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Postdoc ALUMNI Spotlight:

Omar Fisher, Asst.Prof, Temple Univ.; former MIT; Bioengr. postdoc

Core Competencies for Future Researchers

A Compass for Navigating Your Career
By Emil T. Chuck, Ph.D.

I was really naive when I was an early-phase graduate student. I believed that all the rewards for success were dictated by studying hard, doing well on my exams, and getting publishable data. I looked to the faculty who surrounded me as paragons of success who would write me wonderful letters of recommendation, and I presumed that being the best in my field meant knowing, thinking, and dreaming about my experiments and my data. I had no idea how limiting I let my training become as a result of these misconceptions.

Luckily, my research mentor and doctoral thesis committee made sure that I gave myself more than sufficient opportunities to be trained as the best scientist I could be. Even though I didn't have particularly outstanding grades, this group really forced me to think about all the professional skills that would allow me to survive the early phases of my science career. For example, when I gave presentations or worked in a team, my mentors encouraged me to think as an interdisciplinary scientist working with clinicians, engineers, and basic and applied scientists.

When I was given an opportunity to help articulate the competencies of future scientists with the National Postdoctoral Association, I frequently thought about the things I did to become an early career scientist who could get competitive grants and awards and become a desired future colleague. Now that I'm in administrative academia and have insights into other science or health professional careers, I tell high school and undergraduate students beginning careers in research to take these competencies to heart, as it may dictate their future training and success. These six core areas or competencies (www.nationalpostdoc.org/competencies) define the characteristics of an ideally trained scientist. They are also a toolkit of resources that will aid trainees, supervisors, and institutions throughout one's career progression to pursue a wide range of scientific questions and transition among research areas as opportunities emerge.

1. Discipline-specific conceptual knowledge
It should be self-evident that a successful scientist needs to have a solid mastery of the foundational concepts of science and a familiarity with applications of the research being performed in other fields. With knowledge of the discipline, a scientist is able to identify gaps in knowledge, develop hypothesis-driven strategies, and evaluate any generated data. For me, my research forced me to learn molecular biology, electrophysiology, developmental biology, and clinical medicine, as evidenced by a 20-page thesis proposal (which eventually became a review article). Individuals who demonstrate the highest level of competence in this field should be aware of not just the technical details of experiments that support the field but should also envision and develop innovative future experiments to further explore the critical questions facing the discipline.

2. Research skill development
In the design of experiments that can test these hypotheses, the successful scientist should be familiar with the process of identifying and assessing primary sources whose results can be germane to the scientist's research. Such knowledge of past experiments can inform the scientist of innovative approaches to design new experiments and execute novel techniques in a safe and ethical manner. Moreover, just as the successful scientist relies on quality peer-reviewed research to govern the direction of research, the scientist is aware of the importance of proper documentation of experimental results and the rigor of peer review when submitting research results for publication or grant review. Scientists who master research skills are renowned not just for technical skills but are also excellent critical thinkers who can analyze and evaluate literature and experiments that may be related to the scientist's original research interests.

3. Communication skills
Leading scientists demonstrate versatility in the way they communicate science to peers and to the public. More than just writing peer-reviewed articles, communication skills truly encompass multiple situations, among which are reporting results to one's colleagues, developing performance assessments and evaluations, delivering poster or plenary presentations, discussing one's research with the general public, and teaching techniques or giving lectures to trainees. Mastering communication skills involves not just the delivery of information but also critical listening skills to establish discussion settings that are inclusive and welcoming to all members of an audience.

4. Professionalism

By becoming a scientist, one recognizes that he/she enters a community of scholars through associations with one's laboratory group, one's institution, one's discipline, and one's affiliation with the general public. How others perceive you and your profession as a scientist often dictates how they value your research or your expertise, and any controversies that cast a negative light on your colleagues' professional decisions often paints your institution, your discipline, and even all of science negatively. Competency in professionalism focuses on how the individual identifies with each of these subcommunities, respects the individual contributions of other members of those communities, represents the communities to which he/she belongs, and appreciates the diversity of membership.

5. Leadership and management skills
By recognizing the value and diversity of one's peers and colleagues, a scientist can develop appropriate skills in management and leadership. To allow a research project to progress in a timely manner, one must be able to appropriately set a project schedule, manage finances, and utilize collaborators, thus effectively managing one's research, the data generated and the staff and colleagues needed to execute the experiments. One of the differences between manager and leader is the ability to develop a strategic vision that can be shared among and inspire one's peers in the aforesaid professional communities. While the most competent leaders may be identified by the rewarding of administrative titles, one need not have a title to be a leader. Rather, the competency of a leader is often measured by the impact he/she makes within the community served.

6. Responsible conduct of research
In every profession, there are usually legal constraints that define the autonomy of a profession, and for this competency, professionals must acknowledge and operate within the explicit and often implicit expectations for the conduct of research. Most scientists tend to resist acknowledging or developing this competency until damage is done to the lab in a personal, physical, institutional, or disciplinary sense. The most competent researchers are not only aware of the legal ramifications of these restrictions, but also exhibit a deeper understanding of the ethics and philosophy behind them. Those who master this area are adept at discussing improvements or changes to these restrictions, and they assist in mediating conflicts that arise among colleagues.

In solicited comments to the developing strategic plan for the National Institute of General Medical Sciences, the National Postdoctoral Association urged: "Today and in the future, postdocs must prepare for more than one career path and develop a broad range of competencies to succeed…. A trainee's success may indeed depend upon their mastery of a broad range of skills and their flexibility regarding their career goals." More than just a map, the Core Competencies Toolkit should provide a career compass— a "Graduate/Postdoc Sherpa" — to guide each scientist to his/her ultimate career destination. Even though I left the lab years ago and despite the detours I have had to take, these general principles allowed me to approach my personal destination toward becoming a better science professional.

A member of the SACNAS Postdoctoral Committee, Dr. Emil Chuck is a committee member for the National Postdoctoral Association Core Competencies Toolkit (professionalism author) and the Health Professions Advisor and Term Assistant Professor of Biology at George Mason University. He can be reached at etchuck@yahoo.com. Dr. Ivonne Vidal Pizarro contributed to this article.

Figure: Dr. Emil Chuck in 1997, his third year of graduate school at Case Western Reserve University.

Feedback and Comments:

I very much appreciated your article on "Core competencies for future researchers: a compass for navigating your career" that appeared in the most recent SACNAS news. … It seems to me that applying for research grants and quickly becoming engaged in reviewing research grants is also an important competency. Again I much appreciated your advice to prospective scholars.
Best wishes,
Eugene Cota-Robles
SACNAS Founder and
Emeritus Professor, University of California, Santa Cruz
August 12, 2010

Thank you, Professor Cota-Robles, for your email and your compliments!…I do agree that reviewing grants should address both the responsible-conduct-of-research and communications competencies.
Emil Thomas Chuck
August 12, 2010

Editor's note: This article first appeared in the Summer/Fall 2010 issue of *SACNAS News* on page 18. This article is used with the permission of SACNAS. A PDF version of the article can be downloaded here.

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