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Careers in Chemistry: Keys to Success … *Beyond Hard Work!*

Catherine T. (Katie) Hunt,
President, American Chemical Society, 2007

Chemistry at a Crossroads

I am not what I was twenty years ago and neither is the chemical enterprise. While the United States has held a leadership role in science and technology to date, indicators show that we are ceding this enviable position to foreign competition. The fast-growing economies of China and India are rapidly gaining on us in number of science and engineering patents granted, number and quality of students graduated, and levels of R&D funding committed and invested.

You only have to read Thomas Friedman's *The World Is Flat*—or better yet, look around you—to see that globalization is upon us and there is no turning back.

But all is not lost—with every challenge comes an opportunity; or as my father used to say, *"When the going gets tough, the tough get going!"* I started at Rohm and Haas in 1984 as a bench chemist in analytical research. Today, I lead technology partnerships at the Rohm and Haas Company. I have lived through downsizing by proactively looking for new opportunities and, in short, reinventing myself.

Keys to Success … *Beyond Hard Work!*

Everyone has his or her own slant on success and what it takes. Here's my view of what's important, if not essential:

1. Know and develop your own "toolbox."
2. Engage mentors—to hone skills and minimize weaknesses.
3. Establish strong networks—that work!

1. Know your own "toolbox"—leverage your strengths. I don't have to

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tell you that "in the highly competitive, global economy of the 21st century, mathematics and science are no longer pursuits for the few. They are requirements for all." (*A Commitment to America's Future: Responding to the Crisis in Mathematics and Science Education*, Business–Higher Education Forum, 2005). In short, "the future well-being of our nation and people depends … on how well we educate [you, the next generation] in mathematics and

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science specifically" (*Before It's Too Late: A Report to the Nation from The National Commission on Mathematics and Science Teaching for the 21st Century,* Commission Chair, John Glenn, 2000).

That said, not only do you need to have the math and science skills to be successful; you need leadership skills gained through training and mentorship. From your ranks will come our future leaders and we will need leaders at all levels in our organizations—from teachers to professors to college presidents, from technicians to senior scientists to CEOs, and from interns to staffers to members of Congress.

In a recent ACS Leadership Pilot, it became clear to me that extraordinary leaders bring together three things: alignment (clear priorities, organizational focus, and teamwork), competency (skills to get the job done), and passion (seemingly unbounded energy and enthusiasm). When you see an award-winning national meeting, regional meeting, local section, or student affiliates group, you can see all three of these leadership characteristics shining through!

ACS provides extraordinary examples of collaboration among students and their advisers, among Student Affiliates and local teachers and schools (they've been doing chemistry demos for years), and among members across sections, states, and countries around the world (organizing their own scientific meetings complete with keynote speakers and poster sessions), to mention just a few. All of these forums test our commitment, build our confidence, and ultimately develop professional leadership skills.

Every opportunity that I've had to interact with ACS members, affiliates, and sister societies has touched my heart and renewed my faith in the future. I especially congratulate the Women Chemists Committee, Younger Chemists Committee, and Student Affiliates for their active participation in local, national, and international ACS activities. There is no question in my mind that these ACS experiences will better prepare them for the exciting and challenging experiences that lie ahead.

2. Engage mentors—hone your skills. A mentor is defined as a wise and trusted adviser. Some companies have programs that assign mentors to new employees. That said, I think the most successful matches are the ones you choose yourself.

So, how do you choose a mentor? First, this should be someone who has qualities or skills that you'd like to emulate or develop. Second, this must be someone with whom you feel comfortable talking candidly. You'll need to discuss your career objectives (short- and long-term), your skills and abilities (strengths and weaknesses), and your specific mentoring goals (why you've chosen this individual and how you think he or she can assist you). It will be important that each of you actively participates by listening, as well as talking. Don't overlook your graduate adviser, school dean, or local ACS section and division leadership.

So, what's the best way to "engage" a mentor? Do your homework, consider the pros and cons, and then, just ask. Contact the individual by phone or e-mail and schedule a face-to-face meeting. Bring along a one-page document that highlights who you are and what you're looking to do. This can serve as an icebreaker, an agenda, and a leave-behind. If the first "getting to know you" meeting goes well, you will want to schedule additional follow-up discussions.

In addition to considering mentors, executive coaches, or both, have a look at *The Art of Speed Reading People: How to Size People Up and Speak Their Language* by Paul D. Tieger and Barbara Barron-Tieger. The communication skills discussed in this book can be very useful both at work and at home.

Drawing upon my current participation in Legislative Action Networks, I will join forces with leaders across academia and industry to advocate for better legislative support for science and technology—making agency visits, finalizing policy statements, and following up, face-to-face, with Congressional Visits.

3. Establish Networks—That Work! Investing in the physical sciences is an investment in the future! Incremental improvements are important, but we will not "tweak" ourselves to greatness. Sustainable growth will be driven by ongoing investment in cutting-edge, step-out innovation.

Convinced of this, I set out to build a Rohm and Haas technology partnership team from the ground up. Our ongoing collaborations were—and continue to be—aimed at accelerating the pace of discovery. This is achieved by bringing together world-class scientists, partnering with government agencies, focusing on mastering the fundamentals, and delivering viable commercial products.

As ACS President, I will work to promote this type of entrepreneurial step-out research, which I feel is critical to our playing a leadership role as the largest scientific society in the world.

Drawing upon my current participation in Legislative Action Networks, I will join forces with leaders across academia and industry to advocate for better legislative support for science and technology—making agency visits, finalizing policy statements, and following up, face-to-face, with Congressional Visits.

Giving a face to science and technology is not a one-person job. Imagine if we could mobilize our ACS members, who number more than 158,000, and the members of our sister scientific and related professional societies. Consider taking on a task of your own choosing—join the Chem demo circuit, sign on as a speaker, write your legislators, bring in new members! In this way, you will be giving science and technology a stronger voice on Capitol Hill and a familiar face to the public. In short, joining together will increase our impact, build our confidence, and enhance the public's opinion of our profession.

It is my firm belief that no one company, one university, or single scientific society should go it alone. So, why should you go it alone? I urge you to think "outside of the box"—or more to the point, outside your normal circle of collaborators. As individuals, think about partnering with your local or university libraries for chemistry outreach. This might be done in collaboration with CINF, the Division of Chemical Information. Consider partnering with sister societies in legislative visits or letter-writing campaigns. This might be done in partnership with OLGA (ACS Office of Legislative and Government Affairs). Consider starting or being part of a program like Professor Susan Olesik's W.O.W. program (Wonders of Our World), which now has more than 500 volunteers and pairs college students with local scientists for the purpose of supporting school teachers and bringing chemistry alive in elementary classrooms.

And I encourage you to be innovative. Try different communication media such as wikis or blogs to brainstorm ideas or drum up interest in thematic programming along the lines of The Sustainability of Energy, Food, and Water at the ACS Spring Meeting to be held in Chicago in March 2007. Or, why not try podcasting to communicate your specific outreach activities for National Chemistry Week, to be held in October 2007, or webcasting to ______ (*you fill in the blank).* And when you are ready for funding, consider writing an ACS Innovative Activities Grant proposal.

What's the ASK?

As I was growing up my mother always said, "Ask and you shall receive; seek and you shall find; knock and it shall be opened unto you." Of course, I know today that this quote did not originate with my mother, but it still stands.

