

# Improving Professional Development at the Graduate Level of the Natural Sciences

Brandy Todd, University of Oregon

## Introduction & Goal

The PhD is a research degree. Doctoral training in the natural sciences is designed to teach students how to construct and execute experiments, and how to gather the data from those experiments. However, PhD students are also the pool from which society draws its future teachers and administrators. Amazingly, little to no training in teaching pedagogy takes place in most graduate programs in the sciences (Gold and Dore, 2004).

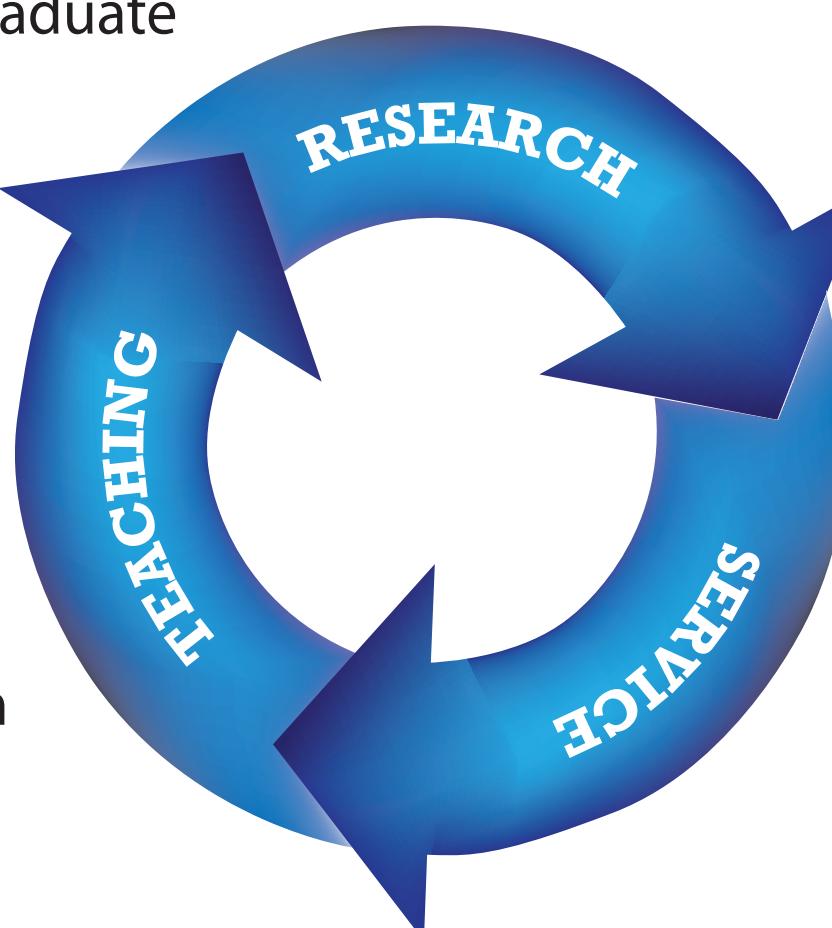
Professional careers in science require not only an understanding of research but also skills in teaching, administration and community service. University faculty (the gold standard for PhD careers) spend on average 59% of their time teaching and 23% on administration and service. Only 18% of faculty time is spent on research (Gold, 2004). Careers in industry also require these skills (Smith, 2002).

Increasingly employers and students are demanding a more rounded graduate education in the sciences (NAGPS, 2001; McAlpine, 2006). Careers in science require the ability not only to conduct high quality research, but also to teach an increasingly diverse undergraduate population, to communicate research to a broad audience, and to function in a complex

administrative environment (Handelsman, 2004; Gonzalez, 2001).

At the same time, institutional funds are growing scarcer and funding rates from external sponsors of research are going down. Increasingly, young faculty and staff scientists are required to pursue research funding even before they start their new positions. Few graduate programs prepare students for all the duties they will assume as independent researchers.

The goal of this project is to develop a program for improving professional development for doctoral students in the natural sciences so that University of Oregon graduates are better prepared for research careers and are more competitive in the job market.



## Options for Intervention

A review of the literature yields three productive possibilities for improving professional development which correspond to the three primary roles professional scientists fill: providing students with a chance to take on faculty roles through service in committees and teams, providing

students with meaningful, progressively responsible teaching experience, and providing experiential training in research proposal development. None of these options is part of standard graduate training in the sciences. Each of these options is summarized and reviewed below.

### Taking on Faculty Roles

Programs like the Preparing Future Faculty (PFF) project have provided graduate students with the opportunity to serve on faculty committees and act as advisors to undergraduate students. PFF scholars (graduate students in the humanities who had achieved candidacy but were not yet writing dissertations) were assigned a faculty mentor who helped introduce them to the world of academic service (DeNeef, 2002).

