Monthly Meeting
William Carroll, ACS President
Elect on an Agenda for an Active Year

Younger Chemists Committee (YCC)
Symposium and Networking Event

Speaker’s Bureau

Employment Guide
ACS Career Services

Summer Research Scholar Report
Travis Pribauskas
2003 Norris/Richards Scholar
NESACS News

Northeastern University
Chemistry Professor Named 2003 Carnegie Foundation for the Advancement of Teaching Massachusetts Professor of the Year

Patricia Ann Mabrouk, Associate Professor of Chemistry & Chemical Biology at Northeastern University, has been selected as the 2003 Carnegie Foundation for the Advancement of Teaching Massachusetts Professor of the Year.

The U.S. Professors of the Year Awards, created in 1981, are the only national honors for excellent teaching in higher education. Administered by the Carnegie Foundation for the Advancement of Teaching and the Council for Advancement and Support of Education, the U.S. Professors of the Year program rewards outstanding college and university faculty for their excellence in undergraduate teaching, their impact on and commitment to undergraduate students, and their contributions to undergraduate education at their institutions, in the community and their profession.

In 1996, she won a National Science Foundation CAREER award. She is being recognized by CASE for her leadership in chemical education and student mentoring. A strong advocate of practice-oriented education, Professor Mabrouk has opened her graduate research laboratory to thirty eight undergraduates from Northeastern University, MIT, Cornell University, Regis College, St. Francis University, and Wellesley College and to seventeen minority high school students from Boston Health Careers Academy, Boston Latin Academy, Charlestown High School, and West Roxbury High School. Mabrouk is particularly proud of the fact that nearly one-third of her thirty-eight peer-reviewed publications in biophysics, materials science, and chemical education include undergraduates or high school student co-authors. Patricia Ann Mabrouk is the eldest...
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THE NUCLEUS

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The Northeastern Section of the American Chemical Society is renewing and revitalizing its Speaker's Bureau. The Section maintained the James Flack Norris Speaker's Bureau under the supervision of Mary Ann Solstad from 1981-1994 and Michael Dube from 1994-2000. It is now being headed by Susan M. Buta.

The importance of an active speaker’s bureau should not be underestimated. Chemists are the public’s best resource for understanding the importance of chemistry in our every day lives. We know the major strides toward Green Chemistry, new materials, new process, etc. that our industries have made and we should be the bearers of our own good news. We are also most able to confront the misconceptions about our profession with knowledgeable answers.

Our revived Speaker’s Bureau must be useful and desirable to the general public. Speakers, theoretically, would be in better demand if they respond to the needs of the community. To understand those needs, over 50 towns, schools, and community groups were contacted in the spring and summer of 2003 to glean their interests. Survey results show that very popular interests include understanding energy sources (coal, natural gas, nuclear, and alternative sources), the chemistry of automobiles, global warming, food chemistry (caffeine to dyes), contemporary topics in chemistry (nanotechnology, combinatorial chemistry, etc.), careers in chemistry, the greening of the chemical industry, water and air purification and protection of our waterways (including impacts from households), household chemistry (including household chemicals and toxic substances, chemical storage and safety at home) and the human body as a biochemistry lab (including simplified genetics, vitamins and food supplements, good chemical practices to keep your body healthy, drugs and the body, and understanding our senses). And don’t forget the kid’s chemistry: toys (slime, glow sticks, silly putty, etc) bubble gum, bubble baths, and chemical demonstrations). Though other topics are certainly welcomed, it is desirable and imperative to respond to the needs listed above.

Consider, then, your role in educating the public on chemical matters. You may have an expertise in one of the areas above and can prepare a presentation. Or perhaps, you have interest in developing your own knowledge in one of the areas. We also encourage you to partner on a topic with another colleague. In partnerships, even planning becomes inspiring! We have developed training materials to help make your participation effective, efficient, and most of all enjoyable.

Many companies and higher education institutions are supportive of their employee’s interest in community service. If you are a business owner or manager, consider promoting participation in the Speaker’s Bureau as a form of company recognition and employee development. A favorable public is built on familiarity and that breeds trust. Help NESACS spread the good news of chemistry to our area schools, cities and towns, and community organizations. Contact Marilou Cashman by calling or e-mailing the NESACS office at 1-800-872-2054 or MCash0953@aol.com today!
Biography

William F. Carroll, Jr.
2004 ACS President-Elect

Dr. William F. (Bill) Carroll, Jr., 2004 ACS President-Elect, holds a B.A. in Chemistry and Physics from DePauw University, Greencastle, IN, an M.S. from Tulane University in New Orleans, and a Ph.D. from Indiana University, Bloomington, IN, both in Organic Chemistry. After graduate school in 1978 he worked for one year in polyvinyl chloride (PVC) impact modifier research for Rohm and Haas Company, Bristol, PA. In 1979, Bill came to Firestone Plastics Company in Pottstown, PA as Manager of Research and Development. In 1985, after Firestone’s PVC operations were acquired by OxyChem, he became Director of Technology for PVC Resins and Compounds with responsibility for R&D, Technical Service, Pilot Plant, and Technical Licensing. In September, 1989, he was named Director of Commercial Development for Polymers and Plastics, and primarily worked in recycling, and in 1994 began two years on loan to the Chlorine Chemistry Council (CCC) working on dioxin and plastics issues for the chlorine industry.

He is currently Vice President, Chlorovinyl Issues for OxyChem and works on public policy issues and communications related to chlorine and PVC. He is Adjunct Professor of Chemistry at Indiana University, and teaches polymer chemistry there. He has been an active member of and chaired various committees for CCC as well as the Society of the Plastics Industry, the National Fire Protection Research Foundation, The Vinyl Institute, the Plastics Recycling Foundation, the American Plastics Council and the National Recycling Coalition Recycling Advisory Council. He has served on the State of Florida Packaging Council, an Oregon Department of Environmental Quality Task Force and an advisory panel commissioned by the United Nations Environmental Program. He is the recipient of the Vinyl Institute’s Roy T. Gottesman Leadership Award for 2000. He is also currently chair of the ACS International Activities Committee, and was elected as 2004 President-Elect. He and his family reside in Dallas, Texas.

