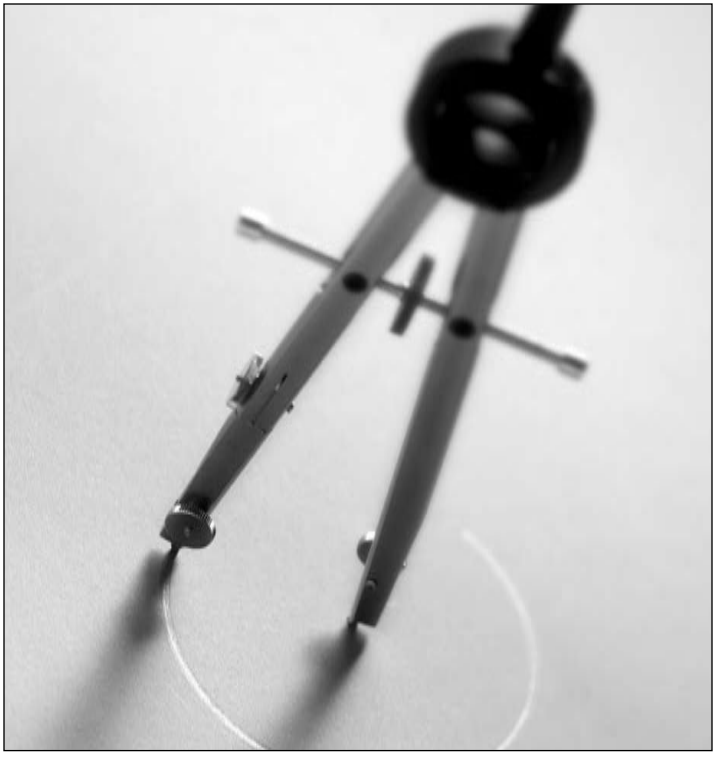

3. Expanding Choices

UNIVERSITY CHALLENGE: Administering Research

by Carol Clugston

As someone who has successfully made the transition from a career in research to one away from the bench, I am often asked what specific steps I took to develop my chosen career in university management. The truth is that my career was not particularly well planned—at least initially—but I have learned a lot of valuable lessons along the way and I now have a career that I greatly enjoy and that challenges me every day.

Best and Worst Mixed Together

I developed a keen interest in science at an early age—I have always been curious to know why things happen and how things work in the natural world around us—and I eagerly began my B.Sc. Honours undergraduate degree without giving much thought to how my career would develop thereafter. Throughout my degree the infectious enthusiasm of several of my lecturers for their subject areas drew me to a career in research, and I embarked on a Ph.D. in molecular genetics.

The time spent earning my Ph.D. was, as I believe it is for many research students, one of extremes—the best and worst times of your life mixed together! Weeks of struggle during which experiments did not go as planned were rewarded by days of elation when positive results made all the effort worthwhile; many unforeseen problems had to be dealt with (equipment breakdowns, vital materials not arriving at crucial times); a myriad of relationships had to be managed with all their attendant challenges, from supervisor troubles to seeking help from colleagues, but at the same time developing friendships that have sustained and grown stronger over the years. There were the agony and ecstasy of presenting research findings at meetings, of writing and submitting papers for publication, and of finally having a completed thesis to submit.

I didn't realise at the time that, throughout the rollercoaster ride of my research project, I was developing a wide range of valuable life skills, including oral and written communication, problem solving, strategic and analytical thinking, project management, time management, and team working. And despite my lack of recognition of them, I continued to develop them over the years and I still use them every day in my current role.

Following my Ph.D., I quickly found employment as a postdoctoral researcher. I spent two years in plant molecular biology followed by six years in cancer research. Although these were different subject areas from those of both my undergraduate degree and my Ph.D., I found it relatively easy to apply my research skills and experience in different subject areas and, on paper at least, my research career was progressing well.

However, I became increasingly disillusioned with research as a long-term career. There appeared to be very few permanent posts and I experienced the practical difficulties and insecurities of life on short-term contracts, among them the issue of securing a mortgage. I felt under pressure to regularly move location to develop my career and I gradually realised that, as a woman, it would be very difficult to pursue a successful career in research unless I was prepared to make sacrifices in my family life.

I did not have children at the time, and I knew of very few successful female researchers who did. What's more, opportunities for part-time working or job-sharing were unheard of. In addition, while I still loved science, I was beginning to find life at the bench very repetitive and my desire to have more variety in my day-to-day activities grew.

