curry School of Education, University of Virginia

Abstract

Motivations: Highly-skilled research scientists are vital to both for economic growth and continued advances in medical science. Doctoral training is central to the preparation of this workforce. However, there is surprisingly little research that evaluates the development of research skills as a function of graduate education practices. Most scholarship in this area relies on self-assessments and/or scholarly productivity measures, which do not provide insight into developed abilities distinct from social networks and influences. We empirically examine skill development of a national sample of 336 Ph.D. matriculants in biological sciences programs across 53 U.S. institutions to assess: (a) the process of skill development, (b) potential variation in skill development across sociodemographic groups, (c) consequences of skill development for academic persistence and scholarly productivity, and (d) educational practices that maximize skill development and reduce racial/ethnic and gender inequality.

Approach: We use performance-based data (i.e., blind-rated annual writing samples), biweekly surveys of time spent on research, teaching, and writing activities, and annual surveys regarding training experiences, mentorship, and academic and career goals data to model the longitudinal relationship between skill development, doctoral program experiences, motivation, and outcomes over the course of doctoral programs.

Outcomes: Based on the first year of data collection, we found that female doctoral students spent significantly more time conducting supervised research than males and were more likely to attribute their time to the demands of their assigned tasks. Male doctorial students, nevertheless, were 15% more likely per 100 hours of supervised research time to receive authorship credit for journal articles, indicating gender inequality in the effort-to-credit ratio of scholarly productivity.

Lessons Learned: Our ongoing analyses will continue to unpack the interactions between different aspects of graduate education such as skill development, self-efficacy, and socialization experiences that lead to differential skill development, scholarly productivity, and subsequent career success.

Abstract 7

Title: The Broadening Experiences in Scientific Training (BEST) Program

Author: The BEST Consortium (presented by Roger Chalkley)

Office of Biomedical Research Education and Training, Vanderbilt University School of Medicine

Abstract: This program was established through the NIH Common Fund. This is a one-time award designed to allow schools to experiment with different ways to provide the environment for a wide range of strategies to support and if necessary, improve the career outcomes for newly minted PhDs and postdocs. There are 17 programs at institutions widely distributed across the country. The outcome of the range of new approaches reflects an almost frenetic outpouring of creative activity, which has been created in 1.5-2.5 years (there are two cohorts of grant recipients announced one year apart). On the one hand, all of the programs have created aspects of career development which reflect the most effective interventions at the home institution (some examples are shown in this poster), but in addition we see an identification and strengthening of activities which are in common at all of the participating schools, and which likely reflect the goals and aspirations of all institutions involved in graduate education. Some of the approaches developed by members of the consortium in common include: extensive career tracking of alumni, reporting of these outcomes to students being recruited, the development of intern/externship programs to broaden graduate students and postdocs exposure beyond the academy, and finally bringing faculty into the career decision and development process. This work is supported in part by NIH grant 3DP7OD018423-02S1.

Abstract 8

Title: Integrating career development and graduate training at Cornell University: A BEST example

Authors: Avery August[1], Chris Schaffer[2], John Parker[3], Susi Varvayanis[4]

Cornell BEST Program, Cornell University

It is increasingly being recognized that a small proportion of current biomedical graduate students and postdoctoral trainees will find careers as academic scientists. This has emphasized the need to provide trainees with the opportunities to understand the full spectrum of their career options. The Cornell BEST program was developed in response to this shift in the education landscape. Leveraging the integrated nature of Cornell graduate education, where graduate training occurs in a cross college and interdisciplinary nature, Cornell BEST has developed programs that integrate career development with graduate and postdoctoral training. The approach focused on three overarching themes: Faculty engagement to ensure that career development is viewed as a part of rigorous graduate training; Flexibility, with no requirements, as much or as little time as trainees have to devote, and allowances for trainees to suggest their own ideas for career exploration; and Experiential opportunities to apply what they learn, and customized to fit their need. This approach has led to the development of modules that expose trainees to Science Policy, Entrepreneurship and Science Communication. The effectiveness of the approaches was evaluated using trainee and faculty surveys, leading to changes in approach, the elimination of some options, and the reorienting of programming to leverage available resources, identify gaps, and coordinate with other units to fill perceived gaps. (Supported by NIH grant DP7 OD018425).

Abstract 9

Title: Preparing Future Professionals: A Career Development Course to Enhance Work Readiness

Authors: Nathan L. Vanderford

Department of Toxicology and Cancer Biology, Markey Cancer Center, and The Graduate School, University of Kentucky

Abstract: Over the last several years there has been a surge of unrest in the PhD community over the disconnect between the training PhDs receive and the realities of the PhD job market in which relatively few PhDs now become faculty members despite that career path being the focus of their training. Ultimately, PhD trainees want more diverse career preparation and a better connection to today's job market. The University of Kentucky has taken steps to address these issues through the creation of a career development course titled "Preparing Future Professionals" (PFP). The goals of the PFP course are for students to (i) understand the realities of the job market and the variety of career paths available, (ii) realize what skills are required to transition into a non-faculty career, (iii) identify resources that can be leveraged to obtain a job within a chosen career path and (iv) gain an appreciation for what can be done within one's academic training to best prepare for a successful non-faculty career. Over the course of a three year period, 47 students have matriculated through the course from a range of disciplines. The course offers several strengths over the more typical workshop style format for career development activities, and perhaps the most important of these strengths is sustained, active student engagement. Likewise, the course platform also creates unique challenges of which issues over whether students have "permission" to participate and who pays the course tuition are the top challenges. Ultimately, the format of this course is highly effective and could easily be implemented by other universities and expanded to reach a larger audience.