Bill holds two patents, and has numerous publications in the fields of organic electrochemistry, polymer chemistry, combustion chemistry and physics, incineration, plastics recycling and chlorine issues.

Abstract

After surviving an election, the person designated as ACS President-Elect starts the process of defining an agenda and preparing for an active year as President. Here are some things I’d like to focus on.

The Public Perception of Chemistry: While we all know that chemistry has arguably brought more benefit to humanity than any other scientific discipline, the public and occasionally, the governments forget. How can we unite the chemistry enterprise in actions to bring the benefits of chemistry back to the public eye?

Pre-college Education and Educators: 60 percent of high school students take chemistry, but few will take it from a chemist. On the other hand, many if not most, career chemists cite an early teacher as their inspiration for their career. When we engage stu- continued on page 6
Nominations
The James Flack Norris and Theodore William Richards Undergraduate Summer Research Scholarships

The Northeastern Section established the James Flack Norris and Theodore William Richards Undergraduate Summer Scholarships to honor the memories of Professors Norris and Richards by promoting research interactions between undergraduate students and faculty.

Research awards of $3250 will be given for the summer of 2003. The student stipend is $2750 for a minimum commitment of ten weeks of full-time research work. The remaining $500 of the award can be spent on supplies, travel, and other items relevant to the student project.

Institutions whose student/faculty team receives a Norris/Richards Undergraduate Summer Research Scholarship are expected to contribute toward the support of the faculty members and to waive any student fees for summer research. Academic credit may be granted to the students at the discretion of the institutions.

Award winners are required to submit a report (~5-7 double-spaced pages including figures, tables, and bibliography) of their summer projects to the NESACS Education Committee by November 7, 2003 for publication in The Nucleus. They are also required to participate in the Northeast Student Chemistry Research Conference (NSCRC) in April 2004.

Eligibility: Applications will be accepted from student/faculty teams at colleges and universities within the Northeastern Section. The undergraduate student must be a chemistry, biochemistry chemical engineering, or molecular biology major in good standing, and have completed at least two full years of college-level chemistry by summer, 2003.

Application: Application forms are available on the NESACS web site at http://www.nesacs.org. Completed applications are to be submitted no later than March 26, 2003 to the Chair of the Selection Committee:
Professor Edwin Jahngen
University of Massachusetts Lowell
Chemistry Department, Room 520
265 Riverside Street, Olney Hall
Lowell, MA 01854-5047

Notification: Applicants will be notified of the results by e-mail on April 18, 2003 with written confirmation to follow.

NESACS News
Continued from page 2
dughter of Mrs. Barbara Elaine Mabrouk of 9 Wildewood Terrace, Framingham. Dr. Mabrouk received her A.B. in chemistry and mathematics at Wellesley College in 1982, her Ph.D. in physical chemistry from the Massachusetts Institute of Technology in 1988, and was a National Institutes of Health Postdoctoral Fellow at Stanford University from 1988-1990.

Questions regarding the announcement details may be directed to either Cheryl Wesley at CASE (Wesley@case.org) at 202-478-5646 or Patricia Ann Mabrouk at Northeastern University (p.mabrouk@neu.edu) at 617-373-2845.

Abstract
Continued from page 5
students in chemistry we increase the chances that bright students make it a career; but even for those who do not, a working appreciation for chemistry makes them more knowledgeable citizens. How do we get more chemists into the classroom?

The Chemistry Enterprise in the US is changing. Whether it relates to the shift in chemistry from small molecules to very large, the commoditization of specialty chemicals, or natural gas pricing, the next ten years will bring sea change to the chemistry enterprise in the US. How do we prepare our current and future members for the state of the industry, 2015?

Think of this presentation as an invitation to dialog.
Impact of Images:

Dana Lipp

As speakers and writers we communicate primarily with words, but another tool we may use to communicate is images. How do the two methods of communication, images and words, compare? Is a photograph worth ten thousand words?

In our first six months of life vision is firmly established before we learn language. We learn primarily by observation; research bears out that even when we are adults the signals from the eyes are processed by the brain before we can even think about it. Clearly, it stands to reason that self-preservation of human beings should work on such a fundamental, unconscious level.

All of us have experienced situations where visual cues like color, tone, light and shadow can elicit an emotional response that precedes rational thought. Even pre-verbal infants can discriminate between colors and use them to aid in their recall of objects. Optical illusions and magician’s tricks take advantage of the bias of our visual perceptions.

Oddly enough, the ability to comprehend photos as representations of reality is a learned skill, as determined in studies of primitive cultures. By viewing images, we learn to interpret and connect the projection of a three dimensional world onto two dimensions. We “connect the dots” as it were, to complete the curves of forms hidden from view by foreground objects.

There are many examples of the power of visual thinking or “visual intelligence” as it’s sometimes called. Albert Einstein was quoted as saying, “thoughts did not come in any verbal formation. I rarely think in words at all. A thought comes, and I try to express it in words afterward.” Apparently, it is initially easier to envision previously unknown concepts rather than it is to describe them. Kekule’s putative dream of snakes eating their tails as the source of his understanding of the structure of benzene is well-known. Freud and Jung were among the first to recognize the importance of mental imagery and associative thinking.

Relative size, perspective, lighting, shadow, arrangement, regularity, patterns, textures, all influence the perception of an image. As mentioned, this process occurs before conscious, rational thought is engaged.

Practical evaluations of the interplay of image and text have been conducted by the Poynter Institute. Using Eyetrac equipment, the organization followed eye movements as readers scanned a newspaper. This study, conducted in 1990, showed readers had a high preference for images. Up to 90 percent of readers were first drawn to large photos, artwork or headlines. A visual element drew in at least three times more readers than an article without any illustration.

