Biomedical Careers in Industry: A Few Tips for the Newcomer

By Robert A. Copeland, Ph.D.

The desire to find practical solutions to problems of commercial interest has fueled key discoveries in the biochemical sciences from early civilizations to the present. Throughout history, practical applications of biological chemistry have contributed in myriad ways to improving the human condition. In modern times, industrial applications of biomedical sciences, perhaps most notably within the pharmaceutical industry, have contributed greatly to extending and enhancing human life through the discovery, development and commercialization of medicines, diagnostics and medical devices.

Hence, innovation, creativity and the desire to apply these skills in a focused and contemporaneous way to societal problems has been, and continues, to be the hallmarks of industrial biomedical science. A scientific career in industry can be extremely rewarding for those who wish to see the potential fruits of their labors translate into meaningful impact on humanity within their own lifetime. A growing number of young scientists are emerging from their academic training with the realization that their professional aspirations can be best met through a career in industry. Although many bright and talented students have come to this realization, few of them have any familiarity with how science is conducted within an industrial setting and what skills are most valued by their potential employers. This month and next month I will attempt to address these issues in a two-part series on biomedical careers in industry. All of my industrial experience has been in the pharmaceutical industry and I will focus my comments on this industry. I suspect, however, that many of the statements I am about to make apply equally well to other biomedical industries as well.

Transitioning from Academic to Industrial Science

Everyone who enters the biomedical industry comes out of an academic setting where there are specific goals and approaches to how science is done. The goals and approaches in industry are distinct, and can seem quite foreign to the newcomer; it is thus worthwhile to consider how these two settings differ.

One of the most obvious differences is in the degree of focus that is applied to biological questions within the two settings. While academic researchers tend to ask questions of broad interest, the industrial researcher must take a more practical view, focusing attention almost exclusively on questions of pathobiology that have a direct clinical utility. To exemplify this consider the activity of target validation within the pharmaceutical industry. The goal here is to determine whether the activity of a particular biomolecule (usually a protein) is critical to a specific disease process and whether targeting this biomolecule for drug intervention will have the desired effect on the disease.

This activity requires the combined efforts of scientists from multiple disciplines including biochemistry, molecular biology, genetics, cellular and animal biology and perhaps medicinal chemistry. One can invest many months or even years in understanding the detailed role of a putative target in, for example, cell signaling. Along the way one may uncover fascinating aspects of the cell biology associated with a particular biomolecule, but may also discover that it is not an appropriate target for drug discovery. At such a point, an academically trained scientist may be tempted to explore further the interesting biochemistry and biology of the molecule, to add to the general knowledge base. The industrial scientist, however, must immediately abandon further work on such a target, as to prolong efforts on the target would be counterproductive to the goal of bringing new medicines to patients in need. The industrial scientist is likely to publish his/her finding so that others, perhaps in academics, can pursue the basic science, but would then quickly move on to other activities.

This example illustrates another distinction between academic and industrial research: project lifetimes are much more finite in the industrial setting. It is not uncommon for an academic scientist to pursue a major research project or at least a common research theme for a significant portion of their career. In contrast, projects in industry are of more limited duration, defined either by successful transition to the market or by suspension for pragmatic reasons, as just described. Pharmaceutical research is expensive; current estimates of the typical cost of going from target identification to a marketed drug are in the range of 900 million U.S. dollars. Hence, if a project is not going to yield a usable drug, it is in the researcher's and the company's best interest to discover this and terminate the project as early as possible. For this reason, scientists in industry are often challenged to come up with what are commonly referred to as "killer experiments" - designed to test rigorously the suitability of a scientific approach for progression. Failure to meet predetermined outcomes in such experiments would lead to termination (i.e., "killing") of the project.

For young investigators in academic settings (e.g. assistant professors) there is usually a strong incentive to work as an independent researcher and to avoid significant collaborative research. This is because collaborative research projects make it difficult for tenure committees to assess the significance of the individual investigator's contributions. In stark contrast, essentially all research in the industrial sector is done as collaborative, matrix teams. This is necessitated by the complexity of drug discovery, requiring the concerted efforts of talented scientists from multiple disciplines from molecular biologists and biochemists to clinicians. Thus, newcomers to the pharmaceutical industry must adapt to this style of interactive and interdependent science.

A final contrast between academic and industrial science is the ultimate product of the efforts in these two sectors. In academics the ultimate product of research is information, most typically disseminated in the form of scholarly publications and lectures. In industry the ultimate product of research is a tangible entity, such as a new medicine in the case of the pharmaceutical industry. What about the information gleaned along the path to product marketing? As with our academic colleagues, we industrial scientists share this information with the general scientific community in the form of scholarly publications, lectures and patents. However, where these media for information sharing are the key products of academic research, they are viewed as byproducts – important byproducts, but byproducts nonetheless - of industrial research.

