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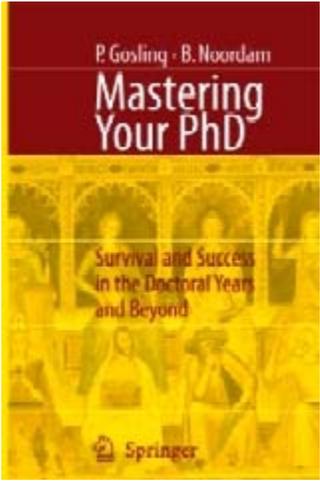
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Mastering Your Ph.D.: Is Industry Right for You?

Bart Noordam
Netherlands
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As you worked toward your Ph.D., it might have crossed your mind that your research activities seem to be of little short-term value and mostly curiosity driven. Join the club. Relatively few academic scientists see an immediate or short-term payoff to their work.

For better or worse--we do not judge whether it is right or wrong--the science-related corporate world values research quite differently, as an essential part of a business strategy. For scientists in industry, this means less freedom--but it also means a higher probability of a substantial short-term impact. The difference of values between academia and industry results in different ways of working and a different set of required skills.

Here, we discuss several aspects of doing research for a company. It might help you decide whether a corporate lab is an appealing destination for your research career.

RESEARCH IN A BUSINESS SETTING

In a corporation, research is an expense that is expected to be offset by substantial future revenues.

The steps between idea and product vary widely in industry. A new gadget for a mobile phone goes through different phases than does a drug developed at a pharmaceutical company. Still, almost all products, in most science-based industries, go through research, development, and engineering phases before they enter final testing and production.

Industry's research phase comes closest to the type of work academic scientists are most familiar with. Corporate research focuses on the company's long-term product pipeline, the products it hopes to launch over the next 5 to 10 years. Activities during this phase often are not related to a product the company is already selling or about to launch; rather, whole new products are contemplated--even whole new technologies that may or may not become products eventually.

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Not every science-based company has a true research phase; some companies prefer to bring promising ideas in from outside by licensing technologies and ideas from other (usually smaller) companies or academic labs.

After the research phase comes the development phase, when the initial conception is transformed into a prototype that demonstrates the product's desired functionality. In the development phase, concepts are either proven or abandoned.

Finally, it takes a lot of engineering to figure out how to produce a reliable product, with the desired functionality and quality, at a reasonable cost. The engineering phase is furthest from the type of research you're probably most familiar with, but the challenges here are no less formidable. A good idea--or even a good product--cannot serve a company's business needs if it's too late to market or too expensive to produce.

Some scientists find the constraints imposed by industry undesirable restrictions on curiosity-driven work or a compromise of pure science for commercial ends. Yet there is an undeniable thrill in knowing you work on something that will actually be used, whether it's to make the world a profoundly better place or merely to serve consumers while improving a company's bottom line. Moreover, resources such as people, equipment, and money are less constrained as you get closer to a real product.

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THE DIFFERENCE BETWEEN ACADEMIC AND CORPORATE PROBLEM SOLVING

One important difference between doing research in these two settings is that in academia the line between colleague and competitor is vague, whereas in corporate research it is quite clear. Everyone employed by the same company works together (in principle at least) toward the same ends. Communication is fast and open within a company, and interactions with the outside world are restricted. Publishing is carefully controlled in industry so as not to put the company's intellectual property at risk or disclose too much of the company's strategy.

The academic world is not so starkly divided; today's competitor may well be tomorrow's collaborator and vice versa. Alliances are always shifting.

In an academic setting, a surprising result can be a breakthrough, providing a new way of looking at a problem. Even if it isn't a breakthrough, you always have the freedom to redefine your problem and keep your science marching forward. In such a setting, serendipity can be an important ally. This academic attitude--being relatively relaxed on the direction of research--has facilitated much progress in fundamental science.

Corporate researchers rarely have such freedom. In a corporation, research is an expense that is expected to be offset by substantial future revenues. Only a small fraction of conceivable research has profit potential within the limits of a company's expertise and resources, and only the most promising projects are likely to be undertaken. Every new project is a roll of the dice, and an unexpected result requires a whole new calculation of risk and potential benefit.