Further Reading:
Readers Consume What They See
http://www.poynter.org/content/content_view.asp?id=4763

The Stanford-Poynter Eyetracking Online News Project
http://www.poynter.org/content/content_view.asp?id=1676


“Science And Engineering Indicators, 2002”, National Science Board, 2002

Marginal Note to:
Ion Chromatography

Arno Heyn

Ion exchange resins are widely used, often without us being aware of them, such as in common “Water filters”, like Brita® or PUR® which contain mixed-bed resins, i.e. a mixture of anion and cation exchange resins in their respective OH- and H+ forms (as well as active carbon for removing nonpolar impurities).

I recall an amusing experiment I undertook when these “water purifiers” were new: Knowing that the two resins could be separated by their different densities by using a CaCl2 solution of just the right concentration, which will allow one of the two resins to float, the other to sink, I carried out the separation then converted them back to their OH and H+ forms, respectively by treating them with strong HCl and NaOH solutions. Finally I washed them with distilled water until obtaining no more Cl test with AgNO3 or flame test for Na+, respectively. So far so good, but the only problem was that the total amount of laboratory distilled water used in these batch operations exceeded the amount of deionized water the resin could produce from tap water – a losing proposition!

So Brita and PUR won’t lose their replacement cartridge market.
Book Review

Detective Stories

Towards the end of his life, the great historian of science Thomas S. Kuhn turned for pleasure to detective fiction. Having exhausted himself in the controversies that he had sparked about the growth of knowledge, the physicist-turned-philosopher explained in a late-in-life interview that he still enjoyed the unambiguous solution of a good mystery. As his scholar daughter said to him one day, “It’s the only thing I can read that doesn’t feel like work.” “That’s it!” replied her pop.

The rest of us, holiday-seeking-busmen of a more ordinary stripe, may enjoy reading stories in which scientists themselves are the detectives. We are all part-time epistemologists, after all, especially we reporters. At least four unusually interesting books about great scientific investigations have come across my desk recently, three of them by journalists and the fourth by a leading professional historian.

Why should persons interested in economics - say, in development economics in countries as different as Vietnam and Venezuela — read the history of technology and science at all? Because, among other reasons, it is in the growth of knowledge that economic history begins.

Before you can think very hard about the choices people make, you have to know something about how the choices that are available to them change over time. That’s where science and technology come in - technology first, then, more powerfully, science. To know something about how new knowledge happens is to know something of how it diffuses.

There is, for example, the very readable short biography of Isaac Newton by former New York Times science reporter James Gleick. “He pushed open a door that led to a new universe,” writes Gleick, “set in absolute time and space, at once measureless and measurable, furnished with science and machines, ruled by industry and natural law.”

So what’s it worth to you to know that gravity started out in young Isaac’s notebooks as half a linked pair, “gravity” and “levity”? — gravity meaning the tendency to descend downwards, levity the tendency to rise, as sparks fly up from a fire.

Here you can follow the adventures of Newton’s mind as he discards the possibility that the “matter causing gravity” must “pass through all the pores of a body” until it reaches the “large cavities and inanities to contain it in” in the “bowels of the earth,” before mysteriously ascending to the periphery again, lest “all the streams meet on all sides in the midst of the Earth” and become “coarcted into a narrow room & closely press together.”

Before your eyes you see the strikeouts in his notebooks. Of a cannonball: “violent motion is /made/ continued either by the air or by /motion/ force imprest or by the natural gravity in the body moved.” Eventually the concept of gravity as a force emerges, a theory so fully integrated with mathematical experimentation that it is considered by insiders to have been proved. But not before Newton has inquired into virtually every kind of phenomenon readily accessible to the senses in the 17th century: rainbows and tides, comets and coins, magnets and vacuums, salts and sulphurs, not to mention the plague, the Bible, and the odds of dice.

Gleick takes special pains to locate Newton in his times and to make clear that, in many respects, he belonged to the pre-Newtonian world. He was born in 1642, twenty-six years after Shakespeare’s death. He spent almost as much time on alchemy as on physics. He was immersed in scientific quarrels, religious controversies and, as Master of the Royal Mint in his later years, obscure matters of monetary policy.

Indeed, Gleick sides with John Maynard Keynes, who insisted that “Newton was not the first of the age of reason. He was the last of the magicians, the last of the Babylonians and Sumerians, the last great mind which looked out on the visible and intellectual world with the same eyes as those who began to build our intellectual inheritance less than 10,000 years ago.”

If there is a shortcoming in the story here, it has to do with the possibility that, unless you are related to him — he had three half-sisters — you may not feel any very pressing need to reconsider the significance of Isaac Newton to our lives and times. What he learned, writes Gleick, “has entered the marrow of what we know without knowing how we know it.” But for the author of “Chaos: Making a New Science” and “Genius: The Life and Science of Richard Feynman,” Newton was an obvious choice, and Gleick is a superb writer, if slightly hyperbolic reporter.

A guy who doesn’t get enough credit is Adam Smith’s old friend and literary executor James Hutton. Jack Repcheck does him justice in “The Man Who Found Time: James Hutton and the Discovery of the Earth’s Antiquity.” Hutton was a leading figure in the Scottish Enlightenment, a remarkable intellectual conjunction of intellectuals in Edinburgh that included Smith, Hutton, David Hume and Joseph Black, the discoverer of carbon dioxide.

In the social context of this “Athens of the North,” Repcheck describes the series of controversies among natural historians of the earth that led to Hutton’s “breathtaking discovery” at Siccar Point along the coast of the Firth of Forth south of Edinburgh in 1788 — a certain pattern of older rock amidst the new that demonstrated irrefutably, at least to trained minds, that the earth was immeasurably old.