I believe that the scientific community is at a crossroads. So, I am asking you to work with me to reignite our commitment to science and technology fueled by education, collaboration, and innovation—education to engage the next generation; collaboration to build a vibrant and vocal technical community; and innovation to provide the resources to recreate our companies, our universities, and ourselves.

I welcome your questions, comments, or suggestions and can be reached by e-mail at president@acs.org. I look forward to working with all of you to make our ACS vision a reality.

Improving People's Lives through the Transforming Power of Chemistry! ■

Dr. Catherine T. Hunt is Leader of Technology Partnerships at Rohm and Haas Company and President of the American Chemical Society, 2007.

Editor's Column—Employment

Marjorie C. Caserio, University of California, San Diego

Getting that first job, stepping onto the career ladder, can be a daunting experience, especially in this time of uncertain and rapid change. The experience can be exciting when change is science driven, but worrisome when dictated more by politics and economics. Graduates and those in the workforce pipeline deserve a candid look at the employment situation in the chemical sciences to help them make sound career decisions. We offer a sampling of such information in this issue of the *Newsletter.* You will find valuable insight into employment trends in the chemical industry (H. N. Cheng, p 4), the pharmaceutical industry (Kim Albizati, p 6), and the National Laboratories (Peterson and Allen, p 8), as well as a stimulating article on chemistry careers from ACS President Catherine (Katie) Hunt (p 1). You will also find firsthand commentaries from four recent Ph.D. graduates about their respective job search experiences. There is less coverage of academic employment because it has been highlighted in previous issues under the Academic Employment Initiative (AEI). Finally, please take a look at a new column beginning with this issue called AskGradEd, in which relevant questions and responses are featured (p10).

A big plus of ACS membership is the weekly issue of *C&EN*. This incredible publication does a great job of reporting the status of employment and salary in chemistry and chemical engineering. These reports are based mostly on data generated by surveying the ACS membership. Although it may seem pointless to receive employment questionnaires from ACS that seem to ask the same questions year after year, the responses to them are essential for reliable reporting on the health of the profession. It struck me that it may not be obvious, particularly to new graduates, that there is a close connection between the questionnaires and the *C&EN* employment reports. (It took me years to understand the relationship.) Also, several types of employment reports appear in *C&EN* in a calendar year, and again, it may not be obvious what distinguishes them. So I thought a brief explanation might be helpful.

The ACS routinely conducts two types of annual survey of its members' employment and salary. One targets a statistical sample of all active members, including graduate students and postdocs, for information about their current employment status and salary. The other targets new graduates entering the workforce in order to get a reliable handle on starting salaries. The raw data from each survey are statistically sorted and analyzed by the ACS Department of Member Research and Technology. Generally, the results appear as reports in C&EN along with editorial commentary. The Employment and Salary Survey appears in either August or September of each year (for the most recent report, please see *C&EN* **2006,** *84* (38), 42–51). The results of the Starting Salary Survey likewise appear annually in *C&EN* (for the 2005 survey, please see C&EN 2006, 84 (32), 42–51). You may recognize that the article by Henly and Kasper-Wolfe on page 9 *of this Newsletter* is based on the 2005 Starting Salary Survey. In addition to reporting the annual survey results, *C&EN* puts out a cover story on an annual basis (usually in November) called "Employment Outlook," which builds on the various survey results and additional professional input (for example, please see *C&EN* **2006,** *84* (45), p 33–34).

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That is not all. Every five years since 1985, the ACS has conducted a census of its working members that is more comprehensive than the annual employment and salary surveys. The published results, the ACS ChemCensus report, offers an illuminating picture of employment in the

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chemical and chemical engineering professions over an extended time period (currently twenty years). The most recent

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is the 2005 report, which is available as a 60-page pdf file replete with all manner of charts, tables, and analyses of data on the status of the workforce since 1985 (please see reference 4 in H. N. Cheng's article, page 6). The five-year census, together with the annual employment surveys, provides a pretty good picture of the current status and ongoing changes in the job situation. The whole survey process falls under the purview of the ACS Committee on Professional and Economic Affairs, the working arm of which is the Department of Career Management and Development.

This may sound boringly "corporate" as you are immersed in exciting graduate or postdoctoral research, but it is not a good idea to ignore—or to allow your focus on research to obscure—current and future employment prospects. There are additional informational resources to be aware of, such as the AAAS Web site ScienceCareers.org The site includes a wealth of information and career-development articles helpful in matching scientists with jobs in industry, academia, and government. There is also the ACS career Web site Chemjobs.org. Lastly, we mention the new program "Preparing for Life After Graduate School," which directly connects graduate students with career information while they are in graduate school (please see *Graduate Education Newsletter* **2006,** 5 (1) p 3–5).

We hope that you find this *Newsletter* of interest and we welcome your comments and suggestions at GradEd@acs.org. Remember, the *Newsletter* is on the Web at www.ACSGradEdNewsletter.org. ■

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Employment Trends in the Chemical Industry

H. N. Cheng, Hercules, Inc.

A couple of days ago I went to the local Wal-Mart store and found a calculator priced at $10. It had an attractive display, many mathematical functions, and other added features. Thirty years ago such a calculator would sell for $100. Today, hundreds of calculators are in the marketplace, made mostly overseas, all clamoring for consumers' attention. This is what happens to a mature product with many suppliers and relatively steady demand. In the same store I also saw some specialized calculators with graphics or programmable capabilities; although they were more pricey (about $100), they seemed to sell.

Whereas calculators are not chemicals, there are similarities to the job situation in the chemical industry. Jobs are subject to the same economic factors as commercial products, such as supply and demand, competition, value proposition, specialization, and globalization. In the past several years, the job market for industrial chemists and chemical engineers has seen quite a few changes, partly reflecting the changing times we live in.

In this article, I shall first look at the big picture of supply and demand, and then zoom in on some specific issues related to employment trends in the chemical industry.

Supply and Demand

Demand. According to figures from the Bureau of Labor Statistics (BLS),[1] the chemical and allied products industry employed 602,700 wage and salary workers in 2006, which equals approximately 4% of the total number employed in all manufacturing in the United States. The distribution of their occupations, except in pharmaceuticals, is set forth in the accompanying table, Distribution of Employment in Chemical Manufacturing—2006.

The BLS data also indicate that chemical employment in these areas has declined by 11% in the past 10 years and will decline by another 14% in the next 10 years.[1] A number of factors may be cited for the decline, for example:

1. Mergers and acquisitions in the chemical industry;
2. Restructuring and reorganization;
3. More efficient work processes and increased worker productivity;
4. Increasing plant automation;
5. Globalization, leading to increased foreign competition and job movement overseas; and,
6. Safety, health, and environmental concerns.

Underlying these factors is the maturity of many chemical products. Relatively little competitive advantage exists for them, and business activity often depends on competitive pricing. Many companies have partly remedied the problem by producing specialty chemicals in order to differentiate their products.

Supply. Overall, the supply of chemists and chemical engineers in the United States appears to be decreasing. This supply change is influenced by several factors, including:

1. The retirement of baby boomers,

Distribution of Employment in Chemical Manufacturing—2006

Manufacturing Sector	Employment	%
Basic chemicals	149,800	24.9
Soaps, cleaning compounds	120,600	20.0
Resins, rubbers, fibers	113,500	18.8
Paints, coatings, adhesives	70,000	11.6
Agricultural chemicals	40,000	6.6
Other chemical products	108,800	18.1
Total, all chemical industries	602,700	100.0

2. The decreasing number of U.S. students studying science and engineering, and,
3. Immigration.

The first wave of baby boomers turns 60 this year. Data from the Census Bureau show an increase of 10.1 million people over the age of 65 in the next 10 years (roughly 3% of the U.S. population of about 300 million).[2,3] Similarly, the ACS survey gives 47 as the average age of ACS members.[4] Thus, we can reasonably expect a fair number of people to retire in the next 10 years.

