31st Annual International Conference of the IEEE EMBS
Minneapolis, Minnesota, USA, September 2-6, 2009

Ten Year Experience of a PhD in the Medical Device Industry

Douglas R. Daum, *Ph.D*

Abstract—**Most of those who graduate with an advanced degree in biomedical engineering must choose between a career in academia or industry. In this paper, various aspects are discussed, including publications and patents, decision criteria between a scientific career and business management, importance of a business hypothesis to parallel scientific hypothesis, academic and cross industrial collaboration, and general skills needed in industry.**

I. Background

In 1998 I completed my doctorate in Medical Engineering and started employment as a research scientist at a major medical device company. In the last ten years, I have worked on a variety of technical projects and made a change from individual contribution to personnel leadership. I have been active in recruiting new scientists to industrial research and have led groups as small as five and as large as sixty.

I have found that there are key similarities and differences between academic and industrial research that a graduating scientist should weigh in the decision of career fields. I believe that the requirements for successful scientists in corporate and university research positions are comparable: both require creativity, diligence, and endurance. However, companies and universities have fundamental differences in motivation to fund and complete research. This motivation expresses itself in a variety of ways.

II. Discussion

A. Publication and Patents

First, if a university role can be described as "publish or perish," a corporate scientific role could be described as "patent or perish." My academic doctoral advisor used to call publications "the currency of academia." In other words, good research would lead to strong publications which would in turn yield grants to provide the money to complete research. On the other hand, industrial positions are funded by corporate earnings, and these earnings are enhanced by proprietary solutions that are constitutionally protected through the patent process. Hence, patents can be considered the "currency of industry." [1]

This does not mean that publications are not important or valued in the industrial setting: my group routinely publishes in both journal and conferences. These publications help gain credibility through the same peer review process of academics. Still, the ratio of patents to publications must be higher in industry. It is also worthwhile to note that universities are putting increased emphasis on patents. While this emphasis can have an effective financial outcome for a university, it has created significant barriers between academic and industrial collaboration. Knowledge of the patent process is recommended for either field.

Manuscript received June 19, 2009. Douglas R. Daum is with the Boston Scientific Inc. Cardiac Rhythm Management (CRM), St Paul, MN 55112 USA (phone: 651-582-2492; fax: 651-582-4678; e-mail: Douglas.daum@bsci.com). The views of this paper represent those of the author and not Boston Scientific.

B. The Scientific Method and the Business Plan

Second, both university and academic researchers must follow the scientific method. The need to create a hypothesis, experiment, and revise the hypothesis are very similar. Neither organization has unlimited resources and must find creative methods to efficiently use this process. The use of the method will be documented through external publications and internal review documents. However, I have found another critical use of the scientific method that is required in industry: the business plan [2].

A business plan is not technical hypothesis, but it does require the same scientific method: prepare a hypothesis of how a market will react to product, create the product, and revise the hypothesis. This method can be implemented in very early stages of product prototyping through the use of good clinical collaborators. A static business plan is no better than an untested technical hypothesis. In my experience, decisions are best made when the technical and business hypotheses can be simultaneously tested and revised. These decisions then can be more accurately adopted or discarded by the corporate organization as the hypothesis is validated or rejected.

C. Academic and Industrial Organizational Structures: Scientific Career and/or Business Management

Third, universities and corporations have many different organizational structures, but generally corporations require more hierarchical systems than their flatter university counterparts. This can have a direct impact on the scientific work of the organizations. For example, while a university professor can generally choose his or her area to research, it is not uncommon that an industrial scientist will receive an assignment from his/her supervisor to work in a particular area driven by the immediate needs of the company or by longer term corporate strategy. These needs can shift periodically and it is critical for the effective industrial researchers to adapt to a project that may expand or contract based on events outside of the technical hypothesis.

Of course, to say that an academic post always gets to choose a research area and that an industrial position is

assigned a research area is an incomplete generalization: an academic position is governed by the grant money that can be obtained, and more junior members (such as the graduate students) are often guided by a previously awarded grant. Conversely, senior technical individuals in a company are often not assigned projects, but are rewarded for finding valuable projects to champion within their organization. The selection and coordination of these projects often may remove talented PhDs from technical experiments to apply their critical thinking to financial, market analysis, and personnel management. This is career path that should be considered as it is a relatively common position for scientists with advanced degrees.

III. Conclusion

In conclusion, if you are deciding between a career in academics or industry, I highly recommend that you seek out individuals in each field to find out their perspective. I have colleagues who have switched from academics to industry and a smaller number who have returned to academics. The science can be equally compelling in each area and both can yield rewarding careers. For a current PhD or MS level candidate, I encourage gaining as much experience as possible in experimental methods, publications, patents, and basic science understanding. Additional courses in business, regulatory, and clinical sciences may further give you an edge in a competitive environment.

IV. References

[1] Joachim Henkel and Markus Reitzig, "Patent Sharks," *Harvard Business Review*, June 2008.

[2] Vijay Govindarajan and Chris Trimble, "Building Breakthrough Businesses Within Established Organizations," *Harvard Business Review*, May 2005.