Abstract 10

Title: Student-Led Groups as a Model for Non-Academic Experiential Training

Author: John H. Russell

Division of Biology and Biomedical Sciences (DBBS), Washington University School of Medicine

Abstract: The 2012 Biomedical Workforce Report (1) presented the challenge of preparing Ph.D. students for non-academic careers without increasing time-to-degree (TTD). The most effective training for any career requires experiential training. DBBS in 2011 collaborated with the Washington University Skandalaris Center for Entrepreneurship to establish BALSA, a Biology and Life Sciences Advisory Group (2). Formation of the group as a non-profit was initiated by Ph.D. students and postdocs who had been participating in bioentrepreneurship workshops originally established by a grant from the Kauffman Foundation. The leadership of the group is students and postdocs with an advisory board from DBBS, the Skandalaris Center and local entrepreneurs. BALSA provides a consulting service to a broad spectrum of clients with teams of 5 students and postdocs completing individual projects in 6 weeks. Thus participation requires intense (10-15 hrs/week) for brief periods that can be accomplished with minimal long-term impact on progression towards degree.

More than 200 students and postdocs have been involved in more than 125 BALSA projects over the past 5 years, serving more than 80 companies. The group is financially self-sufficient and fees charged (varies with project scope) are returned to the group and used for additional training opportunities (e.g. workshops, speakers) and community service (including establishing a foundation to provide seed money to local start-ups and funding summer high school and college student research experiences).

There have been two important challenges to the success of the group: sustainability (financial and organizational); and faculty attitudes towards participation. The sustainability challenge has been largely solved by the group through their pricing and organizational structures. They have established clear succession plans to ensure experienced transitions in consulting teams and group leadership. Faculty attitudes are being addressed by collecting data on participant outcomes in productivity and career path.

References:

1) http://acd.od.nih.gov/biomedical_research_wgreport.pdf
2) http://thebalsagroup.org/

Abstract 11

Title: Empowering Bioscience PhD Students: An Integrated Academic, Professional and Personal Development Approach

Authors: Terrance R. Mayes[1], Latishya Steele[2]

Office of Graduate Education, Stanford University School of Medicine

Stanford's PhD training and academic foundation are very highly regarded, and the 21st century has been hailed as the "era of biomedical research" (1). Yet this vital enterprise is under strain, not only from economic factors but also from a "crisis of expectations" of our most valuable resource, our trainees. Traditionally, academia has been viewed as the desired career goal for PhD trainees, while other, 'alternative career' options, are considered less prestigious, and students entering other fields are often looked down upon for their choices (2). Our philosophy is that individuals do their best, providing the most meaningful, substantial contributions to society, when they are passionate, and supported with encouragement, training, and outlets for pursuit of their passion. To support this philosophy, we have aimed to reshape the definition of success in biosciences education through an integrated academic and professional development curriculum, known as the ADAPT model (Acclimation, Development, Awareness, Preparation, and Transition).

Abstract 12

Title: Use of a Grant Writing Class in Training PhD Students

Authors: Richard A. Kahn[1], Keith D. Wilkinson[2]

[1]Emory University School of Medicine, Department of Biochemistry, [2]Laney Graduate School

Abstract: A well-written application for funding in support of basic biological or biomedical research or individual training fellowship requires that the author perform several functions well. They must (1) identify an important topic, (2) provide a brief but persuasive introduction to highlight its significance, (3) identify one or two key questions that if answered would impact the field, (4) present a series of logical experiments and convince the reader that the approaches are feasible, doable within a certain period of time, and have the potential to answer the questions posed, and (5) include citations that demonstrate both scholarship and an appropriate command of the relevant literature and techniques involved in the proposed research study. In addition, preparation of any compelling application requires formal scientific writing and editing skills that are invaluable in any career. These are also all key components in a doctoral dissertation and encompass many of the skills that we expect graduate students to master. Almost 20 years ago we began a grant writing course as a mechanism to train students in these specific skills. Here, we describe the use of this course in training of our graduate students as well as our experiences and lessons learned. The skills acquired from the grant writing process (writing, logical argument construction, hypothesis design and testing) are useful in all later careers. Challenges include identifying instructors, optimal timing of the course, providing feedback to the student and grading. Critically, both students and their advisors must be clear on the differences between work that is performed and submitted for credit as part of a class and a graduate fellowship application that is submitted to an outside agency for funding consideration.

References:

1. Lovitts BE. The transition to independent research: Who makes it, who doesn't, and why. J High Educ 2008;79(3):296-325.

2. Jamieson S. Reading and Engaging Sources: What Students' Use of Sources Reveals About Advanced Reading Skills Across the Disciplines 2013;10(4).

3. Lovitts BE. Being a good course-taker is not enough: a theoretical perspective on the transition to independent research. Stud High Educ 2005;30(2):137-154.

4. Willingham DT. Critical Thinking. American Educator 2007:8-20.

Abstract 13

Title: A Concurrent PhD/MBA Degree Program Prepares Biomedical Science Graduate Students for Careers in Business and Finance

Authors: Ralph L. Keil[1], Jong Yun[2]

[1]Department of Biochemistry and Molecular Biology, and [2]Department of Pharmacology; Penn State College of Medicine

Abstract: Following PhD training in biomedical sciences, graduates frequently pursue careers in pharmaceutical or biotechnology companies, finance, venture capital, consulting, or entrepreneurship for which a MBA program can provide key business and managerial training. Our concurrent PhD/MBA degree program involves studies at separate but nearby Penn State campuses. After successfully completing biomedical sciences coursework and the doctoral qualifying examination at the College of Medicine, PhD students can petition their doctoral adviser for permission to apply to the MBA program at Penn State Harrisburg. Due to the rigorous admissions requirements for our PhD students and the previous success of students in the concurrent degree program, the admissions process to the MBA program has been streamlined including waiver of the requirement to take the GMAT exam. Most MBA classes are offered in the evening permitting uninterrupted time for doctoral research. Elective course credits for the MBA degree are fulfilled by course work credits from the already completed PhD courses. Approximately 10% of the PhD students in our integrated Biomedical Sciences Graduate Program pursue the concurrent degrees. In the more than 20-year history of the concurrent PhD/MBA program, the time to graduation is not increased for those receiving the concurrent degrees. Further, as judged by number of first-author publications, the concurrent degree program does not adversely affect productivity in doctoral research. Due to the success of this 'academic enrichment' experience, our program now offers additional opportunities including a dual-titled PhD degree in Biomedical Sciences and Clinical and Translational Sciences for students focused on careers in translational aspects of science, and an internship in the Office of Technology Development for students considering careers related to intellectual property or commercialization of products of research.