As for graduate students enrolled in chemistry and chemical engineering in the past 10 years, the data from NSF show a 12% decrease.[5] This is partially offset by foreign students, some of whom will stay in the United States. The net result of all these factors is a decrease in the supply of chemists and chemical engineers in the near future.

Supply–Demand Balance. For a steady job market, it is beneficial to achieve a balance between supply and demand. Currently, the future supply and demand in the chemical industry are both decreasing. However, the decrease in demand (about 14% of the chemical workforce) involves a large number of people, while the decrease in supply (primarily involving retirees and new graduates) involves fewer people. Thus, it is not surprising that the BLS has projected a downward employment trend of about 12% in the chemical industry (excluding pharmaceuticals).[6]

Whereas the forecast for the traditional chemical industry looks gloomy, we should point out that for many years, chemists have found employment outside the long-established chemical manufacturing areas, working instead, for example, in pharmaceuticals and biotechnology. In fact, ACS survey data indicate that since 1992, more than 90% of the new jobs created have come from the latter two employment sectors.[4] The same BLS projection that shows a 12% decrease in traditional chemical jobs also shows a 38% increase in pharmaceutical manufacturing jobs in the next 10 years.[6] Thus, the overall job market (traditional chemical industry + pharmaceuticals + biotechnology) should remain robust.

Employment Trends Within the Field

Job Opportunities. If we take a closer look at job opportunities and employment trends within the chemical field, we will be able to note several bright spots.

1. Pharmaceuticals and biotechnology offer the largest number of job opportunities, as noted above. In fact, 1/3 of ACS members under 40 and 1/5 of chemists over 40 are currently working in pharmaceuticals or related fields.[4]
2. Another growth area includes service labs,[4] such as those that provide chemical analysis and product testing. Some companies that used to handle these types of work internally are now outsourcing them to decrease their overhead. Some of these analyses are specialized and more efficiently handled by outside labs (e.g., environmental monitoring, asbestos testing, elemental analysis, microscopy, microbial testing, and immunoassay).
3. Increasingly small companies are hiring a larger proportion of chemical graduates.[4]
4. The demand for patent-related personnel is increasing. For example, the U.S. Patent Office is expected to hire 1,000 patent examiners per year in the next 5 years.
5. On the academic side, there is an expectation of a significant number of retirements, which will create some job openings in the next 10 years.

Innovation. As noted before, the decrease in chemical employment results partly from mature products, technology parity, and commoditization. One way to avoid these pitfalls is through innovation. Indeed, most companies are keenly aware of this problem and continue to innovate. This may entail developing new or improved products or processes, applying new tools or technologies, or finding new opportunities or new markets. To this end, some companies have set targets for introducing new products as a certain percentage of their total offerings.

Of course, a large part of cutting edge research in the United States is done at universities. New technologies can open up new fields, reinvigorate old fields, and stimulate new business activities. A welcome trend is the increased employment by small companies. Many of these small companies are pursuing new technologies or new markets. Some of the small companies are spin-offs from university research. It is to be hoped some of these technologies will be successful and help propel future employment.

Multidisciplinarity. Over the past several years, the boundaries among scientific disciplines have begun to blur.[7] In industrial, academic, or government labs, chemists increasingly work in biology, medicine, food science, materials, agriculture, forestry, electronics, and computer science. Several fields are also emerging at the interfaces of these different disciplines, among them nanotechnology, sensors, bioinformatics, systems biology, functional genomics, metabolomics, combinatorial chemistry, and computational chemistry. While it is too early to tell whether these fields will become huge commercial successes, the dynamism and the excitement they generate can only be viewed as positive developments.

Globalization. The term "globalization" refers to the increased mobility of goods, services, labor, technology, and capital throughout the world. Global outsourcing (or offshoring) refers to the migration of jobs from the United States to foreign countries.[8] The main force driving globalization is cost reduction against the backdrop of an increasingly competitive market; thus, the phenomenon can potentially strengthen U.S. companies and help them compete in the future. The in-sourcing of some jobs to the United States by foreign companies partly compensates for the outflow of U.S. jobs. However, at least for now, the effect appears to be a net loss of jobs for the United States. We should keep an eye on this development and observe its impact on future U.S. employment.

Relevance to Education

U.S. graduate education in chemistry and chemical engineering is still the best in the world, although other countries are rapidly catching up. To keep the chemistry enterprise healthy and to maintain our manpower pipeline, we need to support university research in both fundamental science and applied areas.

While it is true that the number of U.S. students studying science is decreasing, we still want our share of the best and brightest students. In view of the dynamic job market, students need to be broadly trained and flexible. They also need to keep up with advances in technology, learn new skills, and be prepared to navigate one or more job changes in the workplace.

In summary, the current data suggest that future employment in the traditional chemical industry is likely to decrease by 12% in the next 10 years, but the situation

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is mitigated by opportunities in related scientific areas, such as pharmaceuticals and biotechnology. It is to be hoped that the positive trend of continued innovation in industrial and academic laboratories as well as in small companies may provide future vitality for the industry. Globalization remains an uncertain factor in future employment.

At the beginning of this article I mentioned the Wal-Mart calculators. They carried different price tags, some for $10 and some for $100. Depending on the market needs and the technologies they offer, both types of calculators sell. Likewise, a variety of chemical jobs may exist in the future, and some of them will be different from those in the past, but the future of the chemical job market is still bright for those chemical professionals willing to learn and adapt. ■

Dr. H. N. Cheng is an ACS Councilor of the Polymer Chemistry Division and the 2006 Chair of the ACS Committee on Economic and Professional Affairs (CEPA). He is a senior research fellow and team leader at Hercules Incorporated, Wilmington, DE.

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Employment Prospects in the Pharmaceutical Industry: A Period of Change and Uncertainty

Kim Albizati, BioVerdant, Inc.

Although this article will deal with employment opportunities in the pharmaceutical industry, I will deviate somewhat to discuss hiring practices, the kind of education and experience the industry values, and how to prepare yourself for a career in pharmaceuticals. A lot of what you will read is my humble, yet supercilious opinion, based on 7 years in academia and 14 years in the pharmaceutical industry.

Therefore, the industry will probably proceed cautiously for the next few years. We can expect hiring practices to be changing and inconsistent as pharmaceutical companies undergo more transformations, as companies get more experience—good or bad—with offshoring, and as price pressure on drugs starts to take its toll.

Where Is the Pharmaceutical Industry Going?

Like most types of business and manufacturing, the pharmaceutical industry generally goes through cycles of boom and bust, with the hiring rates and practices tending to mirror these ups and downs. At this time, however, the pharmaceutical enterprise is changing rapidly in response to outside pressures from many sources. Two major pressure points face the industry today, and they will exert opposite effects on growth and employment rates.

The more prominent is the pressure on drug prices coming from a large number of sources. These include consumers, medical insurers, various governing bodies, and, interestingly, drug distributors such as Wal-Mart. The second factor is the growth and emergence of the workforce in the scientific–industrial complex in other countries, most notably India and China.

