



## Reflections on PEET, the Partnerships for Enhancing Expertise in Taxonomy\*

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### Abstract

The 12-year old PEET engages a retired program officer in a question-answer session focused on the aspirations and tribulations of the NSF-sponsored research, training, and computer infrastructure program, Partnerships for Enhancing Expertise in Taxonomy.

**Key words:** Biodiversity Crisis; taxonomic impediment; training taxonomists

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### Introduction

In 1995 the U.S. National Science Foundation (NSF) initiated PEET, the Partnerships for Enhancing Expertise in Taxonomy, to achieve three interrelated goals: training new taxonomic experts, conducting monographic research, and building computer infrastructure in biodiversity science (Rodman & Cody 2003). PEET was the Systematic Biology Program’s second response, following the 1991 start of the Biotic Surveys and Inventories Program, to the call by the U.S. National Science Board (NSF’s governing body) for focused research addressing the Biodiversity Crisis (NSB 1989). It also responded to the community-based alarm voiced in the Systematics Agenda 2000 report (SA2000, 1994) that taxonomic expertise was in danger of extinction for many groups of poorly known organisms. More than 60 PEET projects targeting an extraordinary range of seed-free and notochord-free organisms have been funded since then, following six biennial rounds of competition, and the program remains ongoing. Following the most recent meeting of PEET awardees and their students, at the University of Georgia (PEET VI, Athens, Georgia, March 2007), the 12-year old PEET engaged a program officer now retired from the agency in a question-and-answer session

about the enterprise. What follows is a highly edited, semi-hallucinatory transcript of their dialogue, reflecting upon the origins, aspirations, and tribulations of the PEET enterprise, perhaps of utility to those contemplating like-minded initiatives in an age of imperiled biological resources.

### **PEET: Why “PEET”?**

**Program Officer (PO):** Abbreviations and acronyms are endemic to all bureaucracies, and they have their uses, at a minimum as mnemonic aids, cheerleading chants, and fundraising slogans. Also, “partnerships” was a popular buzzword at the time, appropriated mostly by the astronomy and computer science communities for high-profile big-budget programs, and the not-so-hidden message was that biodiversity science required commensurate attention and resources. That the acronym packed punch, while sounding commonplace at the same time, was not entirely fortuitous; what was fortuitous, however, was the rapidity with which the first PEET awardees and their students took to referring to themselves as “peetsters”. That jovial solidarity emerged at the very first meeting of the new cohort, PEET I, held at the University of Kansas in 1996, a meeting sponsored by the NSF to encourage cooperative activities among the taxonomically diverse projects and which helped to inspire a team spirit both within and among the several separately funded projects. Almost instantly a sense of community coalesced among taxon-oriented groups that rarely met at the same society gathering, or published in the same journal, or collected on the same field trip, or studied in the same museum or laboratory. It was revolutionary.

The “partnership” idea was a considered one; taxonomic practice and training draw upon traditions that abide in many different organizations: museums and herbaria and marine stations, colleges and universities, government agencies charged with the inventory and care of natural resources, conservation organizations, even some kinds of commercial firms. The hope was that a well-funded program would attract talent from many of these institutions, ideally multiple talents willing to work in teams to achieve PEET goals. In turn, exposure to a wide range of institutions concerned with taxonomic practice and skills would open employment opportunities for PEET trainees that otherwise might not even be contemplated. The more subversive goal in bringing together multiple mentors and experts for research and training was to break with traditional apprentice-style or arts-and-crafts models in the field of taxonomy and embrace an industrial-strength team approach. The oceanographers manage half the job: they send teams of researchers, splendidly equipped, to haul up vast arrays of strange and wonderful creatures; but after a preliminary sorting of the beasts, individual specialists retire to their lonely museum benches to identify the knowns and describe the unknowns, typically working in isolation and without the management that motivated the original expedition. A Biodiversity Crisis demands new models of taxonomic practice and training. No slight on the value of learning one’s organisms from the experienced master was intended; but the needed skills require an accelerated education across multiple disciplines, and the practice of taxonomy must exploit synergies that emerge from multidisciplinary teamwork and focused cooperation. The old-fashioned “taxonomy” in the PEET acronym was the mask hiding that subversion.

### **PEET: Each NSF PEET award was made as a 5-year grant for a total of \$750,000; not to sound ungrateful, but is that really enough?**

**PO:** By the standards of the NSF Systematic Biology Program at the time, the budgets for PEET awards were generous and the durations were long. Of course, the expectations were high as well: training for two new taxonomic experts in the course of the 5-year grant (the maximum duration under NSF rules), plus research and Web products. Certainly the partnering institutions contributed resources of immense value, both direct and

“in kind” in nature: mentor salaries; laboratory and conference facilities; access to collections, curatorial advice and assistance; computer resources; field-collecting equipment and logistics. The hard fact remains that taxonomy as a science depends upon readily accessible collections of organisms, and the national (not to imagine worldwide) infrastructure that provides those resources is immensely expensive to maintain. Generous as the PEET awards were, there is no way that NSF alone could have financed such a scale of research and training. The partnering institutions were indispensable. Heartening and reassuring, therefore, has been the response from the geographically and organizationally diverse set of institutions that have sponsored PEET projects and participants through the years, and not just in the U.S. but throughout the world.