Abstract 14

Title: Innovations in Practical Computational and Data Science Training for Biomedical Science

Authors: Patricia Kovatch, Andrew Sharp, Luz Claudio

Icahn School of Medicine at Mount Sinai

Abstract: The speed of advancement in data-rich biomedical sciences is limited in part by the lack of awareness and expertise in big data sets and tools, the absence of approaches that productively intersect disparate domains, and the underrepresentation of diverse groups in the workforce. To derive knowledge from the mountains of data collected in the biomedical sciences, we need individuals who can interpret and analyze this data. To do this, students need to be skilled in the computational and data sciences as well as in the biomedical sciences. Through practical training, students can be taught to collaborate effectively and productively across domains. Because of the intense need for individuals with this cross-disciplinary understanding and proficiency, we have developed several programs to address this need: a local graduate class called *Introduction to Scientific Computing*, a national *Community Research Education and Engagement for Data Science* and a *Master of Science degree in Biomedical Informatics*. These programs offer a range of innovative activities for learning with an emphasis on building practical skills through hands on, team science activities.

Abstract 15

Title: The Translational Science Training Program at NIH: Introducing Early Career Researchers to the Science and Operation of Translation of Basic Research to Medical Interventions

Authors: C. Taylor Gilliland[1], G. Sitta Sittampalam[1], Philip Y. Wang[2], Philip E. Ryan[3]

[1]National Center for Advancing Translational Sciences, National Institutes of Health
[2]Office of Intramural Training and Education, National Institutes of Health

Abstract: Translational science is an emerging field that holds great promise to accelerate the development of novel medical interventions. As the field grows, so does the demand for highly trained biomedical scientists to fill the positions that are being created. Many graduate and postdoctorate training programs do not provide their trainees with sufficient education to take advantage of this growing employment sector. To help better prepare the trainees at the National Institutes of Health for possible careers in translation, we have created the Translational Science Training Program (TSTP). The TSTP is an intensive 2-3 day training program that introduces NIH postdoctoral trainees and graduate students to the science and operation of turning basic research discoveries into a medical therapeutic, device or diagnostic, and also exposes them to the variety of career options in translational science. Through a combination of classroom teaching from practicing experts in the various disciplines of translation and small group interactions with pre-clinical development teams, participants in the TSTP gain knowledge that will aid them in obtaining a career in translational science and building a network to make the transition to the field.

Abstract 16

Title: Engineering Innovative Training in Applied Biology: the Harvard Graduate Program in Therapeutics

Authors: Catherine I. Dubreuil[1], Timothy Mitchison[2], and David E. Golan[3]

[1]Harvard Medical School, Director of Training and Education, the Harvard Program in Therapeutic Science; Lecturer in BCMP, [2]Harvard Medical School, Professor of Systems Biology, [3]Harvard Medical School, Dean for Basic Science and Graduate Education and Professor in BCMP and Medicine

Abstract: The Therapeutics Graduate Program (TGP) at Harvard University is supported by an NIGMS T32 training grant in Pharmacological Sciences. The mission of the TGP is to offer rigorous, multidisciplinary training in the sciences relevant to identifying and developing novel therapeutics and applying them in preclinical and clinical studies to improve the treatment of disease. One major aim of the TGP is to link graduate training to industrial, clinical, and regulatory activities by providing students with hands-on, real-world experiences in the form of a required internship in a non-academic setting, and to network individual students with peers and mentors (both academic and industrial) who share their commitment to therapeutic science. The first cohort of students completed their internships in 2015, and 100% of the students reported it to be one of the most valuable experiences they had had in graduate school to date. A second major aim of the TGP is to provide students with the intellectual tool kit and practical skills necessary for research in therapeutic science, including experimental design and quantitative and computational skills. The TGP core courses emphasize quantitative and computational approaches to research design, which are increasingly important in drug discovery and therapeutic development. In summary, the TGP is an innovative training program that leverages the expertise of HMS faculty members and their industry colleagues to prepare students with the knowledge and skills to be productive researchers in therapeutic discovery and development throughout the workforce.

Abstract 17

Title: Mentored Teaching Experience in Health Professional Courses

Authors: Lisa M. Kozlowski[1], Kristy Shuda McGuire[2]

[1]Thomas Jefferson University, Jefferson College of Biomedical Sciences, Office of Postdoctoral Affairs, [2]Community College of Philadelphia, Biology Department and Faculty Center for Teaching & Learning

Abstract: A novel, semester-long program where postdoctoral fellows and Ph.D. students from an academic health center are paired with faculty at a community college teaching undergraduate courses for students entering nursing and other health professions has been developed. At Thomas Jefferson University (TJU) there are not many teaching opportunities for biomedical trainees, however, many of these trainees are interested in pursuing careers that involve teaching to some extent. The Community College of Philadelphia (CCP) is an ideal place for trainees to gain teaching experience and learn about evidence-based practices from faculty mentors whose primary responsibility is teaching. Selected trainees from TJU were paired with a CCP faculty member teaching a health professional course that included the trainee's broad area of research. The trainees observed all classes and labs and met with their CCP mentor weekly to discuss student learning outcomes, instructional methodologies, and assessment strategies. Their experience included the preparation and teaching of one class and laboratory exercise where they were encouraged to incorporate their current research topic and techniques. They also participated in a two-hour, bi-weekly pedagogical journal club. Although the time obligation during the semester was significant, limiting the program to one semester made it more feasible for trainees to incorporate this teaching experience during their research training. In addition, trainees have now created components of a teaching portfolio which should add to their success in obtaining future teaching positions. This program was made possible by a Career Guidance for Trainees grant from the Burroughs Wellcome Fund.