Listing Transferable Skills

My decision to leave research was a difficult and daunting one. I had known no other career and initially thought that I had few skills to offer elsewhere. I seriously considered studying for an M.B.A. in order to gain a business-related qualification, but the high cost ruled out this option. Instead I

I had convinced myself that I had a range of useful skills to offer the world outside science, but could I convince an employer?

made lists of the transferable skills I had and of the nonresearch activities that I had been involved in that would demonstrate competencies and commitment outside my functional discipline; for example, I had organised my department's external seminar programme for several years and I had acted as secretary to my local Community Council for a similar period.

When I reviewed the lists, they were more impressive than I had thought they would be. This process helped me to identify my existing skills and, significantly, gave me the confidence to pursue a different career path with a positive attitude, rather than viewing it as faltering in my original plan.

I had convinced myself that I had a range of useful skills to offer the world outside science, but could I convince an employer? It was not an easy task. I applied for a variety of positions that interested me, from jobs in health promotion and health education, to various administrative posts within the higher education sector, and found myself competing with people who had directly relevant experience. Although employers could see that I had enthusiasm, commitment, and potential, it took six months of perseverance to secure my first nonresearch role as a university administrator.

The job that I was offered wasn't immediately the most appealing to me—in fact I considered turning it down—but I developed an instant rapport with the enthusiastic professor who would become my line manager, and I could also see that by accepting the post I would have the opportunity to gain a lot of administrative experience to add to my CV. I believe that I found it easier to get a position within a university, rather than a nonuniversity role, because the university recognised the value of my Ph.D. as a multilevel achievement rather than simply as a specialist in academic publication.

I moved to a subject area that was completely new to me—nanoelectronics—on a reduced remuneration, but from day one I didn't look back. The job was challenging, stimulating, and full of variety. I was immediately responsible for all the administrative aspects of the department, from managing the multimillion pound research budget and coordinating European networks, to organising a major international conference for 300 delegates. I was also responsible for promoting the research of the department and quickly had to learn to deal with regular press enquiries.

The requirement to quickly learn and understand new subject areas and technologies in order to be effective tested the limits of my capabilities. I realised that I had been working within a relatively narrow subject area and I was now exposed to areas of research whose existence I had not previously been aware of. But I also realised that I wasn't wasting any of my previous research experience—every day I was applying the generic and transferable skills that I had developed over the years of being a research student and a postdoctoral researcher. Each day brought different challenges, whether they be solving problems, managing resources, analysing complex data, or presenting technical material in a variety of

formats to a range of audiences. I didn't miss life at the bench for a minute!

I stayed in my university administrator role for two years, building on my existing skills and developing a range of new skills and experience. I was then able to move to a more senior post, as administrative assistant to the university's vice-principal for research. This was an even broader role as it encompassed all the subject areas of the university, and it enabled me once again to use my biomedical research experience as well as my generic skills. It also enabled me to develop a much greater understanding of university management and to see research from other perspectives, e.g., the importance of research income to the university, what "overheads" are, the high costs of accepting charity funding (which covers no indirect costs), how research is balanced with teaching, and how interdisciplinary research can be fostered.

Over the past five years my role has developed considerably and my responsibilities now include many areas of strategy and policy, from helping to develop the university's research strategy and submission to the research assessment exercise, to drafting policies relating to research ethics and misconduct. Most recently I have assumed responsibility for developing the university's postgraduate research strategy and I am working closely with the University Careers Service to ensure that all our postgraduate research students and postdocs have access to generic skills training and personal development planning.

Fortunately, most postgraduate research students today are aware that the majority of them will not have long-term careers in academic research and they are much more aware of their generic and transferable skills through personal development plans and structured career planning. Funding bodies now also offer a wider range of career development schemes that allow for career breaks and part-time working. However, if you are considering a career outside research, my advice would be first of all to be confident of your motivation, and then to go for it! Your Ph.D. is a passport to many exciting career opportunities outside the confines of the laboratory!

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PATIENT TO RETRAIN IN PATENT LAW

by Anne Forde

"Describe a game of hockey to a Martian." That was the task that neuroscientist-turned-patent-agent Sarah Thompson was asked to do when she was interviewing for a job as a patent agent trainee a few years ago. Thompson must have provided a decent impromptu description since she got the job; four years later, she is almost fully qualified as a patent agent.

"You have a lot to learn, but when you can argue the case of your patent application successfully to a patent examiner, it's great," says Sarah Thompson.