Benefits	Challenges
<ul style="list-style-type: none"><li>• Learning how to set boundaries</li><li>• Learning to protect time</li><li>• Deeper understanding of the internal workings of an academic department</li></ul>	<ul style="list-style-type: none"><li>• Confidential information</li><li>• Existing graduate reps on committees</li><li>• Faculty belief that students should focus on research</li></ul>

### Meaningful Teaching Experience

Almost all students in STEM disciplines are guaranteed teaching appointments for their first 1-2 years until they settle in a research group. The quality of this teaching experience varies wildly from relatively simple work grading homework and tests to co-teaching and developing novel classes and labs.

Research shows that teaching is only valuable in graduate education if it is meaningful and includes a progressive increase in responsibility (AAU, 1998).

Benefits	Challenges
<ul style="list-style-type: none"><li>• Teaching rekindles enthusiasm for science</li><li>• Improved teaching skills</li></ul>	<ul style="list-style-type: none"><li>• Limited number of teaching spots</li><li>• Conflict with research appointment</li><li>• Getting progressively responsible teaching jobs.</li></ul>

### Writing Research Proposals

Though doctoral students in the sciences spend the bulk of their graduate careers on research projects they do not receive instruction in writing research proposals, nor do they often have the opportunity to develop independent research ideas.

Benefits	Challenges
<ul style="list-style-type: none"><li>• Learn to develop a research idea</li><li>• Practice communicating ideas to broader audience</li><li>• Gain familiarity with sponsors, submission and review of grants</li></ul>	<ul style="list-style-type: none"><li>• Finding instructors</li><li>• Providing support for proposal submission</li><li>• Time constraints on student schedules</li></ul>

## Strategy and Implementation

This project proposes to develop a graduate level course in proposal development for students in the natural sciences.

Research proposal development provides a number of benefits to students and their departments and is less complicated/controversial than service and teaching options. If timed correctly, training in proposal can be put to use by encouraging students to apply for paid research fellowships during their first 18 months of study. Research fellowships make students self-supporting, which means they have more prestige and have more options in which research groups to work with. They benefit departments by reducing the amount of research/teaching appointments needed.

The process is expected to take 18 months for full implementation. A timeline of major milestones is available below.

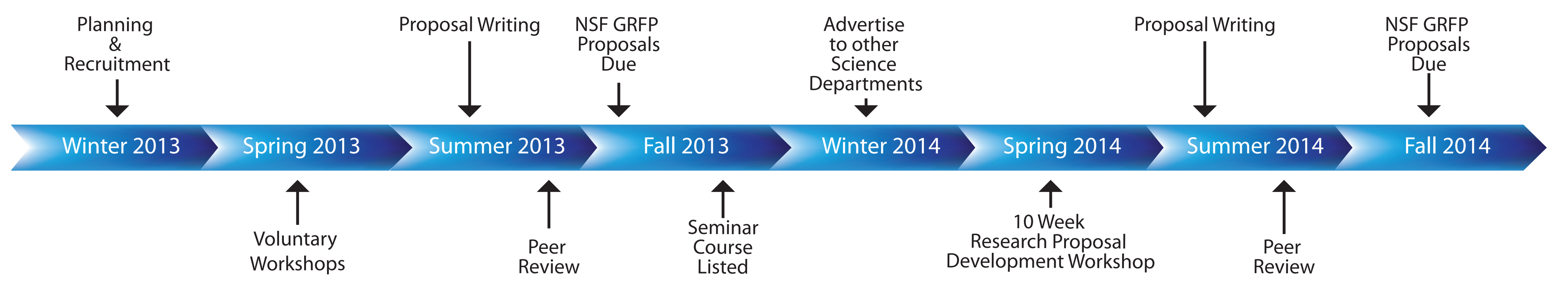
The first major project goal is to offer voluntary proposal development workshops (4-6 1-hour sessions) in the Spring of 2013. These workshops will be targeted at 1st year graduates in the natural sciences. Students who

participate in the workshops will have the option of developing a proposal for submission to the National Science Foundation Graduate Research Fellowship program (GRFP).

In the second year, workshops will become part of a 2-credit professional development workshop. The workshop will be mandatory for first year students in participating departments. During the course students will develop a proposal for submission to the GRFP or another suitable program. Over the summer a panel of previous workshop participants, chaired by a faculty member, will review proposals. This review process will give students useful feedback on their proposals and provide the volunteers with valuable insight into the review process.

If it is found to be valuable, this 1-term course could be expanded to a 3-term professional issues course which would encompass the teaching and service elements of science careers..

## Timeline



## Resources & Budget

The project will require coordination between several departments, faculty, staff and students.