The latter will create a negative impact on hiring from American universities while the former will probably favor it. Therefore, the industry will probably proceed cautiously for the next few years. We can expect hiring practices to be changing and inconsistent as pharmaceutical companies undergo more transformations, as companies get more experience—good or bad—with offshoring, and as price pressure on drugs starts to take its toll on the industry's traditionally high margins. The industry will have to change and that, in turn, will translate into hiring uncertainty and fluctuations for the next two to five years.

What Can a Student Expect in the Coming Years?

So, what's in store for the 13,000–14,000 people who receive chemistry degrees each year? A large percentage of them will not seek jobs in chemistry, choosing instead to follow career paths in medicine, dentistry, law, and other professions. For those who stick with chemistry, historically around 25–30% have been hired by pharmaceutical- or health-related companies.

In general, a chemist beginning a career in private-sector pharmaceuticals will take one of two routes—Big Pharma or Biotech. Big Pharma comprises 50 or more large, well-established companies that combine full-service drug development and marketing. The Biotech field is composed of hundreds of smaller companies varying from 10 scientists or so to perhaps several hundred. These businesses engage primarily in drug discovery and early- to mid-stage drug development. Biotech also includes a sizable number of companies in the medical device field and others engaged in platform technology development for the industry.

Big Pharma and Biotech exercise fairly distinct hiring practices, especially at the Ph.D. level. Big Pharma companies generally look for freshly minted graduates when hiring Ph.D.s. They hire comparatively few highly experienced people unless they are searching for a specific type of expertise. Biotech businesses, on the other hand, generally look for instant expertise and—at least in their first several hires—seek mostly individuals with significant pharmaceutical industry experience.

Scientists with bachelor's and master's degrees are in higher demand right now. My practical experience tells me that qualified holders of B.A., B.S., and M.S. degrees are much harder to find, despite their numerical superiority to new Ph.D.s. Both Big Pharma and Biotech companies hire widely across the experience spectrum when it comes to B.A., B.S., and M.S. degree scientists.

Although there are advantages and disadvantages to working in each part of the private sector, this is not the proper forum for discussing them. However, it is worth mentioning that the proportion of new drugs and new drug candidates originating in the Biotech companies—versus those originating in Big Pharma—is growing. As a result, several advantages of employment in Big Pharma are disappearing. For example, Big Pharma used to offer greater job stability and higher pay. This is no longer generally true. If any company, big or small, experiences a few adverse events—such as the failure of a key drug candidate, or drugs going off patent, or some other calamity—it is a foregone conclusion that scientists will be "downsized." Further, the Biotech industry has come to realize that they must offer competitive compensation if they wish to obtain the best scientific talent; therefore, starting chemistry salaries in Biotech are becoming comparable to those in Big Pharma.

What Kinds of Training Will the Industry Be Seeking?

The pharmaceutical industry tends to hire mostly scientists with backgrounds in analytical or organic (primarily synthesis) chemistry. It offers fewer positions for biochemists (mostly in the discovery research groups), inorganic chemists, and physical chemists.

Companies hire organic chemists into their medicinal chemistry and process chemistry groups, while they employ analytical chemists in either analytical chemistry or drug formulation groups, depending on each individual's prior experience and expertise. The breadth of analytical problems a scientist could experience is fairly large because many sections of a company's discovery and development research organization may include analytical chemistry groups. Most hiring into the organic chemistry realm occurs from synthetic chemistry groups in academia; less takes place out of what might be called the non-synthesis based groups.

My personal opinion is that the industry's process groups need to take a much longer look at people coming from catalysis and physical organic chemistry backgrounds rather than the large organic synthesis groups. The best and most forward-looking employers (again, my opinion) will seek to hire scientists with broad expertise and experience, not narrowly-defined specialists in a single area. In any case, a background in organic synthesis—whether gained as an undergraduate, graduate student, or postdoc—is, and will continue to be, a valuable and highly desirable experience to the industry. However, formulation and materials science are growing in importance. A greater demand for people with training in these fields, as well as in related areas of physical chemistry, will reflect that.

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All this being said, breadth of exper– tise and experience is also important for long-term career growth. One underappreciated aspect of the pharmaceutical industry is the number of nonresearch, science-related career paths it offers, which are available to and generally taken by people with scientific training. I would estimate that about a third of the people who begin a career in pharmaceutical chemistry research veer off this path. They pursue tracks not directly related to chemistry—in law, regulatory affairs, quality control, project management, or other areas within the industry. Keep this in mind as you train yourself. You don't really know how your interests or life will change in the years following graduation. The good thing here is that the peculiarities and the discipline inherent in science training prepare you for a lot of different careers in the pharmaceutical industry. All things considered, the best course of action for the long run is to gain broad training, but keep it firmly based in one of the major branches of chemistry. For instance, if you get a degree specializing in synthesis, move on to something else in your next level of schooling.

Scientific competence and training aside, nonscience skills also rank high on the list of attributes important to hiring managers. The pharmaceutical industry uses a research structure based on project teams. You will find that good communication, social, and teamworking skills will prove crucial in taking you far in the industry.

Final Comments

As yearly surveys conducted by *Chemical & Engineering News* suggest, job satisfaction in the field of chemistry runs quite high. We are fortunate to be working in such a challenging, interesting, and fun profession. Although employment prospects in the industry will be uncertain for the next few years while significant change occurs, pharmaceuticals will continue to be the largest employer of chemists in the private sector of the chemical industry. A student can take various actions to maximize long-term employment prospects in what is sure to be a cyclic field over the next few decades. For those in school, make your training broad by working on a variety of problems in different fields. Try to guess what you will want to be doing in 10 years. Decide whether career or other considerations (such as location, family, or environment) are paramount and search for a job accordingly. For those already in the industry and considering a change, think outside the science box. Is there something else in the industry you really want to try? For those out of school and trying to break into pharmaceuticals, look at your chances realistically, but persevere. Think about working in smaller companies to get some experience. Above all, enjoy your time in science. Our era will be viewed as a "Golden Age" when seen through the looking glass of history. ■

Dr. Kim Albizati is the CEO of BioVerdant, Inc., an environmentally focused pharmaceutical company in San Diego that he founded after years of experience with Agouron and then Pfizer. He joined the pharmaceutical industry following a successful faculty career at Wayne State University.

Employment at National Laboratories

E. S. Peterson, Idaho National Laboratory
C. A. Allen, Idaho National Laboratory

Scientists enter the national laboratory system for many different reasons. For some, faculty positions prove scarce, so they take a staff-scientist position at a national laboratory (e.g., Pacific Northwest, Idaho, Los Alamos, and Brookhaven). Many plan to work at the national laboratory for 5 to 7 years and then seek an academic post. For many (these authors included), before they know it, 15 or 20 years have gone by, and they've never seriously considered leaving the laboratory system.

The Department of Energy (DOE) owns 15 government research laboratories that constitute the "national laboratory system." Although the land and the buildings belong to the federal government, universities and corporations run the laboratories, which are found in 12 states and employ roughly 65,000 scientists and engineers. The DOE's national lab system is best known for huge, expensive projects—such as building accelerators and nuclear reactors—but national lab scientists work across a wide array of disciplines, from particle physics and materials chemistry to environmental and life sciences.

For many doctoral-level scientists, a career in the national laboratories provides an environment for research and learning that is free of the teaching obligations of universities. The labs exist, in a sense, halfway between the academic and industrial worlds. Here, scientists basically provide for themselves through grants and contracts in an arrangement resembling soft-money research institutions. However, the scientists need not teach, as they normally would at a university.