So were those interviewers being facetious? Not really. One of the fundamental skills required to work as a patent agent, says Thompson, "is putting difficult concepts into what a layperson—your clients—would understand." True, those clients are not extraterrestrials, but there is a wide gulf between the worlds of law and science, and Thompson's new job is to span it.

Seeking Her Niche

After finishing her undergraduate degree in pharmacology at Bristol University, Thompson wanted to continue her studies and felt that "doing a Ph.D. was a natural progression." She was keen to do a neuroscience research project, so in 1997 she started her Ph.D. at the University of Manchester in neuroimmunology. Thompson investigated the role of anti-inflammatory mediators in context of stroke and the resulting cell death. She soon decided that research was "very frustrating"—and unappealing for the long haul.

While still doing her doctoral work, Thompson found her interests growing broader. She became the editor of a newsletter in her university focused on public awareness of science. She also participated in the Biotechnology YES[1] (Young Entrepreneurs Scheme) competition, an activity that presaged her professional future. In Biotechnology YES, teams of undergraduate or postgraduate science students form a business plan for a virtual company and present the plan to a panel of judges, competing against other teams. The competitors live on-site and the competition runs over three days. During this time, the teams are visited by expert advisers who help them mold their business plans.

One of the competition advisers was a patent agent, and Thompson had the opportunity to talk to him about his job. He agreed to let her shadow him at his office—a private practice in Glasgow—for a day. Through her personal networks, she later gained another week's experience at another private practice in London.

After those brief work stints, Thompson decided to pursue a career as a patent agent. She felt that working in private practice would give her the best and broadest training, exposing her to a wider patent portfolio. As a starting point, she set about investigating what the firms were looking for. "Some places were looking for someone with a specific background, others not," she says. "Some did not even require you to have a Ph.D." In December 2000, she interviewed at the firm Mewburn Ellis L.L.P.[2] Being able to communicate difficult concepts in general terms—like explaining a game of hockey to a Martian—was probably the key to her getting that position, she feels. The following September, she started her new job.

A New Beginning

Although a scientific background is essential for her job, Thompson had to fully retrain to make the transition. For the first two years or so, Thompson worked under the supervision of various part-

ners—senior patent agents—rotating every six months. "For example, I had to read examination reports from the European Patent Office (E.P.O.)," says Thompson. The key question a patent agent has to be expert in asking and answering, explains Thompson, is, "What is the invention? You need to be able to sumarize a lot of complex data to do this. There was lots to grasp."

Patent Agents, Examiners, and Attorneys: What's in the Name?

Patent agents have several employment options, Thompson explains. The first is working in private practice—like a law or accounting firm—where you act as the interface between your client and patent offices. The second is to work "in-house," for example, at a pharmaceutical company. In both scenarios, the patent agent is drafting, prosecuting, and defending the patent.

Patent examiners, on the other hand, review—and then reject or accept—the patent applications submitted by patent agents on behalf of their clients. They are employed by a government or intergovernmental agency, such as the U.K. Patent Office,[3] in Newport, Wales, or the European Patent Office[4] (E.P.O.), in Munich, Germany. Patent examiners may move to work as patent agents, says Thompson, "but not normally the other way around."

In the U.K., registered patent agents can use the title "Patent Attorney" although this title is also used by solicitors who may have no formal qualification in intellectual property.

A year into her training, Thompson spent four months at Manchester University doing a foundation course—a certificate course in intellectual property—in preparation for the first of the two sets of examinations that are necessary to qualify as a patent agent in the U.K. During this period, Thompson studied U.K. and overseas patent law, trademark law, and design and copyright law. "It's an intensive course," says Thompson, "with a lot of subjects to cover." While on the course, Thompson was still on salary at Mewburn Ellis, and the firm paid her course fees. "It was good to do it full-time; not all firms allow that." On completing the course, participants can take an examination that is equivalent to the first of the patent-law qualifying exams. Back at the office, on her return, "I was allowed to be a little more independent," she says.

But her studying was far from over. She still needed to do part 2. The qualifying examinations—especially the second—are notoriously rigorous. Candidates are examined in all aspects of U.K. patent law. Passing the exams, says Thompson, "means studying most evenings and weekends"

"Here you have to make sure you're getting things done and meeting your objectives. It's almost a completely different experience."

beginning many months prior to the exams. The failure rate is high; many have to resit individual papers. Last month, Thompson resat part 2 papers for the second time and is awaiting the results. Last March, she also took the European Qualifying exams—exams the vast majority of U.K. patent agents in private practice and industry take—so she will be authorized to work with the E.P.O. She needs to resit one of these next year.