Skills Valued by Industrial Employers

As a young scientist nears completion of their academic training it is common to begin thinking about how best to present oneself to potential employers. A question that frequently arises at this point is what are the skills and talents that are most valued by potential employers and that may portend career success in the industrial sector. There is no generic answer to this type of question. Every company and every individual hiring manager will have different perspectives on this issue. I can only answer this question from the perspective of a supervisor and hiring manager, in terms of what I personally find of most value in potential employees. Below I describe some of the attributes that I look for in job candidates.

Be a scientist, not a technologist. Everyone coming out of their academic training will have honed their skills in specific types of technologies. Employers expect you to be a master of your craft. However, it is a fundamental mistake to market yourself on the basis of a collection of specific techniques that you are trained in. Rather, what is most valued is someone who demonstrates good scientific problem solving abilities. This involves being able to: identify important scientific problems, define a cogent plan for experimentally approaching the problem, collect and analyze data appropriately, test hypotheses objectively, draw clear and thoughtful conclusions and be able to effectively communicate these conclusions and their impact in the broader context of a drug discovery project to fellow scientists and laypeople.

Demonstrate quantitative skills. While there are many important techniques in biological sciences that yield qualitative results, the greatest value is usually gained from quantitative data. Hence, researchers who can analyze and interpret data in quantitative terms, using appropriate mathematical models, are highly sought after. I believe this to be universally true in all science, but it is especially important to industrial science. Phenomenological observations may be a good starting point for an investigation, but it is only when one can define a phenomenon quantitatively that one can truly begin to understand the nature of the observations. In the pharmaceutical industry quantitative data is needed at every step in discovery and development. Drug-target affinity, cellular and in vivo dose-response analysis must all be expressed in quantitative terms; synthetic steps must be quantified in terms of reactant stoichiometry and yields; drug formulation must be precisely described; and pharmacokinetics, toxicokinetcs and pharmacodynamics must all be defined in a quantitative fashion.

Communicate effectively. I cannot stress enough the importance placed on effective oral and written communication skills. These are absolutely critical to success in any field of science. It doesn’t matter how brilliant a theoretician, nor how skilled an experimentalist you are if you cannot communicate your ideas, results and conclusions to your peers and others. Hence, hone these skills throughout your academic training. Write and speak as often as you can. Seek out and accept constructive criticism from mentors, colleagues and others whose skills you admire. If English is not your first language, don’t expect prospective employers to take this into account; it is up to you to be a competitive job candidate. Therefore, look for extra help during your academic training.

Be a team player. As I’ve described above, industrial science is a team sport. People who can effectively network and collaborate in the context of project matrix teams will be most successful in industry. Those who need all the glory and therefore try to work in isolation are doomed to failure in this setting. Drug discovery is just too complicated for any one person to master. It is only through team efforts that new medicines can be successfully discovered and developed.

Think holistically. As a member of a project matrix team, you will have primary responsibility for one aspect of the project, or for the application of one scientific discipline (e.g., biochemistry or molecular biology). Again, you are expected to be a master of your specific discipline, but that is not enough. Successful researchers in the pharmaceutical industry are those who commit to understanding a project in its entirety. This does not mean that one must be an expert in every discipline. Rather it means making a commitment to learning enough about each aspect of a project team so that one can be an effective collaborator with one's colleagues from different disciplines, and can best put one's own research in the correct context of the project team objectives.

Frequent Misconceptions about Industry

When I speak with students and postdoctoral researchers who are considering an industrial career I often encounter some common misconceptions about industry. Let me set the record straight here by addressing some of the more common of these misconceptions.

Scientists in industry have no freedom to work on their own ideas. This could not be further from the truth. Industry seeks to hire bright and motivated people who will be the source of new ideas and directions for the company. No one today, in any employment sector, has unfettered freedom to work on projects that cannot be justified. In academic settings, research must be funded, usually through government sources. Thus, academic researchers must convince funding agencies of the value of their proposed research. Likewise, ideas for projects in industry must be funded by management, and it is up to the scientist to justify this investment of resources by showing the value of their proposed research to the company. In both sectors, good ideas get resources, and clever people find creative ways to work on interesting and germane research topics.

Industrial scientists can't publish or otherwise obtain external recognition for their work. It is true that companies must maintain their competitive advantages over competitors, and sometimes this means keeping certain information out of the public domain, at least temporarily. In the pharmaceutical industry, for example, the chemical structures of drug candidates are not usually disclosed until late in development (i.e. during clinical trials) or when the drug is brought to market. Most other information is considered less proprietary and is typically published at some point by industrial scientists. Most companies encourage their scientists to publish and otherwise communicate their work to the external community. This proves to be very beneficial to the morale of their creative scientific staff. Publishing, however, is not encouraged merely to benefit individual scientists. The company also benefits from such external communications by showcasing the high quality work of its employees. This helps to bolster the overall reputation of the company, helping in recruiting future employees, garnering favor with potential investors, and generally enhancing the scientific credibility of the company.