Generally speaking, scientists at national laboratories work with multidisciplinary teams to solve problems important to the U. S. government. Output consists of peer-reviewed publications; internal reports; and new processes or instruments for energy, environmental management, or national security. Contrast this both with the usual university model, wherein a single investigator assisted by students conducts basic research to produce peer-reviewed publications, and with industrial research conducted by multidisciplinary teams to develop new commercial products and processes.

The Laboratories

At the laboratories, research-focused scientists may take one of two directions. The first would be to develop a personal research area of interest that also follows the needs of the laboratory. The other would be to develop shorter-term research directions that serve the needs of the laboratories' larger programmatic efforts. Many of the "national labbies," as they casually refer to themselves, use both approaches to remain funded and develop a long-term research direction. The laboratories typically group and finance the scientists and engineers according to the project or projects (e.g., Polymer Science) that they work on; a research group manager leads them. The labs typically draw managers at the research group level, who have firsthand research experience, from the scientific ranks.

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Funding for projects comes in smaller allotments to the individual performing research on smaller projects; it may arrive at the laboratory in larger quantities for larger programmatic efforts (building a nuclear reactor, for example). The DOE, which receives its money through annual congressional appropriations, provides most of the funding. In addition to the big-money efforts, national labs can set aside some of their federal dollars for small research projects that the labs deem "high risk." These projects are known as Laboratory Directed Research and Development (LDRD) Projects. Sometimes they lead to results that allow the scientists to expand the work into larger programmatic efforts.

What Direction for a Scientist?

In addition to choosing between two directions for their research work—big, group projects or small, individual projects—Ph.D.-level scientists can generally opt for one of two career paths: research or management. The laboratories offer entry-level researchers either postdoctoral or staff positions. Starting salaries for these openings vary by lab, field, and the employee's experience. Just like their industrial counterparts, scientists and engineers at the laboratories work their way up through a series of ranks by publishing, patenting, presenting, and carrying on productive research. Salaries vary widely, starting at approximately $35,000 for postdoctoral workers and junior staff and increasing to over $100,000 for senior staff.

Candidates for the management track at the labs often come from the ranks of researchers and generally share similar salary ranges. At Idaho National Laboratory, four or five levels of managers exist, starting with those at the group level who oversee scientists directly and moving to upper-level managers who oversee multiple groups of scientists. The top managers focus on winning and maintaining the large-dollar-value programs.

Is a National Laboratory for You?

The national laboratories are not for everyone. Although some people excel in that setting, the political aspects of working there drive others crazy. Additional problems arise from working in a national lab. You have to contend with a lot of paperwork, and you have to abide by many more rules and regulations than if you were in a university setting. Rules, politics, and paperwork aside, how well the labs fare on the national political scene also affects you. Of course, universities and industry include bureaucratic impediments as well. In universities, these include the "Publish or Perish" mindset, tenure, and issues involving committee work. Industry, on the other hand, offers increased employment security, but with reduced publication opportunities.

Hiring On

Like any institution, the national laboratories actively recruit for, advertise, and post employment opportunities. They also offer summer training programs for students, educators, and other scholars. Many of the larger programs attempt to hire undergraduate and graduate students for these short-term appointments simply to give them the flavor of working at a federal facility.

Each national laboratory focuses on its own areas of research. Performing background work in these fields will aid prospective applicants in targeting laboratories that are carrying out research congruent with their interests and expertise. The easiest way to find out what the various laboratories are doing is to visit their Web sites and learn about the research activities at each one. (Simply go to "google.com" and enter "National Laboratories" in the search box.) It also pays job seekers to attend national-level conferences such as those hosted by ACS and AIChE. Additionally, it is important to listen to presentations made by laboratory researchers working in areas of interest to you as a student.

The national laboratories do not advertise all their career openings. Direct contact between prospective applicants and laboratory scientists often helps identify research groups thinking of adding either permanent or postdoctoral staff. Also, many of the national laboratories send recruiters to the Employment Clearing House at ACS National Meetings. Students looking for positions should register at the Employment Clearing House and set up interviews with national laboratory recruiters, even if the labs have not posted positions that match the student's expertise. Sometimes the recruiter is aware of positions that may open in the future.

Some national laboratories engage in classified research. Because of that, they rarely employ foreign scientists. The end of the cold war and the nationally decreased interest in nuclear energy left the labs with an aging population until the terrorist attacks of 2001. As a result of the subsequent increase in national security and energy research, the national laboratories are seeking to hire a number of new scientists. This is a good time for graduate students to consider employment there. If you have a Ph.D. in chemistry, materials science, physics, or math, the national laboratories offer a lot of career growth opportunities. ■

Dr. E. S. Peterson is a joint appointee as a Program Director, in the National Science Foundation's Engineering Directorate, and is the Process Science and Technology Business Line Lead at the, Idaho National Laboratory.

Dr. C. A. Allen (retired) formerly Manager, Chemical Sciences Division, Idaho National Laboratory.

Starting Salaries for New Graduates in 2005

Megan Henly
Janel Kasper-Wolfe, American Chemical Society

Results of the 2005 Starting Salary Survey, which documents starting salaries and employment characteristics for new graduates, indicate that the workforce has stabilized somewhat (please see *C&EN*, August 7, 2006, 84 (32), 57–64). This is good news after a slight downturn in salaries in the early part of the decade. Salaries varied only slightly depending on the type of employer, type of work, and size of employer.

Starting salaries for recent chemistry graduates with less than a year of work experience were up in 2005. The average salary for inexperienced bachelor's degree recipients was $35,202, or about 3.6% higher than the average starting salary in 2004. However, after adjusting for inflation, the 2005 average is only marginally higher (0.2%) than that of the prior year. Master's degree and Ph.D. recipients in chemistry reported considerably larger salaries in 2005 as compared to the 2004 graduating class. The real increase in salary was 3.8% for chemistry M.S. degree recipients with little or no work experience and 5.1% for chemistry Ph.D. recipients. The 2005 average starting salary was just over $48,000 at the master's degree level and just under $69,000 at the doctorate level.

While this increase over last year is promising, in terms of constant dollars, salaries still fall short of those earned by graduates in the year 2000. The job market was strong in the late 1990s to 2000, and salaries for scientists and engineers rose quickly during this period. From 2002 to 2004, salaries in chemistry stagnated, even declining in terms of real dollars. However, data from 2005 indicate that starting salaries for chemists may be back on track. ■

Janel Kasper-Wolfe is Research Associate with the ACS Department of Member Research and Technology.

Megan Henly is an Independent Consultant.

Ask Grad Ed

AskGradEd is a new column in which we share with you some of the questions we receive about the graduate and postdoctoral experience, along with our responses. We hope you will find this of interest. The topic in our first column relates to the important question of letters of recommendation.

Dear GradEd:
A close friend and former colleague from my research group has gone on to a postdoc and is currently applying for both academic and industrial positions. He's learned from other alumni from our group that our dissertation adviser puts off writing letters of recommendation and often misses deadlines, even with repeated reminders. My friend is asking his postdoctoral adviser to write a letter, along with two other professors with whom he's collaborated. However, he's concerned that the lack of a letter from our dissertation adviser will hurt his chances. Is there anything he can do to help alleviate this problem? I'll be in the same situation in a couple of years. Is there anything I can do now to avoid this being an issue for me?
—Concerned

Dear Concerned:
Your question has two parts, an immediate problem for your friend that requires an immediate solution, and a longer-term issue for you. As far as your friend is concerned, lacking a letter from his dissertation adviser is not necessarily a disaster, especially if there are letters from his postdoc adviser and other faculty. Some companies may prefer a phone reference to a letter, and your adviser is probably amenable to taking a call from a prospective employer. Academic employment is less flexible, and the dissertation adviser's letter is important. (In the rare case that the adviser is indifferent to the candidate, it may be better to have no letter in the file than a poor letter.) There are a few steps your friend could take. One is to talk directly with his adviser about the missing letter. This may reveal whether it is a simple case of procrastination or something more serious. If it is the latter, it is time to seek help from another faculty mentor, or possibly the department chair.