Gaining Experience and Responsibility

Now that she is working at a more senior level, Thompson says, she really enjoys being able to argue why an invention is worthy of its name—or not. "You are kept up-to-date; intellectually you are on the go the whole time," she says. Agents at her current level manage a portfolio of applications, which means swift decisions and many deadlines. But it's fun.

Last year, Thompson moved from Mewburn Ellis to the biotechnology firm, Cambridge Antibody Technology[5] (CAT), in Cambridge, U.K. Thompson appreciates the broad training she received in private practice, but she now finds specializing "in one particular technology area and working closely with the company's scientists" just as stimulating.

For Those Considering Patent Law

Passing those exams, says Thompson, required tenacity and years of study. Tenacity—and an argumentative streak—have helped her make it as a patent agent. What else? Communication and time-management skills are key, she says. Knowing a foreign language is also useful. Research training is important, but don't expect to work on patents that match your research area. When she was working at Mewburn Ellis, Thompson's "specialty" was all of biotechnology. "I had only one neuroscience-related patent in those three years," she says.

Was it worth it? "It was hard, you have a lot to learn, but when you can argue the case of your patent application successfully to a patent examiner, it's great."

This article first apeared on ScienceCareers.org (Next Wave) at: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2005_12_02/patient_to_retrain_in_patent_law

1. Biotechnology YES: http://www.biotechnologyyes.co.uk
2. Mewburn Ellis L.L.P.: http://www.mewburn.com
3. U.K. Patent Office: http://www.patent.gov.uk
4. European Patent Office: http://www.european-patent-office.org
5. Cambridge Antibody Technology (CAT): http://www.cambridgeantibody.com

LIFE IN BIOTECH

by Jim Kling

Life in the biotech industry is a far cry from academia. It isn't pure science. If you make the leap, expect to be indoctrinated into the world of business, because in industry business goals drive research. And even if you join a company as a scientist, you may find yourself moving out of the lab altogether. "There are lots of scientists who get tapped to do things in project management, business development, or marketing. As scientists, they don't have the background to handle those duties," says Rebecca Rone, who is director of the M.S. program in drug discovery and development at the Massachusetts College of Pharmacy and Health Sciences. The program offers classes in business and financing as well as various biotechnology-related sciences.

A biotech company is a tightly focused environment, where freedom of academic inquiry is often curbed in the interest of completing a project as quickly as possible, whether it's a new drug, a diagnostic technique, or some other science-related product. "In industry you gain knowledge along the way, but your focus is to do whatever you need to do to [to finish a project]. If something doesn't work, you have to realign your focus," says Joshua Seno, who is an associate in corporate development for the technology evaluation group at Amylin Pharmaceuticals in San Diego, California.

Like many graduates, Seno spent a couple of years working in an academic lab after he graduated from Purdue University with a degree in cell biology in 1998. He spent the time working at the Indiana University Medical Center in Indianapolis, Indiana, studying DNA repair proteins and how they respond to heat, a possible adjuvant to radiation in cancer therapy.

"I guess we were working toward some sort of goal [in academic research], but it was not a [well-defined] goal. There weren't any pressing deadlines except to get grants in," he recalls. But the academic life wasn't quite what he wanted. He didn't want to do a Ph.D., and he wasn't sure a master's degree would be any more valuable than the practical experience he was already getting. But when he read an article in *Science* about a new kind of hybrid master's program that combined biological science with business training, he was intrigued.

He settled on the master's of bioscience offered by the Keck Graduate Institute, a program in Claremont, California, that offers classes in biology, bioinformatics, and bioengineering side by side with courses in management, ethics, and business policy. After two years there, during which he did a summer internship at Amylin, Seno hired on at the company. Initially he worked half time in the lab because he wasn't completely comfortable moving into the business side of things, but after about six months he went to his current position full time. He soon found out that things had changed. "[At the Indiana University Medical Center], I felt a little more free to do anything I wanted, whereas here you have to make sure you're getting things done and meeting your objectives. It's almost a completely different experience," he says.

Seno's primary focus is researching therapeutic or technology areas

that Amylin is considering investing or participating in. For example, he was assigned to look into proteomics—to survey the field, identify the key players and potential collaborators, and survey the technology providers. He also performs financial analyses for specific projects. Once he identifies an opportunity, his role is to pursue relationships with companies, make contacts, and begin to set up potential deals. "My job as ... the rookie in this group is really to handle some of the smaller scale projects, whereas people with more business development experience would handle bigger projects," he says.