Abstract 18

Title: Advancing Graduate Education in the Natural Sciences with a Modularized Curriculum

Author: Michael T. Ashby

Stephenson Life Sciences Research Center, Department of Chemistry and Biochemistry, University of Oklahoma

Abstract: Embodying over a decade of development that was initiated during the University of Oklahoma's involvement in the Carnegie Initiative on the Doctorate (CID) [1], we have launched an entirely new curriculum that comprises modules (750 minutes of instruction) that are not constrained by conventional scheduling. The curriculum targets the first, key conclusion of a recent American Chemical Society report [2], that the current educational opportunities for graduate students do not provide sufficient preparation for their careers after graduate school. In essence, the recommendation is that doctoral programs in the chemical sciences should maintain traditional depth and a focus on mastery, while adding opportunities to develop professional skills, and while decreasing the time to degree (TTD) from the current six-seven years to four. Thus, a classic tension exists where more (content) is to be delivered with less (time). Two tenets comprise the design of the curriculum: 1) an emphasis is placed on providing students with the skill set necessary to transition from undergraduate-like recipient learning to original thinking and 2) time is treated as a commodity. We have implemented an efficient modular scaffolding of graduate student training and a "first year experience" that is grounded upon greater oversight and Individual Development Plans (IDPs) that navigate the aforementioned tension while affording the flexibility necessary to address the individual professional goals of each student [3].

Table 1. Milestones for student progress resulting from the Curriculum and Features.

- Fully integrated into a research laboratory by the end of the first semester.*
- Complete core disciplinary instruction by end of second semester.*
- Complete all coursework and the Preliminary Examination by the end of the third semester.
- Complete General Examination and Ph.D. Candidate in fourth semester (before second summer).
- Final defense before the end of fifth year from B.Sc. (four year eventual target).**

* Previously as long as two years. ** Previously six-seven years.

References:

1) The Formation of Scholars: Rethinking Doctoral Education for the Twenty-First Century, G. Walker, C. M. Golde, L. Jones, A. Conklin Bueschel, P. Hutchings. San Francisco: Jossey-Bass, 2008.

2) Advancing Graduate Education in the Chemical Sciences, American Chemical Society, 2012.

3) Details concerning the curriculum are available at http://ChemGradEd.com.

Abstract 19

Title: Five Years Under the Umbrella: Integration and Evolution of the Biomedical Sciences (BIMS) Graduate Program at the University of Virginia

Authors: Janet V. Cross[1], Amy H. Bouton[2]

Biomedical Sciences Graduate Program, University of Virginia School of Medicine

Abstract: During the period from 2011 to 2016, the Biomedical Sciences (BIMS) graduate program at the University of Virginia has undergone significant modifications in three significant areas: admissions, curriculum and program structure. This was motivated by the unifying desire of our faculty, administrators and students to improve the educational experience and outcomes for our graduate students. The first and, in many ways, most challenging change was the reorganization of BIMS into a true umbrella program. Currently, nine degree-granting programs reside under this umbrella. The coordinated process through which we now recruit our matriculating class was designed to support standardization across all disciplines, thereby improving the overall quality of each incoming class. Simultaneously, we devised a single immersive core course to provide all students with the fundamental knowledge and tools essential for success as a researcher. In addition, discipline-specific courses were reorganized into six week modules that allow students to both explore a wider breadth of topics while also digging deeper where necessary. Finally, in response to feedback from faculty and students alike, we restructured the first year program to temporally separate lab rotations from coursework obligations. This restructuring allows most of our students to select their thesis advisor and degree-granting program and begin their research projects in early February, after which each student's curriculum can be personalized to best meet their needs and goals.

To date, we have achieved reduced variability in score-based metrics of admitted students across disciplines under the coordinated admissions umbrella. We have developed a robust system for evaluation that is supporting iterative improvements in both the core and modular coursework. Overall assessment of the success of our initiatives is ongoing, through a process that includes input from students and faculty, as well as data driven efforts.

Abstract 20

Title: The Harvard Medical School Curriculum Fellows Program: an Education Lab as Catalyst for Innovation in Graduate Training

Authors: Johanna L Gutlerner[1], Ronald Jason Heustis[2], Yan Liu[3], David Van Vactor[4], David E. Golan[5]

[1] Harvard Medical School, Co-Director of the Curriculum Fellows Program and Lecturer in BCMP, [2]Harvard Medical School, Curriculum Fellow and Lecturer in BCMP, [3]Harvard Medical School, Curriculum Fellow and Lecturer in Cell Biology, [4]Harvard Medical School, Co-Director of the Curriculum Fellows Program and Professor in Cell Biology, [5]Harvard Medical School, Dean for Basic Science and Graduate Education and Professor in BCMP and Medicine