Since you still have a couple of years left in graduate school, my main advice is to be sure to nurture a positive relationship with your adviser, so she or he will be a strong advocate for you when the time comes. Also, make sure that you develop good relationships with other faculty members—whether other members of your dissertation committee or perhaps someone with whom you work as a teaching assistant—so you will have other people willing to write letters on your behalf, if necessary. As a practical matter, when you need the recommendations, provide in writing the names and addresses of all those who should receive your adviser's letter, including deadlines. You might even provide stamped addressed envelopes, if you feel that your adviser would regard this as helpful.
—GradEd

We welcome your questions for the new AskGradEd column at GradEd@acs.org. Please indicate whether you would like us to use your name or keep you anonymous.

Preparing for Life After Graduate School (PfLAGS)

How can chemistry graduate students and postdocs prepare for entering the workforce?

PfLAGS is a two-day workshop designed to inform chemistry graduate students and postdocs about their career options after graduate school and how to prepare for them. About two-thirds of the PfLAGS workshop is directed toward nonacademic careers in business and industry. This complements other ACS programs targeted to graduate students and postdocs seeking academic careers. Broadly defined, the workshop covers three topics: defining careers for chemists; some nontechnical skills and knowledge needed for career success (with an emphasis on industry); and finding employment opportunities (including a postdoc). A third optional day includes mock interviews and resume reviews.

In its pilot year, the PfLAGS workshop was presented at the University of Wisconsin–Madison, Princeton, Purdue, and Texas A&M. These workshops have received outstanding evaluations from the graduate student participants, and already six more workshops have been planned for this year, including one at the ACS Central Regional Meeting in Cincinnati.

The PfLAGS workshop is available to chemistry departments at Ph.D.-granting universities through the ACS Office of Graduate Education and the Department of Career Management and Development. If you would like more information or your department is interested in finding out more about hosting a session of PfLAGS, please contact the ACS Office of Graduate Education: GradEd@acs.org; 202-872-4588.

Reflecting on the Job Search

We invited recent graduates to comment on their experiences in their employment searches. Here are their insights. We hope you find them helpful.

A Postdoctoral Appointment

Julia Clay, Eli Lilly and Company, Indianapolis

While doing postdoctoral research is not right for everyone, the decision to do so was an easy one for me. I not only wanted to improve my knowledge as a synthetic organic chemist, but I also knew the experience would improve my chances of getting the job I wanted as a chemist at a large pharmaceutical company. These are the main reasons to do a postdoc after the completion of the doctorate.

Timing is important when applying for a postdoctoral position. After consulting with my adviser, I decided that eighteen months in advance would be appropriate. This would allow me time to solve a significant problem associated with my graduate research and to publish results prior to applying. Additionally, it would give me time to apply for external funding once I was accepted into a group.

In determining where to send my applications, I considered three key factors. For me, the most important one was the focus of the adviser's research. While some people elect to do postdoctoral research in a different field of chemistry from their graduate research, I was interested in continuing in organic chemistry. The next factor I considered was whether geographical restrictions might limit my ability to find the best program. Lastly, it was critical to consider the mentoring style I needed in a postdoctoral adviser.

After giving each of these considerations a significant amount of thought, I made a list of 10 to 15 professors who fit my criteria. I consulted with my thesis adviser and other faculty members whom I trusted about who would be a good match for me. This was one of the most important parts of the process. Behind closed doors, many people were able to share very candid opinions, and this not only helped me to shorten my list, but also boosted my confidence in the people I applied to.

At this point, I divided my list into three groups. My "A List" contained my top choice. My "B List" consisted of other advisers whose research also excited me. My "C List" was also viable. This type of ranking system is important if you choose to apply to more than one professor at a time, because once you are accepted, it is inappropriate to expect the professor to wait to see if you get a "better offer." Alternatively, you can apply to one at a time in order of preference, but this can become problematic if you have to wait a long time to hear about the status of your application.

After giving each of these considerations a significant amount of thought, I made a list of 10 to 15 professors who fit my criteria. I consulted with my thesis adviser and other faculty members whom I trusted about who would be a good match for me.

Having made a decision about my top choice, I began to assemble my application packet. It contained four key components. First, I wrote a cover letter that included biographical information, my scientific accomplishments, and why I was motivated to work for the particular professor. Second, I included a brief research summary that did not exceed three pages. Third, I provided a two-page CV that included three personal references with contact information. Lastly, I provided copies of my publications and manuscripts in preparation. Because I was advised *not* to e-mail a postdoctoral application, I mailed my application from the post office.

After I mailed the application, it was an excellent time to ask my adviser to call the professor on my behalf. This can accelerate the process, and in fact some postdoctoral advisers do not review applications until the thesis adviser has called. The process of waiting to hear generally takes weeks, although it is probably OK to inquire about the status of your application after four to six weeks so that you can apply elsewhere if necessary. There is a delicate balance between not wanting to harass a potential adviser and also not wanting to wait forever to hear a decision.

I was fortunate because I received an offer in the group that was my first choice. Following the initial offer by phone, I promptly sent my acceptance by e-mail. This is standard practice. Furthermore, it is important to get the offer in writing and to find out whether the offer is contingent on your ability to get external funding.

While my postdoctoral appointment did not require me to apply for external funding, I wanted to apply for a postdoctoral fellowship anyway. There were two reasons for this decision. First, I was excited about the possibility of being funded to research my own scientific proposals. Second, while external funding was not required, obtaining a postdoctoral fellowship would pay my way and allow my postdoctoral adviser to use his grant monies in other ways. I applied to the two primary funding agencies in my field. It generally takes at least four to six weeks to write a competitive fellowship application. It helps to contact the future postdoctoral adviser early and often. Another consideration is that the people providing references often need plenty of lead time to write supporting letters.

Looking back on my postdoctoral appointment, I can say that I accomplished my goals. I recently obtained a fantastic job as a medicinal chemist with a large pharmaceutical company in the geographic location of my choice. I feel that this would not have been possible without my doing postdoctoral research. Furthermore, I feel that the knowledge and experience I gained over the last eighteen months was invaluable and will help me to succeed in the future. ■

Julia Clay did her postdoctoral work at Princeton University.

An Appointment in Industry

Paul Nowatzki, Bayer MaterialScience

I started interviewing on campus in Fall '04 and was flexible about job type. At the time, my sense was that the job market was very competitive, although slightly better than it had been a year or two earlier. There was some demand for synthetic chemists, but not much else. I knew three people who looked for (and found) professorships only because industry jobs were so scarce. I'd observed a similar thing after finishing my undergraduate degree in chemical engineering—despite the strong reputation of our school, fewer than half of my classmates found relevant jobs. I have a hard time reconciling the proclamations that technical talent is scarce or that there's a shortfall of future scientists with the reality of the current job market. I do perceive that prospects improve once you have some industrial experience.