Cross-disciplinary programs like Keck were created because of a lack of business training for scientists that join the biotech industry, but Rone also sees a need for cross-disciplinary education. "Several people have mentioned to me that they think the pipelines have dried up because we've taken advantage of the easy hits—the [targets] that Mother Nature has informed us about. There is a real feeling that we have to totally reinvent things in order to come up with [new classes of compounds], and the best way to handle that is to have understanding between the disciplines," she says. That means that molecular biologists, cell biologists, chemists, pharmacologists, and bioinformatics specialists must be able to communicate with one another in order to combine their efforts.

You need that kind of communication just to get anything done in a small biotech company, says Douglas Gjerde, CEO of San Jose, California-based PhyNexus. "Today's small company has to produce. I firmly believe in the ability of the individual to have an impact, but the individual needs help. The only way that's going to happen is if they ask for help in a very specific way. You have to know enough [about another discipline] to know how to ask a question."

But don't get too caught up in trying to know a little bit of everything. Specialization is still very important. To succeed in industry, "you have to know at least one [discipline] extremely well, and you have to know the jargon of others," Gjerde says.

So be an expert, but be a generalist, too.

No one ever said the life in the biotech industry was easy.

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MAKING THE LEAP: When, How, and Why a Career in Drug Discovery May Be Right for You

by Matthew Bell

As a young scientist considering a career in drug discovery, you may have many questions that need answers. How does the pharmaceutical industry work? How would my career progress? What skills are companies looking for? Would I do high-quality science? Is it a better option than academia? The answers to some of these questions depend, of course, on the individual scientist. But the good news is that the pharmaceutical industry has many opportunities for scientists seeking a career in drug discovery, both in the laboratory and out.

First Things First—Is There an Opportunity for Me?

Creating new drugs is a risky, expensive, and time-consuming business. A top-10 pharmaceutical company will employ over 1,500 scientists, and spend over $1 million every day, on discovering new biological targets and creating new therapeutics (chemicals, proteins, or vaccines) to move forward into clinical testing. In total it can take more than 10 years to get a new drug to market, and the effort will involve thousands of people from many scientific disciplines.

In such a large and complex organization, there are many different career options for young scientists. If there is a life sciences discipline being pursued in academia, there will be a pharmaceutical industry opportunity in a similar field. No longer limited to biology and chemistry, the pharmaceutical industry offers long-term careers in various disciplines and subdisciplines (see Tabulation 1). Furthermore, cross-functional scientists are becoming an increasingly valuable commodity. As systems biology begins to take hold and bear fruit, there will be an increasing opportunity for scientists with multiple degrees: information technology with biology, statistics or mathematics with bioinformatics, pharmacology with genomics, and so forth. The opportunities are many.

Where Do I Start, and How Does a Career Progress in Industry?

You can make the leap into industry at any point in your science career. A promising young life scientist can secure an entry-level drug discovery position, usually termed "associate scientist" or "scientist," with a bachelor's degree in science. At this level you are responsible for completing basic experiments and will be a member of one or more cross-functional project teams that focus on discovering and progressing new medicines. These teams will have representatives from many scientific disciplines: chemistry, biology, and others. With a Ph.D. or postdoctoral experience, you can expect greater seniority and control over your own activities, and you also can expect to be leading these project teams soon. Being team leader of a discovery project is akin to being the senior postdoc in an academic lab, controlling the key staff and activities associated with a given line of research.

The good news is that drug discovery is unique in offering multiple career options that let you stay close to science without the daily grind of laboratory life.

The most successful team leaders can, in time, move into broader management positions, gaining progressively greater responsibility in terms of staff size, budget, and ability to impact strategy and direction. These people focus on managing other scientists (usually of the same discipline) and eventually attain the title of director in most companies; job titles are remarkably consistent between big companies. For many, this is the pinnacle of a successful career in drug discovery, but the most successful and ambitious directors will usually get promoted to head up entire departments, often with upwards of 100 people. Department heads can expect a title of vice president; they are akin to the very high-profile, large group, successful principal investigators (PIs) in academia. In the organization I work for there are about 15 vice presidents (senior leaders), and about 60 directors (middle managers) in a discovery organization of 1,300 staff.