Tangible resources for this project include:

- One faculty member to take lead in instructing the course
- Two to five guest lecturers (faculty & research administrators)
- Advertising & recruiting for the voluntary workshops
- Advanced students to act as panelists

Intangible resources include:

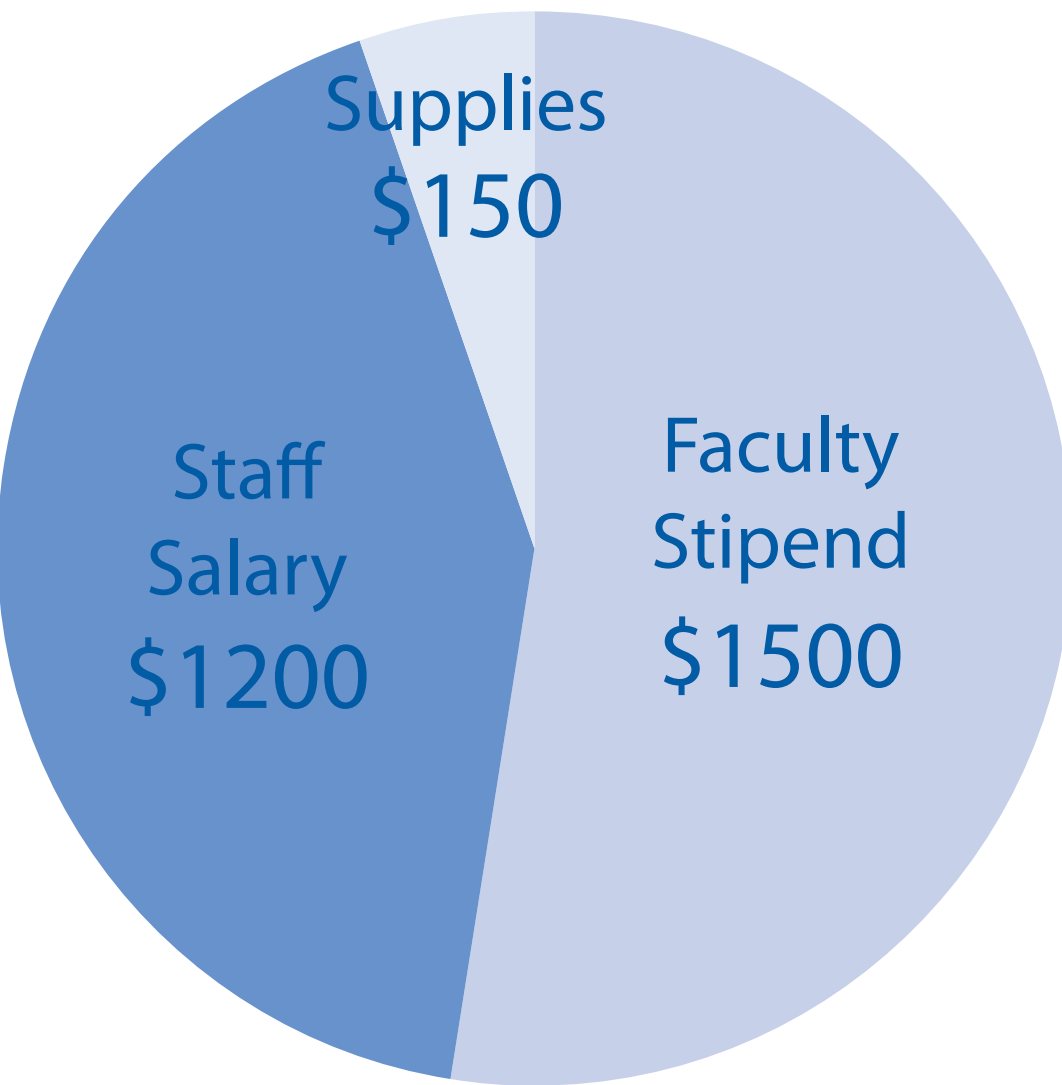
- Champions within departments to support the new course
- Coordination of course requirements across departments
- Good will from department heads

One existing resource is the curriculum developed for a previous voluntary workshop series that was held in the physics department in 2010 & 2011. The voluntary workshops were popular and generated good will toward the idea. They have been on hiatus due to the busy schedules of the faculty and staff who organized the original workshops.