Abstract: Developing educational activities that support robust graduate training programs requires a significant investment of faculty time. However, many faculty members do not have adequate time to dedicate to researching the most innovative, evidence-based strategies for teaching and curriculum development to incorporate into their programs' curricular and paracurricular offerings. To catalyze innovation within the graduate courses and training programs at Harvard Medical School, departments and graduate programs have hired PhD scientists, with a strong interest in pursuing careers in higher education, as postdoctoral Curriculum Fellows (CFs). These CFs work with faculty members to bring new, evidence-based strategies to their graduate classrooms and programming. In a survey of faculty members who have worked with CFs, 90% report that CFs are effective or highly effective in all aspects of course management, curriculum development, and innovation. The HMS Curriculum Fellows Program (CFP) was built to provide a community of colleagues, individualized mentorship, and training opportunities to support CFs in their work. Having a community of scholars dedicated to innovation in curriculum and pedagogy has led to several emergent benefits for the HMS community. The CFP has mounted three STEM education courses on the HMS campus, where there had previously been no similar offerings. The program also offers a monthly seminar series on topics relevant to the academic scientist, and a biannual invited speaker series. CFs are supported to spend 20% of their time on their own scholarly and teaching pursuits and they have increasingly engaged in scholarship of teaching and learning, with 17% of CFs having received independent educational research fellowships. The eighteen CFs who have *graduated* from the CFP have gone on to positions as faculty at teaching-focused undergraduate colleges, STEM program management and higher education administration, or positions in online learning. Thus what began as independent postdoctoral hires to catalyze innovation in graduate training, has developed into an educational laboratory and postdoctoral training program in STEM higher education.

References:

https://curriculumfellows.hms.harvard.edu/

Gutlerner JL, Van Vactor D (2013) Catalyzing curriculum evolution in graduate science education *Cell*. **9**;153(4):731-6.

Abstract 21

Title: Cell and Developmental Biology Training at Harvard Medical School

Authors: David Van Vactor[1], Christopher Wood[2], Theodore Feldman[3], Jason Heustis[4], Wade Harper[5]

[1] Co-Director of Cell & Developmental Biology and Professor of Cell Biology, [2]Curriculum Fellow in Cell Biology, [3]Curriculum Fellow in Developmental and Regenerative Biology, [4]Curriculum Fellow in Biological Chemistry and Molecular Pharmacology, [5]PI of the NIGMS T32 in Cell & Developmental Biology and Chairman, Department of Cell Biology, Harvard Medical School, Boston MA 02115.

Abstract: The Cell and Developmental Biology (CDB) program at Harvard Medical School (HMS) aims to propel innovation in education and integrative training. We want our students to acquire the core competency and transferrable skills necessary to make a transformative impact in a rapidly evolving field. Our strategy is to provide rigorous educational resources and multiple levels of support for career development in research. CDB has introduced new course formats to facilitate skill development, from our hands-on 'bootcamp' courses that showcase a wide range of tools and technologies, to our specialized nanocourses engineered to supply inspiration for advanced students throughout their training. Our most recent ongoing innovation in curriculum uses the nanocourse platform to build a series of emerging methodology courses based on 'reversed' experimental design, where investigators learn to anticipate the challenges of unambiguous interpretations and incorporate quantitative analysis and limitations to build robust hypothesis testing. In this new series, we will embed formative mathematical and computational skills into coursework to provide students with an understanding of how to the demands of rigorous data analysis of large datasets and the inherent physical principles behind such technologies must be accounted for in the initial design of experiments to meet reproducibility challenges. In parallel, we also foster creativity and innovation in experimental design through incentives and personalized training through our new Innovation Grant Program (IGP) that offers competitive internal funding of student-conceived projects involving direct collaboration between two or more labs in order to bring transformative technologies or analytical approaches to important cutting edge problems. IGP gives students mentored critique in project design and grant presentation, as a means to prepare them for a competitive funding landscape. Finally, CDB also sponsors career networking opportunities to encourage our student to consider how to best apply their developing expertise and talents within the career marketplace.

Abstract 22

Title: Cognitive, Computational, and Systems Neuroscience: Training Interdisciplinary and Independent Brain Scientists

Authors: Kurt A. Thoroughman

Department of Biomedical Engineering, Washington University in St. Louis

Abstract: We have built, grown, and sustained an innovative program in brain science spanning engineering, biology, and psychology. Our Cognitive, Computational, and Systems Neuroscience (CCSN) Pathway recruits doctoral students from three PhD programs, spanning traditional fields, separate schools, and two campuses. Preliminary work prepares CCSN students for two integrative courses. Advanced CCSN is a case-study examination into multiple approaches toward investigation of higher brain function. Project Building guides students through crafting their own interdisciplinary projects, using the formalisms (including peer review) of NRSA proposals. Students mature into research that crosses between their home lab and the broader university neuroscience community. These connections arise from the student's own interests and energies, and have spawned new collaborations across labs and across fields.

Students complement their research through engagement and leadership in communities, including a journal club and a student-led seminar series; outreach at the Saint Louis Science Center developed, led, authored, and presented by students; and a series of professional, scientific, and networking events.

We will present our program and our development over our first 12 years, including critical funding from NSF and (currently) from NIH and internal sources. We will also provide insights into our balance between traditional laboratory training and broader opportunities. We will also detail our collaboration with the Washington University Division of Biology & Biomedical Sciences (DBBS), our consortium of biological training programs. DBBS provides students and professors key central resources that strengthen our integrative educational mission, broaden internal and external engagement, and diversify our capabilities and opportunities.