One hope was that partnering institutions and cooperating PEET projects could achieve “economies of scale” in various aspects of the taxonomic enterprise. Examples would include: joint field trips by different taxon-specialists; workshops on techniques and technologies relevant to multiple groups of taxa; shared computer resources, whether hardware or software, including digital imaging technologies, database systems, and identification services. Consortia of various PEET projects have in fact explored these and other products or technologies, and the benefits may in time percolate to the general taxonomic community. PEET participants across many groups of organisms are active contributors to the globally linked “Encyclopedia of Life” initiative, for example (see the website [www.eol.org](http://www.eol.org)). Intellectual “economies of scale” may prove more valuable in the long run than any cost-saving from improved practices; witness the grand coalitions that are assembling the Tree of Life, with PEET participants playing conspicuous roles in fields like entomology and mycology for example (see the websites [www.tolweb.org](http://www.tolweb.org) and <http://atol.sdsc.edu>).

While on the subject of money, some little-appreciated fiduciary facts deserve emphasis. The first PEET competition attracted 88 proposals, and a merit-review panel of taxonomic experts recommended more than 20 of these for award. Cumulatively the 5-year budgets for this large cohort exceeded (U.S.) \$15M; the Systematic Biology Program that fiscal year (1995) had a little over \$3M for PEET funding. The Program took the huge risk of forwarding 21 project-award recommendations for final NSF approval, creating a \$12M mortgage over the next four years. Nearly all programs at NSF operate with this “continuing grant” mechanism, funding some multi-year projects one-year at a time and cumulatively incurring a mortgage carried over year to year. Planning and judgment are required to manage the portfolio of new and continuing-grant awards, but as well, the science community served by that program must be informed and must feel involved in the decision-making and risk-taking. The “rotator” program officer mode of management at NSF helps immensely in this regard; experts from academe, museums, or other agencies, rotating for a year or two of service to NSF, bring knowledge of community concerns and trends as well as their own insights and perspective to the running of the program, on a regular basis. But it is also a fact that even with the \$12M mortgage created that PEET-inaugural year (augmented by subsequent PEET awards in the course of regular biennial competitions), the Systematic Biology Program continued an uninterrupted tradition of spending the majority of its funds on grants researching either angiosperms or vertebrates—for the simple reason that most of the research proposals directed to the Program focus on those two groups, as has been the case since the very beginning of NSF grant-making.

### **PEET: Training is a big part of PEET; will my PEET training get me a job?**

**PO:** Undoubtedly this is the single most often asked question about the PEET program. Would you expect to be hired as a taxonomic expert without training in the taxonomy of some group of organisms? But of course the question is, are taxonomists being hired, in the U.S. and elsewhere in the world. The answer is yes, but surely a qualified yes. One specific datum is available, derived from querying trainees from the inaugural cohort of 21 PEET awards (Rodman & Cody 2003); 33 named trainees of 42 expected in total (79%) reported securing full-time positions relevant to their taxonomic interests, while the remainder either reported holding

postdoctoral positions or could not be located. A later survey of trainees from both the 1995 and 1997 cohorts (10 new projects were funded in 1997) revealed a lower rate of employment in taxonomy-relevant jobs, 53%, and suggested attrition in the ranks from the 1995 cohort (Agnarsson & Kuntner 2007). Certainly the widespread perception exists that taxonomic jobs are in decline, at least in the U.S., with various causes advanced to explain the disappearance. In part the matter could be semantic: many “taxonomists” are likely being hired, not primarily for their ability to identify and study a particular group of organisms but for skill sets of another nature: statistics or computational biology; DNA forensics or genomic analyses; digital microscopy and imaging; computer databasing and software development; field survey and reconnaissance methods. Further reports on the employment status of trainees from the now-completed second (1997) and third (1999, 14 projects) PEET cohorts will help assess trends beyond the current 2-point comparison. Anecdotally, a small sampling of PEET investigators from the third cohort, conducted by telephone and e-mail, reveals that most trainees secured either full-time jobs or postdoctoral positions. Training in a broad array of modern technologies, such as has been experienced by many PEET students, opens doors. Still, no age has ever complained of a surfeit of taxonomists (lawyers, yes — taxonomists, no); ours may be the first to recognize the dangers of a lower limit.