This was explosive news in world in which church fathers reckoned from counting the Bible’s “begats” that the Creation had occurred no more than 6000 years before. And the infant science of geology in short order led to paleontology — all those peculiar fos-
The economic forks in the roads came only a little later.

“Einstein’s Clocks and Poincaré’s Maps” is a genuinely difficult book, not made any easier by the political arguments and fads that bedevil the history of science in the present day — the same arguments that drove Tom Kuhn to detective fiction twenty years ago. But if you want to know something about what goes on at the highest levels of science — about what it means to catch up, thrust ahead, fall behind — it is a terrific goad to meditation.

A few years ago the journalist John Crewdson wrote something similar about the battle between French and American scientists in the 1980s for priority in the identification of the AIDS virus. That was an even harder book than this. But then that’s the point. A hundred years ago economic development was about electrodynamics. Today it is about software and biotechnology.

I am not suggesting that you need to read all this. But a nation that doesn’t train people to speak these languages has no strong stake in the development game. And an economic historian who doesn’t have some sense of the impact of the growth of knowledge on ordinary lives is no historian at all.

David Warsh; warsh@comcast.net
(reprinted, with permission, from a previously published column on www.economicprincipals.com)
An Employment Guide for ACS Members:

Mukund S. Chorghade, Elaine Diggs, Truman Light, Arlene Light, Bruce Millar, Dorothy Rodman
Jura Viesulas, ACS Department of Career Services, 1155 16th Street, N.W. Washington D.C. and
the Northeastern Section of the ACS.

Note: This guide is meant to serve as a basic information
resource in areas of concern to chemists. Information was
compiled from published sources that we deemed reliable
(see Bibliography and Appendix lists). Readers should con-

tact the appropriate authorities for additional information
or assistance beyond the scope of this guide. The American
Chemical Society (ACS) does not guarantee employment to
any reader of this document or accept responsibility for set-
ing standards for any topic discussed within. ACS and the
authors are not responsible for the accuracy of information
obtained from other sources.

During five years in Japan as a postdoctoral fellow in both
academia and industry, Salvador G. Alvarez says he “lost
touch” with the U.S. job market. When he decided to return
in 2000, he didn’t know where to start looking for a job,
how to market himself, or even how much he could expect
to earn. But, within three months of his return, Alvarez
landed his “dream job” as a senior scientist at Versicor Inc.,
a biopharmaceutical company in Silicon Valley. Along with
generous stock options and excellent benefits, he is earning
a salary that exceeded his most optimistic estimates. As an
added plus, his new job allows him to collaborate with
Novartis Pharma AG, his employer in Japan, enabling him
to continue working with similar classes of compounds.

Lucky? Alvarez doesn’t think so. He credits ACS’s
Department of Career Services (DCS) with helping him find
his new job by providing him with current salary data and
tips on writing excellent cover and thank-you letters, and by
shrinking his “wordy” résumé from four pages to two. First,
he read through DCS’s popular publications, “Tips on
Résumé Preparation” and “The Interview Handbook.” Then,
he forwarded his résumé to DCS for a review. It came back
with a sea of red ink. “I was using too many words to get to
the point. It was as if I was writing a curriculum vitae for
academia,” Alvarez recalls. “What I got back after it was
overhauled by DCS staff members was very impressive.”

Since its beginnings, the member-oriented DCS has
provided career development assistance to tens of thousands
of chemists and chemical engineers and has become one of
the most valued of all ACS member benefits. “Younger ACS
members count on DCS for valuable assistance in molding
their careers”, says Nancy R. Gray, director of ACS’s mem-
bership division, which includes DCS. “It is the time of their
lives when they are looking for reputable information that is
relevant to their skills, and they want to make sure that they
maintain marketability,” Gray says. “They look to ACS to
know what the chemical industry and academic endeavors
are looking for in hiring and promoting.”

One of DCS’s longest standing member benefits is the
National Employment Clearing House. NECH is the largest
single drawing card at each of the society’s two national
meetings; operating as a vast interview site matching
employers and job seekers DCS also conducts eight
Regional Employment Clearing Houses (RECHs) each year.
Begun in 1937 in a hotel parlor in Rochester, N.Y., NECH
has grown phenomenally during the past six decades. The
first NECH drew 128 job candidates and 77 employers. At
the 2001 Chicago national meeting, NECH occupied in
excess of 139,000 sq ft—The clearinghouse attracted 169
employers who had 1,392 open positions to fill—more posi-
tions than the 1,112 job candidates on hand. At all future
national meetings, pre-registration for NECH will be con-
ducted entirely online. This innovative service will make it
more convenient for employers to set up interviews and to
e-mail job seekers prior to the meeting, curtailing lengthy
lines for on-site registration.

“The “electronic NECH” is one example of DCS’s
intention to offer members a balance of expanded conven-
ience while still providing its hallmark personal attention
that is tailored to the needs of chemical professionals”, says
Jean A. Parr, former director of DCS activities. “DCS dif-
fers from commercial job-hunting services by offering per-
sonal, chemist-to-chemist attention and by drawing on its
knowledge and understanding of the chemical workplace”,
she adds. “We couldn’t accomplish what we do without the
nearly 200 career consultants and local section coordinators
who spread the word,” Parr notes.

For each national meeting, DCS organizes the Career
Resource Center, or CRC, which functions as one-stop
shopping for job candidates attending NECH. Before they
interview, they can polish their résumés in one-on-one ses-
sions with seasoned academic and industry professionals or
obtain a videotaped critique of their interviewing skills.
They also can gain practical job-hunting skills and broader
knowledge of the chemical workplace by attending one of
38 workshops or by visiting the CRC’s career development
library.