Tabulation 1. Common Drug Discovery Disciplines

Biology	**Chemistry**
Assay development	Analytical chemistry
Cellular biology	Medicinal and synthetic chemistry
Electrophysiology	Rational design
Genomics and molecular biology	Computational chemistry
Medicine	In silico and de novo design
(Behavioral) pharmacology	High throughput screening
Physiology	
Protein biochemistry, expression, and synthesis	**Related Sciences**
Protein engineering and biopharmaceuticals	Engineering
Proteomics	Mathematics
Structural biology and crystallography	Statistics
Veterinarian services	Bio- and chemi-informatics
	IT, hardware, and software design

Many scientists don't like the daily grind of grant writing and administration that comes with a successful career as a PI in academia. Similarly, many scientists in industry have no interest in a progression into management. These scientists prefer to stay close to the science and away from the details of management, politics, and company bureaucracy. Thankfully most pharmaceutical companies recognize this and work especially hard to retain their best scientists, usually by offering an attractive nonmanagement career ladder. In many organizations these bright, dynamic, and innovative scientists can expect to become distinguished re-

search fellows, on par with the most senior leaders of the organization but without day-to-day management duties and with the time and authority to focus on developing innovative new ideas, new technologies, and new science. It would be like being a visiting professor every day.

Tabulation 2. The Five Myths of Working for Industry

1. You don't get to publish
Not true. Most pharmaceutical companies strongly encourage publication of scientific work and often link bonus payments to high publication levels.

2. You don't get to go to conferences
Not true. Pharmaceutical companies generally encourage scientists from all levels to attend key conferences as both delegates and presenters.

3. You just screen or make compounds all day
Not true. A drug discovery operation is made of many different disciplines and involves many activities including a lot of basic research.

4. You are not free to follow your own interests or to be innovative
Not true on both counts. Innovation and creativity are strongly encouraged and scientists spend significant time exploring new hypotheses and approaches.

5. The science is not as good as in academia
Not true. Pharmaceutical companies claim many high-profile publications, patents, and groundbreaking concepts every year.

Why Do Scientists Choose Industry?
The majority of drug discovery scientists are motivated by the chance to discover a new medicine. Imagine being the first chemist to synthesize an important new treatment for Alzheimer's disease. Imagine being the first biologist to champion a new therapeutic approach for the treatment of cancer, and see it work. The desire and opportunity to do good science motivates industry scientists, just like their academic colleagues. In addition, the pharmaceutical industry offers a substantially higher salary (often double the academic level), better working conditions, plentiful equipment, and a superior work environment.

That said, industry isn't for everyone. Some scientists detest the idea of being accountable to a budget, of having to be part of a company culture, or following company strategy. Some scientists will always prefer to write grants and carve out their own niche, which works best in academia—not within a large company. But when you are deciding whether industry or academe is best for you, don't base your decision on the myths that circulate in academic circles (see Tabulation 2). Most are untrue much of the time; others are wrong all of the time.

Love Science, Hate the Lab
Many scientists want to stay in the science world, but don't like the idea of a lab-based career. The good news is that drug discovery is unique in offering multiple career options that let you stay close to science without

the daily grind of laboratory life. A platform in basic science can be the stepping stone to careers in pharmaceutical patent law, business planning and strategy, project management, operations management, publishing, media, communications and promotional activities, management consulting, competitive research, regulatory support, and business development (setting up alliances with biotechnology partners). These functions are all critical to drug discovery, are intellectually stimulating, and give a great opportunity to stay within science while leaving the lab behind.

What Next?

Drug companies are always keen to attract and recruit the best scientists. They are looking for a solid university track record, good publications, and evidence of good communication, team, and leadership skills. If you desire a career in the pharmaceuticals industry, think of yourself as a valuable commodity and network relentlessly. Annual reports and Web sites are great places to start looking for information. Medline is a good resource to identify researchers' names and scientific fields of interest.

Conferences are a great way to introduce your self to companies. Don't limit yourself to the accompanying career fairs. Visit posters and attend talks presented by drug companies and make a point of expressing interest in what they do and asking about potential job openings. Take along CVs and publication reprints. Take advantage of your personal connections; network via colleagues and friends. At the very least, get your resume out to the human resources directors at pharmaceutical or biotechnology companies that interest you. See if internship programs are available. Remember: The more contacts you make, the greater the chance of hitting upon a company that works in a technology or research area that you are interested in, and the greater the chance that one of those companies will be interested in you.

There is no way to tell for sure that a career in industry is right for you, but it has one piece of compelling data in its favor; scientists who move from academia into industry rarely move back again.

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