There are no opportunities for teaching/mentoring in industry. Having been in both the academic and industrial settings in my own career, I can honestly say that I do far more teaching and mentoring as an industrial scientist than I ever did as a full time faculty member. In industry, teaching and mentoring are not separate job functions, but are integral parts of doing research within the context of project matrix teams. Beyond this, anyone with any supervisory responsibility is expected to mentor, both scientifically and in terms of career guidance, those who report to him or her. Teaching and mentoring is a daily activity of successful scientists in industry. This does not take place in a traditional classroom, but it is a real and valued part of our profession.

Career advancement in industry requires moving out of the laboratory and into management.

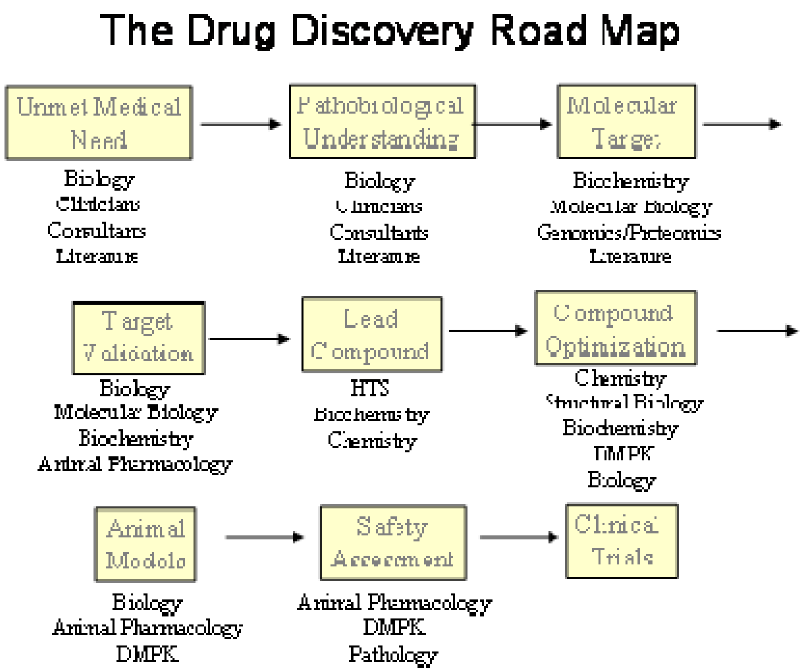
Scientists who demonstrate talents in supervising others and in managing science can advance their careers in industry by moving into a management track. This, however, is not the only means of career advancement and fulfillment within the industrial sector. Most companies, at least within the pharmaceutical industry, offer dual career ladders, allowing talented individuals to advance either along a management or scientific track. Professional fulfillment does not always require a change in job title or responsibilities. One can also grow a career by continuing to expand the repertoire of skills and experiences one has within a particular job title (i.e. growing in breadth rather than in a hierarchical, linear fashion). Whether one chooses an industrial or other career path, eventually one is likely to make the transition from being in the laboratory, conducting experiments with one's own hands, to supervising those who do the actual laboratory work. Faculty members in academics function as managers of science, although they seldom are referred to by such titles. Think about your own academic experience; how often have you seen a full professor working at the bench? Progression from the laboratory to some form of management is an almost inevitable consequence of success in science.

Some general advice

My focus in this brief article has been to clarify the role of biomedical scientists in the industrial sector. I have personally found great fulfillment in applying my own scientific talents to the pursuit of new medicines within the pharmaceutical industry. I believe this industry offers many exceptional opportunities for those who want to contribute to human health. Others will find different paths to professional fulfillment in teaching, academic research, government service, and other venues. Whatever your individual professional path, however, I believe there are some universal keys to career happiness. I will close this article by offering some key points that I have found useful to remember in my own career:

1. **Work in an atmosphere that you find comfortable.**
   * Make sure your value system is not incompatible with that of your employer.
   * Balance career with other life needs (e.g., family, hobbies, etc.).
   * Know what you want out of life, and seek employment that provides a path to your goals.
2. **Identify role models and seek them out as mentors.**
3. **Be adaptive to change.**
   * Be a problem solver, not an expert on a specific method or area.
   * Commit to life-long learning.
4. **Always remember that your career is in your own hands.**
   * Don't look to others to advance your career – be proactive.
   * Distinguish yourself at the job and externally.
   * Network with talented people.

Figure 1. The Drug Discovery Roadmap, illustrating the different stages of a drug discovery project and the different expertise required by the project matrix team at each of these stages.



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