Samina Azad, now a postdoctoral fellow at Pacific
Northwest National Laboratory, credits CRC’s comprehen-
sive programs with providing her with what she terms “the
whole story” of how to find a job. Before the interviews at
each of three NECHs Azad attended, she divided her time
between résumé reviews, mock interviews, and career work-
shops. During those sessions, she “learned all the secrets”
about how to be professional, how to respond to questions,
and how to answer what the interviewer really wants to know. “I will remember those tips from the mock interviews for the rest of my life,” she says. “Things like posture: The way I was sitting down wasn’t very professional. I would sometimes pause audibly before saying something. I would also say, ‘Yeah’—you have to say, ‘Yes.’ Also, I would sometimes take too long to answer questions.”

Azad, who obtained her master’s in Bangladesh and holds a doctorate in physical chemistry, says she learned one important tip from a résumé-review session that led directly to a job offer. Her reviewer advised her to list her professor’s name on her résumé. Later, when an employer attending NECH picked up her résumé, he happened to know her professor. “That was the magic thing. It really worked very well,” she says.

According to Azad, NECH is an effective job-hunting place because job seekers have a clear idea of what jobs are posted and which employers have expressed an interest in them, and they can schedule several interviews, all within the range of two or three days. “It made me very confident about the whole job-hunting experience,” she adds. Azad credits the personal assistance of DCS staff and volunteers with her successful job search. But she says DCS’s comprehensive catalog of publications—books, booklets, newsletters, and pamphlets—also played an important role. Two titles she singles out because they provide a helpful description of the job market are “Current Trends in Chemical Technology, Business, and Employment” and “Managing an Effective Job Search.”

Distributing and producing timely publications about chemists and the chemical workplace are among the most important year-round services that DCS provides. Among the most popular titles are “The Interview Handbook,” “Tips on Résumé Preparation,” and “Targeting the Job Market.” Other titles that are frequently requested are “Employment Guide for Foreign-Born Chemists in the United States” and “Coping with Job Loss.”

Last year, DCS introduced a new member benefit, the ACS Salary Comparator. The comparator allows members to electronically evaluate their salaries in relation to other members in their own employment situation. It also allows members to examine any employment situation within the scope of the ACS salary surveys, including new graduates’ starting salaries.

The Career Consultant Program is another DCS activity that provides year-round member assistance. Established in 1990, the program provides individualized career guidance delivered by a corps of more than 60 volunteer career consultants. They are ACS members, mostly experienced career chemists, who are available by telephone and e-mail to assist members at all career stages that are seeking advice and direction. The service is free and completely confidential. Since its inception, the program has served more than 3,000 members (excluding services provided at national meetings).

George J. O’Neill, a retired research chemist from Eastman Chemical, has been a career consultant for two-and-a-half years. He says his primary interest in joining the program was having the chance to continue mentoring younger chemists and helping them select their career path.

Preparing for the Job Search: Factors to Consider

Employment Trends

Before you venture out on a job search, you should have an understanding of general employment trends. Today there is less security in employment. Permanent employment with one firm throughout one’s career is rare. Frequent career moves are very common and are no longer considered a stigma as long as the career moves indicate upward progression. Management layers have been eliminated, creating flatter organizations. It is a given that flexibility, adaptability, and good verbal and written communication skills are almost always required to complement technical skills. Every employer’s goal is to achieve staff downsizing while attaining required production or work output with a core staff. Teamwork has replaced a multi-layered system of management. Whether a particular job market involves customer-driven production or research, a business sense is important in addition to technical background.

An ability to work in a diverse workforce is important. The outlook on work, production, business, research, or any other area that affects employment is usually geared to a global market. The industry is moving toward the emergence of small firms of between 50 and 500 employees that tend to hire professionals with multifaceted skills and knowledge. Small companies are hiring BS chemists with marketing, sales, customer service, and research and development (R&D) experience. Medium-sized companies hire for replacement and some growth and require chemists at all degree levels.

Identifying Resources to Target and Research Employers in the United States

It is beneficial for every chemist to consider membership in one or more professional societies to make use of the variety of services available to members seeking employment. Once you have identified companies that you wish to target, you can access other types of career assistance through the ACS or other professional societies in your field. ACS also maintains an electronic recruitment site where chemists can post resumes and employers can post jobs they are attempting to fill. To visit the site, go to http://chemistry.org and follow the appropriate navigation.

Professional societies offer employment services, including referral services or clearinghouses, which are held at several locations. ACS operates the NECH at its semiannual national meetings. Pittcon, and AIChE employment clearinghouses are among other major events available for chemists and chemical engineers to make contact with employers and access employment opportunities.

Professional data banks and résumé referral services are also services that enable you to obtain exposure to employ-
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ers. These services are available throughout the year and are based on matching a candidate to the needs of an employer.

Being active in a professional society will also lead to networking opportunities with other professionals in your field. Become active in the local section of your society. Join an ACS division, present a paper or poster at a meeting, or volunteer to serve on a committee or task force. Any of these activities will make you and your abilities visible.

networking:

Networking enables you to learn about different aspects of the chemical industry and the types of positions available in various companies. Networking will also help you to develop job search strategies, particularly if you wish to target specific companies, meet different people to obtain information and ideas, and obtain further introductions that can foster important job leads.

Keep your contacts informed if they have helped you get good information or job leads. This feedback can be verbal or a written thank-you note or e-mail mentioning the progress you have made as a result of your contact. Those who have extended themselves to help you always appreciate such follow-up.

An analysis of data from the ACS 2001 starting salary showed that 20% of B.S. chemists, 22% of M.S. chemists, and 22% of Ph.D. chemists found jobs through personal contact, while only 10% of B.S. chemists, 8% of M.S. chemists and 1% of B.S. chemists were hired after responding to newspaper ads. Networking contacts can be made through various sources, including fellow workers, former workers and/or supervisors, previous subordinates, competitors, clients, consultants, customers, sports groups, church groups, hobby groups, relatives and neighbors, teachers, stockbrokers, fellow commuters, lawyers, accountants, physicians and dentists, e-mail groups, and the World Wide Web.