I went to several on-campus interviews. The primary topic of discussion was my graduate work. The other questions were primarily "behavioral," like "tell me about a time you disagreed with your adviser." I was never asked my strengths and weaknesses or anything quirky. Some weeks after interviewing, I got a couple of "not interested now" e-mails but typically heard nothing one way or the other. Months later, I did get interview invitations from two companies that initially said no; my resume must have stayed in their databases. One thing I heard was that many midwestern or small-town companies don't even bother to interview candidates at schools in California, because students there so rarely accept offers. It's important to emphasize your excitement about the city where the company is located.

Over the course of several months of searching, I was invited to a total of four on-site interviews. Some companies gave me a chance to meet with prospective peers during the day; at others I interviewed only with supervisors. Interviewers usually described their jobs and responsibilities and mostly ended up talking more than I did. I found it difficult to be relaxed while interviewing on-site because of the occasion's importance. I imagine it helps if you adopt the attitude that you are evaluating the company as much as they are you, but this is tricky for people who are anxious to receive even one job offer.

In the end I got three offers; the first two were from companies that were essentially interested in hiring smart people regardless of their research experience. I was surprised to find that my offers were nearly identical in compensation, as were those of my fellow graduate students. Combined with the fact that you're typically given only two weeks to decide and thus don't have multiple open offers to leverage, it's hard to ask for more money. I still think it's worth trying, and it helps if you're willing to walk away.

One thing I heard was that many midwestern or small-town companies don't even bother to interview candidates at schools in California, because students there so rarely accept offers. It's important to emphasize your excitement about the city where the company is located.

Having now seen the interview process from the company perspective, I would suggest that people not read too much into a particular yes-or-no result. Many external postings attract hundreds of applicants, so some arbitrariness is unavoidable. It can also be hard to clearly judge whether an interviewee will be an effective employee or not, even if you spend several hours with him or her. Impressive publication records are nice concrete evidence, but productivity in this sense is often driven by the academic adviser more than the student. One good investment I think you can make is spending time to learn as much as possible about the companies and their industries beforehand. In the end, I think that what is sought in employees varies widely by company and by manager: Is the person making the hiring decision looking for a technical genius, a future leader, or maybe just someone he or she can identify with and who will be friends with or complement the team? There are many niches, so don't be discouraged by initial failures. ■

Dr. Nowatzki received his Ph.D. in Chemical Engineering from Caltech in January 2006 and immediately took a position as an Associate Scientist at Bayer MaterialScience in Pittsburgh.

An Academic Appointment

Amanda J. Haes, University of Iowa
Department of Chemistry

In the first year as a faculty member, there are many firsts—first classes, first students, first time managing a sizeable budget, first time being on the other side of the table during the interviews of potential faculty members. It is a little overwhelming to think back to one year ago, when I was the one who was being interviewed. This first year has been, to date, one of the most intellectually challenging—yet rewarding—journeys of my professional life. While this process is exhausting (as is life as an assistant professor), I would go on this journey again if I had it to do over.

I didn't always want to be a faculty member. In fact, I was very vocal about *NOT* wanting to go into academics. What changed my mind, you might ask? In general, it was a lot of little things that made me question my career goals. For instance, when faced with the opportunity to accept an "ideal" industrial job—something that I had been working toward all through graduate school—I questioned whether that was what I really wanted. After much deliberation and hesitation, I turned down my industrial offers. This decision was the tipping point that eventually led me to the place where I am today.

In all honesty, I am still not sure

whether academics is the right career path for me in the long run. I have been told that this attitude is a sign that I should not be a faculty member. Supposedly, successful academics know all along that they want to be faculty members. When I was trying to decide whether I should apply for an academic position, the thought that I didn't want it enough (or hadn't wanted it long enough) was in the back of my mind. As a result, I procrastinated and felt apprehensive about the entire academic job search process.

With some reservations, my "official" academic job search began in August 2005 at the Academic Employment Initiative, which took place at the ACS fall national meeting. That evening's poster session turned out to be a great networking opportunity. Of the 12 interviews that I went on, I made contact with 7 of the schools at this event. Furthermore, this was my first chance to tell the academic community that I was looking for a job. Overnight, I became really excited about my academic possibilities, and I have not looked back since then.

I spent the entire month of September working on my academic applications and searching the ads for job openings. I submitted my applications by the end of that month. October was reserved for worrying about whether or not I would get any interviews. Luckily, by the end of the month I had scheduled several interviews; however, my new worries were just beginning. Now, I needed to convince schools that I had the potential to be a successful colleague and that my presence would fill a niche that would strengthen their departments. My first interview took place in mid-November and I scrambled to get my presentations and budget ready for that two-day visit. Interviews continued on through December and January as I often flew directly from one school to the next. With each interview, I learned a lot about myself, science, and different types of schools and departments. In the end, I was fortunate in having to make a difficult decision, as I had found multiple schools where I could see myself pursuing my career. I had negotiated with several universities to get acceptable offers, but I could only accept one.

If I had it to do over again, I would not procrastinate. I would not listen to the voices that suggested that I would fail because I hadn't always wanted to be an academic. I would not be intimidated by the horror stories about interviewing that I had heard from those who had gone before me.

Life as an assistant professor is definitely challenging! Have I really been prepared to do this job?!? Each day, I am constantly learning or trying something new. I am finding that my skills as an experimental chemist work well in approaching new challenges. With the support of my mentors and colleagues, I am managing to find my way. Life is busy. I depend on my time management skills to keep me on track. I realize that I must make sacrifices in my personal life for my career and my students. Despite this, I refuse to give up my family and friends. If the day comes when I lose these things, I will change career paths. Nothing is more important than the people that I love.

Of the 12 interviews that I went on, I made contact with 7 of the schools at this event. Furthermore, this was my first chance to tell the academic community that I was looking for a job. Overnight, I became really excited about my academic possibilities, and I have not looked back since then.

I feel hopeful that I am on the right track. Only time will tell whether this is the right career path for me. Ideally, I hope that my students and I will do exciting science and make new discoveries that people will notice. I hope that this research will be funded in a sustainable manner. I hope that I am and will continue to be a successful teacher in the classroom and lab. I hope that I can be a role model for students and help them find their passion for science. I hope that I can make a difference in terms of mentoring the next generation of female scientists. I will strive to be realistic, optimistic, and enthusiastic. As I have learned in life, hard work, a positive attitude, and a solid but flexible plan go a long way toward the achievement of any goal. ■

Dr. Haes received her Ph.D. in 2004 from Northwestern University. Following an NRC postdoctoral fellowship at the Naval Research Laboratory, she joined the University of Iowa in 2006 as Assistant Professor of Chemistry. The focus of her research program is the properties of nanostructures.

Transition from Graduate School to Industrial Employment

Christopher J. Ciolli, Abbott Laboratories

When asked to prepare an article describing my transition from graduate school to industry, I immediately began to think of the many organizations and individuals who helped me through it. The process began with a discussion with my adviser about both my remaining graduate school objectives and my career possibilities. During this conversation, we established a tentative timeline for my graduation. Then I spoke with additional chemistry faculty members, requesting their supporting recommendations and additional feedback. The ACS also provided countless tools to aid my transition. Using the guidance and templates available in ACS's *Resume Preparation: Tips for Chemical Professionals* as a starting point, I prepared my resume and made extensive revisions based on input from classmates and my wife. I also used another of the many benefits of being an ACS member—the Career Consultant Program. This service offers free mentoring from experienced chemical professionals to candidates preparing to enter the job market. My career consultant provided insightful recommendations for my resume as well as guid-

Continued on page 14

Continued from page 13
ance throughout the job search process.