Abstract 23

Title: Enhanced Preparation of Undergraduates For Success in Graduate Training and Career Selection Through the Creation of Undergraduate Biomedical Majors

Authors: Louis B. Justement[1], Daniel C. Bullard[2], Scott Wilson[3]

[1]Department of Microbiology, [2] Department of Genetics, [3] Department of Neurobiology, University of Alabama at Birmingham

Abstract: Graduate students face increasing pressure to make intelligent decisions regarding their future career choice due to the high degree of competition that currently exists with respect to research-intensive positions in academia, government and industry. Thus, it is critical for trainees to be exposed to the realities associated with the pursuit of research-intensive careers in order to make informed decisions about their future as early as possible. An approach that has recently been developed at UAB is the creation of research-intensive, undergraduate majors in areas of biomedical specialization, including neuroscience, immunology, cancer biology and genetics/genomics. The objectives of these undergraduate programs are to: 1) provide enhanced training in specific disciplines of biology to better prepare undergraduates for the academic rigors of graduate school; 2) to provide in-depth research experiences to enhance critical thinking skills, problem solving and analytical capabilities; and 3) to teach transferrable skills, including communication, professionalism, ethics, responsible conduct of research and leadership. Undergraduate programs that better prepare individuals to enter into PhD programs will ideally increase their interest in such programs, while at the same time making them aware of the broad range of career options available to them once they obtain their graduate degree. The goal is to increase the likelihood that undergraduates will undertake the critical career decision process earlier so that those who are interested in pursuing research-intensive careers are highly competitive for admission into graduate school and to pursue future postdoctoral training, whereas those who do not pursue research-intensive careers will obtain critical skills and knowledge at an earlier stage that prepares them for science-related careers. This concept fulfills recent positions put forth by the National Academies[1] reaffirming that the postdoctoral fellowship is a period in which individuals receive training in advanced research skills. Others who forgo postdoctoral training will be better prepared to enter into science-related careers earlier, benefiting both economically and personally.

References:

1. The Postdoctoral Experience Revisited, Committee to Review the State of Postdoctoral Experience in Scientists and Engineers; Committee on Science, Engineering, and Public Policy; Policy and Global Affairs; National Academy of Sciences; National Academy of Engineering; Institute of Medicine, 2014, ISBN 978-0-309-31446-6

Abstract 24

Title: An integrated and multidisciplinary training program in biotechnology: Preparing for careers at the interface of biology, chemistry and engineering

Authors: Deepak Vashishth

Department of Biomedical Engineering, Center for Biotechnology and Interdisciplinary Studies, Rensselaer Polytechnic Institute

Abstract: Fully exploring linkages between biology and engineering and identifying new opportunities requires the bridging of disciplines in specific target areas that are central to biotechnology. One such area is biomolecular science and engineering, where engineering principles are used to understand, design, manipulate, and apply biological macromolecules in a range of contexts. Biomolecular science and engineering needs to accommodate the increased interactions of engineers and life scientists in order to spur growth in areas including but not limited to synthetic biology, stem cell biotechnology, data-driven therapeutics discovery, among others.

To address the above need, the Biomolecular Science and Engineering Training Program at Rensselaer is dedicated to the education of a broad cadre of predoctoral students spanning the life sciences and engineering. The program's mission is to provide an integrated and multidisciplinary platform to train predoctoral students broadly at the interface of biology and engineering, focusing on the quantitative linkages that define this interface and preparing trainees for careers in biotechnology. In particular we have defined a broad boundary for biomolecular science and engineering, which includes biomolecular tools and enabling disciplines, such as **synthetic biology** (represented by biocatalysis, pathway integration and construction, glycomics, bioseparations, and biomaterials design, synthesis, and properties); **biomolecular systems** (e.g., structure, function, and analysis); and **molecular biology and bioinformatics**. In this manner, biomolecular science and engineering becomes a central focus of a broad component of biotechnology; namely, that which operates at the subcellular level, yet with applications over a wide range of length, volume, and time scales.

Key outcomes of the program include a well-balanced **interdisciplinary predoctoral training program in biotechnology that also includes course work and training in** data science/analytics, technological entrepreneurship and a strong public-private partnership based on strong relationship with industry and healthcare providers. More importantly, graduate of our program have gone on with equal degree of success in both academic (47%) and non-academic (53%) careers in broad areas within biomolecular science and engineering including pharmaceuticals, environmental engineering, Semiconductors research and/or created new industries (http://biotech.rpi.edu/students/nih-training-program/career-outcomes).

Abstract 25

Title: Recent Innovations at Johns Hopkins University School of Medicine

Authors: Kimberly Duncan[1], Arhonda Gogos[2], Caroline Pounds[3], Peter Espenshade[4]

Center for Innovation in Graduate Biomedical Education, Johns Hopkins University School of Medicine, Baltimore, MD

Abstract:

Background: The Johns Hopkins University School of Medicine created the Center for Innovation in Graduate Biomedical Education (CIGBE) to address challenges in graduate education through experimentation. By design, CIGBE serves as a laboratory for generating, developing and disseminating new strategies for graduate biomedical education. Biomedical PhDs increasingly pursue non-academic careers in response to changes in the research workforce that have occurred in the past twenty years. While in the past, most new PhDs worked toward careers in academia, many now enter biotechnology, finance, law public policy, politics, communications, information technology and education.

Approach: To address the educational needs of this group, CIGBE developed the Biomedical Careers Initiative (JHU-BCI, http://bci.jhmi.edu), a program to equip students in the biomedical sciences with the information, training and opportunities for a broadened array of professional careers. CIGBE also recently launched the Johns Hopkins University – MedImmune Scholars Program, a unique training opportunity in which students will gain research experience in an industry environment through thesis projects conducted jointly in Johns Hopkins and MedImmune labs.

Outcomes:

1. JHU-BCI has quickly demonstrated its effectiveness in supporting graduate students. Twenty-four students were selected for internships at commercial and research organizations. One hundred percent of these interns indicated that they would recommend their internship to other students, and 84% of organizations rated their intern's performance as "excellent" or "very good". Four of the interns have since graduated and found jobs related to their internship and within their desired field, and all four have credited their internship experience with their success

2. During the first two years of the program, 600 participants attended at least one of the JHU-BCI sponsored presentations on diverse career options within the biomedical field. The participants were students and research fellows from 30 graduate programs and six JHU schools. Of students surveyed, 84% said that they were satisfied or very satisfied with the event they attended.