ACS local sections offer opportunities to make contacts and network on a local level. Local section participation is also useful in developing skills through making presentations and volunteering on committees and projects. Involvement in a professional society at the local or national level can give you considerable exposure and networking contacts that may prove invaluable in your job search and your career development.

Communication skills, especially good listening skills, are very important in successful networking. Develop such skills, if necessary. Pay attention to facial expressions and tone of voice. Rephrase what someone has said to clarify information and avoid misunderstanding. Whenever possible, check information for accuracy, and ask questions. Show interest in other people and give back to your network as well as using the network to meet your own needs.

classified advertising

Classified ads in newspapers and professional journals provide information on job openings. The ACS weekly magazine, Chemical & Engineering News is a good source of advertising by employers. Other magazines for information on job openings include Nature, New Scientist, and The Chronicle of Higher Education.

recruiting agencies

Employment agencies and search firms should not be discounted in a job search. Small companies that do not have established human resource departments use the services of recruiting agencies and search firms to seek candidates. However, check the credentials of such companies and use only reputable agencies with proven track records. Usually, the employer retains the agency for a fee. Be particularly cautious about recruiting agencies that require a fee from the applicant.

Electronic media can help you locate positions through the Internet at any hour of the day or night. Not only can you search for positions, you can also provide your résumé electronically. However, be cautious in providing any information about yourself online. A résumé posted online becomes public property, and it could end up in places you do not expect or want. Your current employer may also stumble upon it while searching for other candidates like yourself.

how do i market myself?

There are four categories of skills: people, things (e.g., equipment or materials), information/data, and ideas/concepts.

To market yourself, you need to clearly, qualitatively and quantitatively identify your accomplishments, skills and strengths and prioritize them in relation to what you want to use in a new job. Often, accomplishments are greater in the skill areas that you enjoy. You will need to make an assessment of what you are looking for in potential employment, examine the kinds of opportunities available in those areas and be aware of what employers find most valuable in the current hiring market.

Technical skills must be combined with many other skills, non-technical or innate, that together bring success in a career: Interpersonal skills are an important component of an applicant’s total skills set and are highly valued by employers.

sample skills:

A) Technical: 1) Acquire technical knowledge to do the job. 2) Develop technical skills through continuing education. 3) Develop research abilities. 4) Learn throughout a career; be dedicated to continuous learning. 5) Learn about fields outside chemistry.

B) Communication: 1) Communicate verbally and in writing. 2) Sell ideas and be persuasive in presenting a point of view to others. 3) Develop good listening, presentation, and interpersonal skills.

C) problem solving: 1) Use complex data and intuition to reason and draw conclusions. 2) Be customer-oriented in problem solving. 3) Be persistent in seeking an answer.

D) Initiative/Judgment: 1) Set and meet (or exceed) specific and realistic goals. 2) Use good judgment about
taking risks. 3) Evaluate critically and constructively. 4) Be innovative, self-motivated, assertive, and self-starting.

**E) Creativity/Innovation:** 1) Formulate new ideas and solutions. 2) Create new ways of doing things better.

**F) Leadership:** 1) Identify key issues and use available resources to formulate strategies to achieve goals. 2) Get commitment from others and work in a team toward common goals.

**G) Team work:** 1) Work well with people at all levels of knowledge and competence. 2) Work with people of other cultures.

**Preparing Your Résumé:**
The most important marketing tool in your search for an industrial position is your résumé that is well presented, highlights your qualifications and abilities and provides a clearly stated summary of your credentials and professional expertise. A résumé does not get you the job but is the key to obtaining an interview.

Your résumé must express a sense of purpose, stated as an objective, concerning the type of position you seek. An objective should not be too broad or vague; it must be supported by the necessary skills and experience on your résumé that fit the position. Some employers prefer to see an objective while others do not attach importance to it. If you include an objective, tailor it to match the specific position for which you are applying.

It is very important to emphasize your achievements showing how your work had a significant impact on an employer’s business and not merely to list job duties and responsibilities. If possible, quantify achievements, but do so accurately. For example, if your work resulted in reducing production costs by 20%, say so.

Information in your résumé should never be exaggerated or falsified. Use clear, simple language easily understood by an employer. For past positions held, state job titles accurately. The facts stated must be accurate, impressive and true. Your résumé give a sense of the person you are and how you work with others.

**Tips on Résumé Writing:**
Employers usually spend no more than 30 seconds reading a résumé; therefore, your résumé must be carefully prepared to attract attention and to give you a competitive advantage over other job applicants.

**Paper, Typeface, and Design:**
Remember that the paper you use should be able to withstand a great deal of handling. Office supply stores carry special quality paper recommended for résumés. Also, résumés will be copied several times and distributed to different individuals in an organization, so be sure that the print on your résumé gives clear copies.

The color of the paper should not obscure the print when making photocopies. Shades of gray, blue, green, or any other colors that give a shadow when copied should be avoided. White, cream, or light buff shades are recommended.

Select a font that does not run together and is easy to read. Usually Prestige Elite, Courier, Arial, and Times New Roman fonts print clearly if your résumé is prepared on a personal computer. Use only one type of font on your résumé. Boldface, italics, underlining, or bullets can be used sparingly for emphasis. A résumé should not be crowded, cluttered, or difficult to read. Provide plenty of clear white space with a one-inch margin all around. Employers need space to make notes on the résumé during interviews. Your résumé should not exceed two pages. If you have a long list of publications, presentations, and patents, prepare a separate list.

**Writing Style:**
Do not use the first person “I” in writing your résumé. Describe your accomplishments using active verbs, such as “developed,” “evaluated,” and “analyzed.” Grammar and spelling must be correct. After your résumé is prepared, make sure that at least two people with good language and proofreading skills review it and determine whether it reflects positive information about you and the type of employment you seek.