As a fourth-year chemistry graduate student at the University of Wisconsin–Madison, I participated in fall industrial recruiting visits hosted by the chemistry department. These visits provided exposure to a wide variety of career opportunities available to chemists. Abbott Laboratories was one of many companies that held seminars that provided valuable information about the benefits of working for the company. One of the presenters was a member of Abbott's human resources department. At the conclusion of her presentation, she offered to return to campus to give seminars on relevant topics for job seekers, so I invited her to speak in the Lincoln Seminar Series, a student-organized research seminar series that I was coordinating at the time.

As part of her visit, the Abbot representative indicated an interest in meeting with undergraduate and graduate advisers to strengthen Abbott's relationship with the department. I arranged for these meetings as well as a lunch provided by the department. Her seminar covered interviewing skills and was well-attended by both undergraduate and graduate students.

During the course of preparing for and hosting the seminar, the presenter from Abbott and I discussed my job search. As a result, she recommended me for a position in Abbott Diagnostics Division (ADD). I had already submitted a general application and participated in a behavioral-based screening interview, but I had not yet received a response. However, after she recommended me, I was promptly contacted by the hiring manager for the open position and began the interview process.

This experience underscores the importance of networking. In preparation for and throughout the interview process, the ACS *Interview Handbook* proved to be a very useful reference. Successful phone and site interviews led to an offer of employment during the spring of my fifth year. Again, my ACS career consultant provided valuable guidance as I negotiated my eventual employment agreement. This, along with advice from a contact in the biotechnology industry, gave me direction for my salary negotiation that helped me greatly, inexperienced Ph.D. chemist as I was. By networking and using all possible channels, I was able to obtain the position at Abbot, which was a great fit for me.

The ACS also provided countless tools to aid my transition. Using the guidance and templates available in ACS's *Resume Preparation: Tips for Chemical Professionals* as a starting point, I prepared my resume and made extensive revisions based on input from classmates and my wife.

Within a week after my thesis defense, I began my current position in ADD. I am a senior process scientist working in a Good Manufacturing Practices (GMP) production and process support lab. Although I was working in a new environment, I discovered that many skills I had developed in graduate school facilitated my entry into industrial employment. For instance, my first observation after making the transition was that, compared to a graduate research lab, this one required a large amount of value-added documentation to monitor the production of chemical reagents for in vitro diagnostic assays. Remaining an expert learner, a contributing factor to success in a Ph.D. program, enabled me to grasp the intricacies of performing organic synthesis in a regulated laboratory. Helpful and supportive colleagues and management also greatly aided in the transition. The ability to remain humble as a novice in a GMP laboratory enabled me to acquire the knowledge that I would need to become competent and eventually lead in my functional area.

Although technical knowledge is critical to success in my position in industry, many other skills have increased in importance relative to their role in graduate school. The work in a Ph.D. program revolves around the efforts of the individual, small scientific groups, or both. Contrast this with industry's large, multifunctional teams—many of whose members may not share a similar scientific background—where the ability to communicate and persuade a diverse group becomes critical. Success in this situation depends on being willing to act as a team player, work well with others, and put team objectives on a par with individual goals.

Although sometimes stressful, the transition from graduate school to industry has been an enjoyable experience. Remaining adaptable to changing requirements and expectations throughout the transition has partially alleviated the striking differences between working in a graduate research lab and a GMP production and process support lab. I have greatly benefited from services available free to ACS members, guidance from trusted mentors, networking, and a supportive family. As I progress through my career, I would like to continue to build on these resources and offer the same support to my colleagues and other ACS members. ■

Dr. Ciolli received his Ph.D. from the University of Wisconsin, and is now a senior process scientist at Abbott Laboratories, Illinois. He was the founding graduate student member of the ACS Graduate Education Advisory Board .

CALLING ALL GRADUATE STUDENTS!

Enter the Presentation Competition for Chemistry of Biorenewable Materials and Fuels!

The best presentations will receive recognition at the March 2007 ACS National Meeting.

The top presenter will receive an invitation to join leaders in the field for a 10-day study trip to top labs for biorenewables in Brazil!

Graduate students who will be presenting contributions on relevant topics (posters, preprints, or slides) at the 2007 ACS National Meeting in Chicago, March 26–29, may enter the contest. Presentations must address the chemistry of biorenewable materials and fuels, particularly subjects relating to crop-based and natural-product biomass conversions for biofuel and biomaterials, standards and metrology, storage and transportation, or byproducts.

An advisory group of prominent U.S. and Brazilian chemists working in the fields of biorenewable materials and fuels will designate the top submitted contributions as "Best of Biorenewables Student Presentations" at the meeting. Students will receive certificates to acknowledge their accomplishments.

The author of the best student presentation at the ACS Chicago meeting will receive an invitation to participate in a visit to top research labs in Brazil, which will take place in May and June 2007, as well as a joint presidential symposium at the annual meeting of the Brazilian Chemical Society. Brazil is a recognized world leader in developing biorenewable materials and fuels. The American Chemical Society will provide for travel, accommodations, and local expenses in Brazil, through a grant from the U.S. National Science Foundation Discovery Corps Fellowship program.

Winning presentation content will also receive consideration for presentation in Web-audio seminars for audiences in the United States and Brazil.

It's easy to enter the contest! By March 23, 2007, send a pdf version of your accepted contribution (poster, preprint, or slides) to Dr. Bradley Miller at b_miller@acs.org. Please indicate the ACS Technical Division and assigned number of your paper.

AEI
Academic Employment Initiative

Boston, MA

ACS NATIONAL MEETING

Monday, August 20
8:00 to 10:00 PM
Sci-Mix

AEI Poster Session

Deadline for AEI abstract submittal is April 9

If you are interested in academic employment or planning to hire new faculty in your department, you are invited to attend the AEI Poster Session at Sci-Mix, where academic recruiters will meet with academic candidates.

At Sci-Mix, the popular interdisciplinary poster session, each candidate seeking a faculty position will present a poster about his or her research or one expanding on research interests, teaching philosophy, and experience. Faculty recruiters will have the opportunity to meet as many candidates as reasonably possible. Candidates will also have a chance both to network among themselves and to meet faculty from many more institutions than would normally be possible.

Posters should be submitted through the Online Abstract Submittal System (OASYS) at http://oasys.acs.org/oasys.htm. **The deadline for submitting the AEI Abstracts is April 9.**

Please write to the ACS Office of Graduate Education at GradEd@acs.org if you have any questions regarding the Academic Employment Initiative, or visit our website at chemistry.org/aei.html.

To Our Readers

This newsletter is published by the ACS Office of Graduate Education (OGE). To learn about other OGE programs, please visit our website at chemistry.org/education/student/gradeducation.html. As you will see from this newsletter, the American Chemical Society is strengthening its focus on graduate education in recognition of the importance of post-baccalaureate studies to the discipline and the profession. For individuals, learning is a lifelong continuum, but society has organized (quantized) education into levels, one dependent on another. All are important, but the graduate level is especially so because it is the gateway to progress in the chemical sciences.—Editor

Write to Us

Your letters and comments are welcome, and, space permitting, we hope to include them in future issues. Please contact us at the Office of Graduate Education, American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036; 202-872-4588; fax, 202-872-8068; GradEd@acs.org.

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