3. Several new courses have been developed as part of this initiative. Preparation for internships was supported by a hybrid course, "How to Be an Intern: Prepping for Life Outside Academia," that was developed with support from a grant from the Burroughs Wellcome Fund. Anecdotal feedback suggests that the students derived benefit from the course material and partner sites are excited about the additional training provided to applicants. More data will be available when evaluation of the course is complete.

4. JHU – BCI launched a website launched in April 2014 that helped graduate students explore

different career paths outside of academia. The website provided information regarding internship and fellowship opportunities, relevant coursework, upcoming events, and networking tips. Over the course of its first year (4/30/14 – 4/8/15), the website had 1,829 visitors, with 3,134 sessions and 8,975 page views.

5. A collaboration with MedImmune has been established and will admit its first group of students in Spring 2017. The Hopkins-MedImmune Scholars program will train Ph.D. candidates in Hopkins' School of Medicine and Whiting School of Engineering for work in the biopharmaceutical industry. In addition to strengthening the skill sets of Hopkins graduate students, the program will serve as a model for future collaborations between industry and the University.

Lessons learned:

- Many JHU graduate students are enthusiastic about the opportunities created by these recent efforts.

- While many faculty embrace these changes, some are less enthusiastic.

- Partnerships between academia and industry can benefit for all involved including students, faculty, industry and universities.

- This partnership was bolstered by coursework designed to help graduate students develop skills to function in settings outside of academia.

- Strong support from University and program leadership has been invaluable to the creation of CIGBE.

Abstract 26

Title: Complement and Collaborate: A Boots on the Ground Revision of Graduate Education

Authors: Lillian Zwemer[1], and Christopher V. Nicchitta[2]

[1] Office of Biomedical Graduate Education, Duke University School of Medicine, [2] Departments of Cell Biology and Biochemistry, Duke University School of Medicine

Abstract: Duke University School of Medicine is home to 18 individual PhD programs, each have their own unique identities, cultures, administrative policies, core curricula, programmatic offerings, and timelines to graduation. With the landscape of biomedical PhD employment outcomes changing – dramatically - there is a pressing need to revise our biomedical graduate curriculum, unify programming, address clear problems in trainee emotional/mental health, and establish an institutional focus on professional development. To this end, we have created an Office of Biomedical Graduate Education, led by PhD-level scientists, to simultaneously support administrative needs, establish best practices in biomedical graduate education and serve in trainee professional development. We are focusing on **sustainable programs** that can have significant, positive impacts on our biomedical PhD trainees. Our approach to professional development is vertical integration in a stage-appropriate manner, throughout the life-cycle of graduate school. Here, we are collaborating with graduate school career services to develop novel content in soft skills and to establish suggested time-lines for professional development throughout the course of graduate school. We are also collaborating with alumni services to create searchable databases of biomedical graduates who can offer advice, networking, and informational interviews about a diversity of biomedical careers. In addition, we are partnering with University teaching support offices to establish best practices in education and to experiment with curriculum redesign. Through collaborations with clinical colleagues, we are conducting an IRB-level study of mental health barriers to our students' academic success and productivity. A primary feature of our program is the development of mobile app-based assessment tools that will allow us to track the progression of all biomedical PhD trainees to measure the efficacy of our training and career diversification interventions. These data will empower us to make evidence-based revisions to existing programs and will inspire future programmatic developments.

Abstract 27

Title: Creating the PhD of the future at Oregon Health & Science University

Authors: Robert Duvoisin[1], Steven Bedrick[2], Allison Fryer[3]

[1] Department of Physiology and Pharmacology, Oregon Health & Science University, [2] Center for Spoken Language Understanding, Oregon Health & Science University, [3] Division of Pulmonary and Critical Care Medicine, Oregon Health & Science University

Abstract: Scientific research is undergoing dramatic changes at many levels. New, powerful techniques allow the study of limitless questions, some generating large datasets. Collaborative and interdisciplinary teams are working together. In contrast, research funding is restricted leading to discussions about whether we are producing too many PhD-trained scientists and what will be their careers. Two years ago, the Associate Dean for Graduate Studies and the Graduate Program Steering Committee started to discuss changes to our Graduate Programs that would increase educational flexibility and give students additional educational opportunities. These discussions were met with strong opposition by the Graduate Council and Graduate Faculty.

To provide the faculty with a voice and stake in the process, a new committee was formed in January 2016. It brings together junior and senior faculty, graduate students, a postdoc and alumni, from across graduate programs in the School of Medicine. Its goal is to envision the future of doctoral education at OHSU. Committee members are not representatives of their units, but were chosen to reflect different perspectives. Open houses and individual meetings with faculty and other stakeholders are ongoing to include a broad participation in the design of our future graduate education, including its curriculum and its structure.

The first open house sought input as to why changes in OHSU's graduate programs are needed. These include anticipating changes in science, scientific careers, funding, and competition with other schools. Strengths and opportunities were identified. While some resistance to change remains, most faculty and students now realize that a fundamental transformation of our graduate education is needed.

Abstract 28

Title: Engaging Faculty in Modernizing Graduate Biomedical Education

Authors: Mary Ellen Lane[1], Anthony Carruthers[2]

[1]Graduate School of Biomedical Sciences, Basic Biomedical Sciences Divisions, [2]Department of Neurobiology, [3]Department of Biochemistry and Molecular Pharmacology, University of Massachusetts Medical School

Abstract: The umbrella biomedical graduate program is the dominant organizational model for large multi-departmental medical centers that train doctoral students. The benefits of such organization include economies of scale and administrative efficiency, the potential to coordinate curricula and standards, a robust, transparent system of faculty governance, recruitment of intellectually diverse trainees who may not yet have committed to particular disciplines, and enhanced potential for collaborative research. However, the tension between the decentralized history and the current administrative centralization present numerous challenges. For example, deference to departmental/program autonomy may result in lack of coordination of the curriculum and in non-transparent practices that promote uneven standards, or the appearance thereof. Conversely, investment in centralized resource with the intent to preserve faculty time for research, and in particular the employment of professional administrators who devote full time to managing recruitment, and academic and student affairs, may result in faculty disengagement and mistrust between faculty and administrators. We sought to address these challenges by engaging faculty from across the institution in a) building governance structures that promote transparency across departments and domains, b) creating and instituting best practices for the assessment of student development and progress, and c) coordinating and innovating the graduate biomedical curriculum to drive the training of scientists with a broad intellectual foundation who excel at problem-solving outside of disciplinary silos. Here we present outcomes of these initiatives, along with continuing challenges and ongoing efforts. We discuss the many opportunities for faculty and administrator education and career development that this project has provided.