Do not include personal information regarding age, height, weight, health, marital status, number of children, or race on your résumé. It is inappropriate to include a photograph. Confine information about yourself to that which is relevant to the job itself – talents, education or experience that will enhance your performance in the job.

Sometimes a section on “Highlights” or Summary is used instead of an objective. These should briefly describe your employment history and highlight the key areas that you want to “sell” to a prospective employer.

**Résumé Formats:**

**The Chronological Résumé:** The chronological résumé should be used when you are seeking your first job, have a career sequence without gaps in employment, and you need to show progression in the same field in your area of expertise. This type of résumé is acceptable in traditional organizations and organizations requiring specialization and progression in one particular area of work.

**Components of a Chronological Résumé:**

**Heading:** name and address; at least two telephone numbers (day and evening); e-mail contact information

**Objective:** should be tailored to a specific position, if known; and linked to a function, specialty, organizational level, and type of organization

**Educational background:**
- a list of degrees received, in reverse chronological order with the highest degree first
- the name of the school and date of graduation (if you are a new graduate)

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- the PhD dissertation title and the advisor’s name (if you are a new graduate); and
- the type of equivalency you received if your education was overseas

Research / Work experience:
- most recent position first
- title, duties, and responsibilities (use active verbs)
- quantified details of successes achieved in the position
- recent jobs only, do not include jobs held more than 10 years ago.
- military service information should state whether service was in the United States.

Special skills:
- languages, computer skills, instrumentation
- leadership positions held
- any other skills outside your technical area that were acquired through paid or volunteer work

Professional affiliations and awards:
- membership in professional societies/associations and special awards received.
- A list of publications, presentations, and patents should be provided on a separate sheet

References:
- List references only if you are a new graduate; not if experienced.
- Provide references after getting an opportunity to interview.
- Be aware of the referee’s relationship to the company offering a position.
- Inform referees about the type of position and employer.
- Discuss with the referee details about yourself such as your strengths and achievements.
- Provide the referee with a copy of your updated résumé.
- Mix referees to cover academic and business contacts.

Functional or Skills-Based Résumé should be used when you are changing career paths, attempting a transition into another type of employment with existing skills, de-emphasizing your age or gaps in employment history, emphasizing the value of your extensive experience, The advantages of using a functional résumé are the opportunity to present a variety of skills acquired in more than one field or outside regular employment and the de-emphasizing of a career with breaks or extensive job changes.

Components of a Functional Résumé:
Several components are the same as those of a chronological résumé heading; objective; summary; education; military service; affiliations and awards; publications, presentations, and patents; and references. Additional components are as follows:

Skills and accomplishments
- Identify and prioritize three to five of your most important skills applicable to the type of position
- List and quantify other skills and accomplishments.
- Work experience
- List positions held, but do not list details of duties performed.
- List your most recent position first.
- Indicate experience in number of years if there are breaks in employment dates.
- Limit mentions of experience to those of the past 10 years.

Applying for a Government Position:
The OF-612
Federal job information can be accessed using a telephone, personal computer, or touch-screen computer kiosks located in cities throughout the United States. To obtain information through the Office of Personnel Management (OPM), call USA Jobs by phone at 478-757-3000 (TDD service 478-744-2299). This service provides information on federal positions available worldwide, including salary, employee benefits, and recruitment as well as how to receive forms and other information packages. The service is available 24 hours, 7 days a week.

You may complete the government employment form, the OF-612, use a federal resume or apply online at http://www.usajobs.opm.gov. A useful feature at this site is a link to a resume builder that allows a potential government employee to create and store an electronic resume for use in applying online for government positions in multiple agencies and departments.

In completing forms or online text boxes, pay close attention to the job announcement. You need to address the knowledge, skills, and abilities (KSA’s) required for the position. Add other information, even if it is optional. Each application is assigned points based on the KSA’s and optional information an applicant presents, so it is to your advantage to submit a thoroughly completed application. Since the U.S. government is a very large and complex organization, it has established formal application procedures to facilitate processing the many applications it receives and to ensure a fair, politically neutral hiring process. The prescribed procedures must be followed very carefully. Applicants that do not meet prescribed application deadlines will be eliminated from consideration.

Government positions that require a security clearance hire only U.S. citizens. In rare instances, a permanent resident status will be accepted. Information and a sample copy of the OF-612 form are available at http://www.cyber-comm.net/~digibook/.

You must provide the following information when
applying for a federal position:

1) Position information, including job announcement number, title, and grade
2) Personal information, including full name, mailing address, zip code, and two telephone numbers (day and evening)
3) Social Security number
4) Country of citizenship
5) Veterans’ preference, reinstatement of eligibility, and highest federal civilian grade held (if you are a veteran)
6) Education, including high school name and location, college or university name and location, and degrees earned, with dates
7) Work experience, including job titles, duties performed, accomplishments, employer’s name and address, supervisor’s name and telephone number, start and end dates of employment, hours worked per week, and salary (with a separate entry for each job)
8) Other qualifications, including on-the-job training, other job-related skills, certificates received, licensing held, and honors and awards for special accomplishments.

Curriculum Vitae for an Academic Position

The tool used for seeking an academic position is the CV, which is longer than a résumé and should contain more information. In the CV, include a detailed list of all your publications and presentations and other significant accomplishments. Frequently, applications for academic positions will require letters of recommendation as part of the application packet.

Components of a CV:

**Heading:** Use the title “Curriculum Vitae”; provide name, address, two telephone numbers and e-mail contact
**Education:** Ph. D. is usually a requirement for an academic position. State your doctoral degree, the date it was received, your thesis title, advisor’s name, and the name of the university. Also provide details of any undergraduate degrees and graduate degrees you acquired, in reverse chronological order.
**Research interests:** State these very briefly in a page or two.
**Professional activities and honors:** List these in order of importance or in alphabetical order. Highlight any special honors or awards received.
**Publications:** List all:
- Publications/Patents.
- Participation in professional societies
- Oral presentations
**Recommendations:** List names and contact information of three or four individuals willing to write recommendation letters.