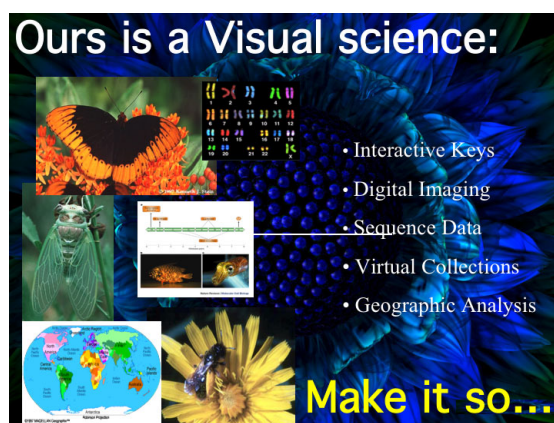
In the survey of trainees from the inaugural PEET cohort, noted above, 15 of the 33 (45%), including both U.S. citizens and foreign nationals, reported securing positions outside the U.S. The international character of taxonomy was recognized as vital in the National Science Board’s report (NSB 1989), which encouraged support of international students at U.S. institutions. Consequently, PEET awards were made as research grants, which, unlike fellowships or traineeships, can include funds for foreign students and colleagues enrolled or otherwise associated with the U.S. grantee institution. The research focus was monographic study of a poorly known yet deserving group of organisms, ideally to be sampled wherever in the world they occurred. And throughout the world is where PEET participants have collected or worked as part of their projects. Numerous foreign institutions have hosted PEET students and mentors, on field expeditions, in libraries and museums and laboratories, and at meetings and conferences. This support from abroad has been crucial to the success of many of the PEET projects, and in turn, an expanded international vista has opened employment opportunities beyond U.S. borders.

On the topic of training, one problem needs mention: recruitment, specifically the timing thereof. Attracting qualified students into a PEET-funded program at any institution requires preparation and time, and many projects encountered difficulty during the first year of their 5-year grant. Nimble project leaders often enticed postdoctoral researchers to join the team for a year or two, with “rolling rotations” coordinated with the one, two, or (rarely) three graduate students who eventually were to join (augmented by the numerous undergraduates who participated in so many of the PEET projects). The mix of levels of experience and education proved salutary for many PEET projects, but recruitment remains an ongoing problem; and of course, the issue loops back to the job situation. What was unanticipated but proves intriguing is the surprisingly large number of undergraduate students who worked on PEET projects (Rodman & Cody 2003). Interest in organisms is high; translating that interest into advanced training, and then into jobs, is the challenge (Agnarsson & Kuntner 2007).

**PEET: I love my critters and want to work with them; so why do I have to learn all this computer stuff?**

**PO:** Much indeed is expected from the modern taxonomist, and learning to become an expert may be harder these days than ever before. For nearly every group of organisms, the taxonomic legacy is both an inspiration and a burden. The exploits and accomplishments of past explorers and experts inspire us, and their collections, field notes and memorabilia, their publications, reports, catalogues and nomenclators, their sketches and illustrations, all these provide the invaluable resources upon which future discoveries are built. And nearly all

these resources are unavailable in digitized formats, often scattered or stored in obscure locations or published in small print runs, sometimes not even indexed. To make them accessible over today's computer networks is a huge but critical task, and many PEET projects are catalyzing that effort for their targeted group of organisms. The beleaguered PEET trainee, tediously accumulating his or her treasury of taxonomic nuggets, is on the spot to assist this enterprise, for one's own sake and for the next generation of experts. But it doesn't stop there. Communicating the results of taxonomic study increasingly will rely on computer interfaces, less on traditional print media, especially as pictures, graphics, and images of all kinds are made available on portable, networked devices. What feature of that fascinating creature captured your interest? The sound from a click-beetle? The taste of a mussel? The touch of moss? The smell of that fungus? Perhaps, but for most people, vision will be the portal: seeing the thing is what will grab them. Learning and exploiting the new computer technologies for visualizing all aspects of the biology of one's favorite organisms, whether microscopic or macroscopic in scale, are the keys to successful communication by peetsters (Figure 1).



**FIGURE 1.** Digital imaging and graphics technologies will help to invigorate a modern taxonomic enterprise, and peetsters will help to lead the way.

### **PEET: Will I be happy as a taxonomic expert?**

**PO:** How could you not be? Indeed, smugness is the trap to be avoided at all costs. Linnaeus, prince of botanists and “God’s Registrar” (Goerke 1973), assured us that taxonomists were doing divine work. And the age of discovery is still ongoing. Reputedly, NASA, the National Aeronautics and Space Administration, supports a program for xenobiology, the search for strange, new life. They are playing catch-up. Taxonomists are this world’s xenobiologists, discovering new and wonderful life forms every year, the first to describe novel forms and functions. Today’s peetsters carry forward that intrepid enterprise to discover and describe the new, the peculiar, the amazing and the bizarre. How cool is that?

### **Acknowledgments**

I thank Bill Shear for the invitation to romp down PEET memory lane; Ken Karol for example, encouragement, and editorial advice; Kathleen Pryer for a key phrase (she’ll recognize the attempt at humor); Jeannine Cody and Elaine Washington for the figure; and the numerous PEET investigators and their students who dedicated such energy and goodwill over the years to Charting the Biosphere—to paraphrase the storyteller: all the mentors are strong, their staff good-looking, and the students above average.

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