Thoroughness, too, must often be sacrificed: Too bad a problem can't be solved completely; in industry, what's needed, especially in the development and engineering phases, is not a completely rigorous solution but a way forward on budget and on schedule. A pragmatic answer to a difficult problem has its own sort of elegance and can be equally satisfying for certain researchers.

Another consequence of the strong connection between research and the product road map is that sometimes projects end prematurely. If your company decides for financial or strategic reasons to abandon a line of activities, research in that area will be curtailed. You may be required to abandon your professional passion of the last months or years and embrace something entirely new. This can be quite frustrating, but in the long run regular changes of direction can stimulate your mind and serve your career well.

COMPANIES CARE

Academic science still follows the tournament model, with all but the most accomplished researchers often being taken for granted, or at least feeling that way. Once you've survived

and earned tenure, your academic freedom allows you to do whatever you like--but outside your narrow research world, still no one may care.

Although the years of lifetime employment are over, companies really care about their employees, for very selfish reasons. Companies tend to regard their people--especially their knowledge workers--as their most important assets. They invest in developing, training, and retention in order to nurture and keep the staff they need to meet their strategic objectives.

WHO GETS HIRED

Science-based companies are major employers of scientists, including some with Ph.D.s. Royal Dutch Shell PLC, the British-Dutch oil company, is typical of large, science-based companies when it comes to hiring. They recruit more than 100 academic scientists each year from the Netherlands alone, about 30 with Ph.D.s. ASML, a supplier of [lithography](#) systems for the [semiconductor](#) industry with more than 2000 people working in research and development (R&D) in the Netherlands alone, recruits more than 150 engineers every year, about 30 of them with Ph.D.s.

One common theme in industry hiring is that intellectual attainment isn't the only criterion. Shell company spokesperson Peter van Boesschoten has an acronym for the skills they seek: CART, for capacity, achievement, relationships, and technical ability. "Capacity" means the ability to analyze a wide range of problems, not just those in your narrow area of technical expertise. "Achievement" is the demonstrated ability to get things done. "Relationships" means the ability to work well and communicate well with others. And "technical"--well, that part is obvious to any science trainee.

HOW TO FIND OUT IF CORPORATE RESEARCH IS FOR YOU

Companies provide information, via Web sites and recruiting brochures, about their activities and employment opportunities, but such information tends to be quite general and promotional. Career fairs, where you can talk directly to a recruiter (or whoever is staffing the company's booth), is a better way to learn what type of folks they are and who they are looking for.

Better still is to talk to people within the company with backgrounds similar to yours. Perhaps a former fellow postdoc or grad student works for the company or knows someone who does. Don't be shy; pick up the phone and make an appointment, even if you know them only remotely. Most will be happy to meet you face to face and show you the type of work they do.

But the best way to figure out whether a particular corporate work environment is right for you is to spend some real time there. Many companies provide such opportunities.

ASML has a fellowship program that allows master's-degree students to experience the ASML work environment, according to Frank Wolfs, ASML's human resource manager. "Yearly, we sponsor 30 to 40 master students with a fellowship at the Technical University Eindhoven. They work on lithography-related scientific problems in collaboration with our R&D organization. After graduation, they have a 3-year contract to further experience what it is to work for a leading high-tech company." Many other high-tech companies--especially the larger ones--have similar programs.

NOT YOUR FINAL DESTINATION

It can be hard to leave an academic research post, especially once you have tenure. Moving from a corporate research career back to academia is difficult though not impossible; only a handful of people make the leap, but some do, most in applied programs like engineering departments at the managerial level, where corporate experience is of greater value to academia.

It may be difficult to return to basic science once you are in the corporate world, but it's relatively easy to branch out within a corporate setting.

After several years of R&D experience, many people are eager for new challenges. Many shift

to management, production, sales, customer service, or intellectual property. Shell, says spokesperson van Boeschoten, encourages such changes. "Our people have the ability to move in and out of research within the course of their career if they so wish. One could start and build a career in R&D but also move on to an assignment in operations and project management and then come back to R&D."

A corporate lab might be an interesting environment to do research with a slightly different twist. It can also provide a step into new kinds of stimulating work later on.

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