Abstract 29

Title: Implementing and tracking innovations in graduate education

Authors: Charles F Delwiche[1], Michelle M. Brooks[2]

[1]University of Maryland, Department of Cell Biology and Molecular Genetics, [2]University of Maryland, Biological Sciences Graduate Program

Abstract: In 2010 the University of Maryland created an umbrella graduate program in the Biological Sciences, typically referred to by its catalog code, "BISI". The BISI program replaced a disjointed set of departmental and interdepartmental programs that had both duplications and lacunae in academic coverage, and yet imposed peculiar, and sometimes arbitrary constraints on training and collaboration. There are three core departments in BISI: the Department of Biology; the Department of Cell Biology and Molecular Genetics (CBMG); and the Department of Entomology (ENTM). Of these, only Entomology retains a Departmental program. BISI also serves students in several other colleges at the University of Maryland, as well as at regional institutions including NIH, the Smithsonian Institution, and the J. Craig Venter Institute. There are currently approximately 150 Ph.D. students in BISI. It is divided into four Areas of Concentration (CAs) that emphasize training and curriculum: Behavior, Ecology, Evolution and Systematics (BEES); Computational Biology, Bioinformatics, and Genomics (CBBG); Molecular and Cell Biology (MOCB); and Physiological Systems (PHYS). Cutting across all of these CAs are a number of Research Clusters that bring together students and faculty working in related areas of interest, but often using disparate methods (e.g., host-pathogen interactions, which includes research spanning all of the CAs, sometimes in a single lab). In order to track student progress, as well as to facilitate reporting and grant proposal preparation, BISI established an integrated information tracking system using a combination of public domain, free, and commercial software. At the core of this system, and consistent with our philosophy that Ph.D. students are colleagues in training, is an annual Graduate Student Activity Report which is designed to mirror the U. Maryland faculty activity report. Data collected from this report system are combined with faculty assessments and additional sources of information to build a program database.

References:

http://www.bisi.umd.edu

Abstract 30

Title: Strength in Numbers: A Collaborative Approach to Graduate Student Career and Professional Development

Authors: Alissa Ewer[1], Eileen Callahan[2], Amy Fruchtman[3]

University of Wisconsin-Madison, Graduate School, Office of Professional Development and Communications

Abstract: Graduate student career outcomes are top-of-mind for many faculty and staff at the University of Wisconsin-Madison. Toward that end, professional development activities abound across campus, covering topics like communication skills, grant writing, job search strategies, software training, Individual Development Plans, and more.

Along with this wealth of opportunity comes the challenge at a large, decentralized university to develop a unified presence around professional development for graduate students: i.e. reducing redundancy; organizing and sequencing related topics; distinguishing these events from those intended for undergraduates; and centralizing advertising.

To address this challenge, the UW-Madison Graduate School coordinated a campus-wide working group. Members share information with each other via a Google site during their planning stages so that related events across campus organizations are sequenced, collaborations formed, and topic redundancy monitored and reduced.

The Graduate School was the natural entity to play this organizing role. Its website has a professional development calendar that includes all events on campus designed for graduate student audiences. Working group members enter their events in a single central calendar, and these are displayed on the Graduate School website, categorized by topic, and promoted in the graduate student newsletter, *GradConnections Weekly*, disseminated to over 9,000 graduate students.

Now, each year, 200+ workshops, panel presentations, symposia, and other professional development opportunities for graduate students at UW-Madison are developed and promoted in a more streamlined and effective way.

References:

www.grad.wisc.edu/pd/events

Abstract 31

Title: Development of a Student Pipeline to Graduate School

Authors: James B Turpen

Offices of Academic Affairs and Graduate Studies, University of Nebraska Medical Center, Omaha Nebraska

Abstract: The motivation for this project was the development of the research capacity in the State of Nebraska, including the development of a pipeline of undergraduate students for the PhD programs at the State's Research Universities. One component of the Nebraska INBRE Project funded by NIGMS (2P20GM103427) was to establish an INBRE Scholars Program at nine Primarily Undergraduate Institutions (PUIs) in Nebraska. INBRE Scholars are recruited during their sophomore year and are committed to participating in undergraduate research for a period of two years. Their first summer is spent studying and doing research in a research laboratory at one of our Research Universities. Subsequently they return to their home campuses and are involved in INBRE supported research during their academic years and second summer in the program. Significant financial support is provided each Scholar throughout the program and support for their first year in graduate school is also provided. The goal is to provide students with the opportunity to determine if a research career is of interest to them. Scholars are required to make a minimum of 4 presentations at scientific conferences and many of our Scholars are co-authors on scientific publications when they graduate from College. As of 2015, 315 students have entered the program, 218 have successfully completed the program and 37% of those Scholars have entered PhD programs at research universities throughout the United States. Only one Scholar whose goal was to attend graduate school was not admitted to a program and most Scholars had between 3-5 offers of admission and support. The key to our success is our development of personal interactions and relationships between faculty and prospective students throughout their tenure as Scholars.

References: http//unmc.edu/inbre