### Budget

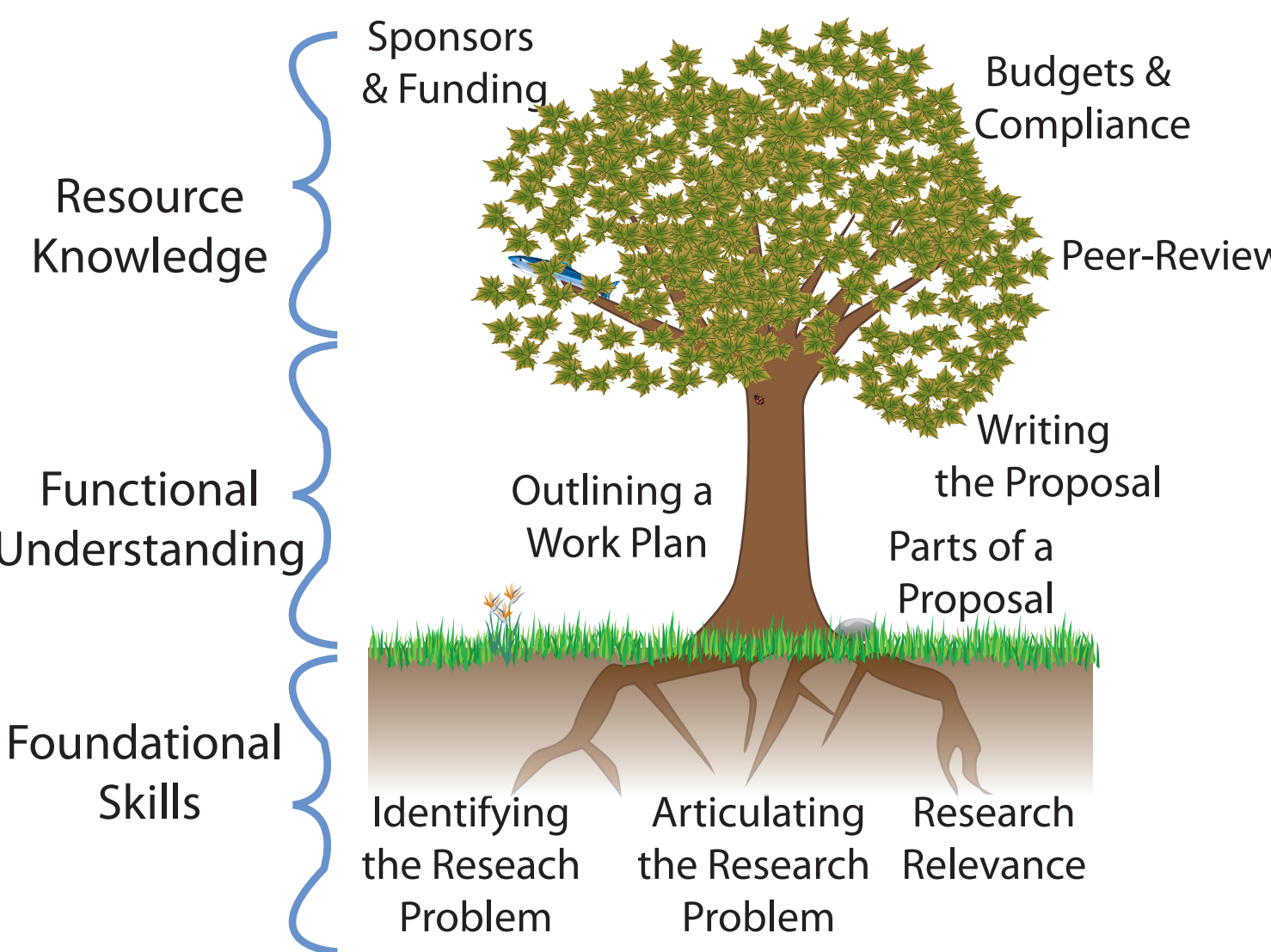
Support will be required for a stipend for the lead instructor, salary for an administrative staff member to coordinate the workshops, and for supplies such as binders and printouts.

Costs are estimates for the initial voluntary workshops. Budgets for the for-credit course will be higher, but offset by tuition.



Total Cost \$2850

### Workshop Topics



## References

Applegate, J. (2002). Engaged graduate education: seeing with new eyes. Washington, DC: Association of American Colleges & Universities.

CoGS. (2007). PhD Completion Project. Council of Graduate Schools.

DeNeef, A. (2002). The preparing future faculty program: what difference does it make? Washington, DC: Association of American Colleges and Universities.

González, C. (2001). Undergraduate research, graduate mentoring and the university's mission. *Science*, 293(5535), 1624-1626.

Handelsman, J., Ebert-May, D., Beichner, R., et al. (2004). Scientific Teaching. *Science*, 304, 521-522.

McAlpine, L., & Norton, J. (2006). Reframing our approach to doctoral programs: an integrative framework for action and research. *Higher Ed. Res. Dev.*, 25(1), 3-17.

NAGPS. (2001). The National Doctoral Program Survey –Results. National Association of Graduate-Professional Students.

Weisblat, Gina and Sell C. (2012) An Exemplar in Mentoring and Professional Development: Teaching Graduate Students Transferable Skills beyond the Discipline. *J. Res. Admin.* 43(1), 60-84.

AAU (1998) Committee on Graduate Education: Report and Recommendations. 28pp.