**Cover Letter:**

A cover letter must be included with every résumé. It serves as an introduction to your résumé and invites the recipient to read the resume. Research the company and obtain names of the unit managers or the hiring manager with correct spellings and accurate titles. The cover letter should not exceed one page and should include information not already mentioned in your résumé.

The first paragraph of a cover letter should explain the purpose of your letter and the attached résumé. Be sure to mention whether you are responding to an ad or doing an exploratory mailing to seek an opening in the company. If you are responding to an ad, pay particular attention to the reference number of the position, if there is one. Also, your cover letter should indicate where and when you saw the ad. If you have been referred to an individual by a third party, state the name of the person who provided you with that contact.

In the second paragraph, indicate how your skills will fit the department and project. Also, indicate how you will fit into the culture and purpose of the organization. Using what you have learned about the company and its long- and short-term goals, indicate what contribution you can make to its business or products.

In the final paragraph, express your desire to seek a position in the organization and indicate that you will be delighted to meet with the executives/scientists/managers at the company.

Submitting a Resume via E-mail or Applying Online:

Many employers today are requesting that job applicants submit their resumes electronically. Some employers, in fact, no longer accept paper resumes. E-mailing your resume to the employer’s e-mail address is fast, easy, and eliminates postage and stationery costs. There are several factors to keep in mind, however, when using this mode of job application. First, beware of submitting your resume as an attachment to e-mail. Because of concerns related to the spread of computer viruses, an employer may be reluctant to open an attachment from an unknown sender. Instead, you should “cut and paste” your resume into the body of the e-mail or submit it as an attachment in plain text, also known as ASCII. To prepare a plain text resume, write a well-written resume in either Word or WordPerfect. Next, go to “File” in your word processing program and choose “Save as.” Save your resume as plain text (.txt file).

A second method of applying electronically for positions in chemistry is to apply online. Many companies and governmental agencies not only encourage job seekers to apply over the Internet but actually prefer that potential employees do so. Go to the employer’s Web site and “cut and paste” your resume into the online text box that is a part of the job application form located somewhere on the Web site. This method simplifies the recruitment, screening, and applicant selection process for the hiring organization.

Preparing for the Interview

After preparing a résumé and responding to suitable advertisements, you may be invited for an interview. A site interview will usually be a follow-up to an initial screening interview. The site interview is an in-depth interview in

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which your technical specialty and related skills will be presented. Because your competition is just as qualified as you are, you need to stand out by being the best interviewee. It is important to demonstrate enthusiasm for your work, sincerity in your purpose, courtesy in your dealings with others, and tact in dealing with stressful or difficult situations.

The art of interviewing can be perfected with preparation and with actual practice. The main purpose of the interview is to generate an offer of employment. It is a crucial element in the employment process and an opportunity to make an excellent first impression. Remember the adage “You do not get a second chance of making an excellent first impression”. It is not appropriate to address salary and benefits at the first interview unless the interviewer takes the initiative to introduce this topic.

To prepare for an interview, make sure you know: 1) Yourself, your skills and abilities 2) Something about the company 3) Logistics of the interview, and 4) What to expect.

Be prepared to ask questions about the position.

Review any accomplishments that could be an asset to the potential employer and demonstrate skills you possess. Use examples to explain how you handled difficult situations, solved problems, and persuaded clients. Always remember to provide quantified results of your accomplishments whenever possible.

By knowing something about the company, you will impress a potential employer. A company can be researched through standard directories and the local chamber of commerce or even by requesting the company’s annual report in the mail before your interview. Most companies have Web sites with information about themselves. Any local public library will have information on companies as well. When you research the company, remember to formulate and be prepared to ask relevant questions about the department, position, and the goals of the company. Also, discuss current market trends such as globalization and where the company hopes to head in the current economy.

**Basic Logistics of Interviewing:**

**Before the Interview**
1. Practice interviewing with a friend or spouse if possible; videotape and critique your practice interview
2. Attend ACS mock interview sessions at national meetings to take advantage of a videotaped interview
3. Take extra copies of your résumé, list of publications and patents, and any relevant information to demonstrate your achievements.
4. Prepare relevant job-related questions that you can ask the interviewer.

**Sample Questions That You Should Be Prepared to Ask:**
- Does the company support participation in professional association activities to encourage career growth?
- Does the company offer advancement in a technical track and a management track?
- How many executive positions are there in the company, and what is the turnover rate? What is the policy regarding promotions from within the organization?
- What are the possible career paths from the position that I am interested in?
- To whom does the position report? How are work results monitored? How frequently are work results checked?
- How do new ideas get started in the company—through individual efforts, by committees, or by teams?
- Are new organizational design methods being implemented to allow greater decision making at lower levels?
- What type of management oversight exists in each unit?
- Who gets rewarded in the organization? Teams? Individuals?
- What factors are important for a successful manager (or technical person) in your organization?
- How much travel is required for overnight and out-of-town assignments?
- Does the organization have flextime? Job sharing? Work-at-home? Part-time employment?
- What kinds of opportunities exist to support the development of research/new products that could be of value to the company?
- What are the greatest challenges in the position?
- How much autonomy is allowed in the position for the creation of new and interesting programs or products?
- Are job rotations available to enhance professional growth or understanding of a particular issue?
- Does the company have a policy to retrain staff in preference to reduction-in-force in tight economic times?

**The Technical Presentation (Industry)**

In the technical presentation, your skills of presentation, as well as the technical content of your work, will be evaluated.

The impression you make at a technical presentation is vital to your success at securing a job. If possible, obtain some advance information about the audience. It will be a further advantage if you have some information about the technical backgrounds of the decision-making individuals so that you can be well prepared for questions that might be asked. It is equally important to research the company. Knowledge about the direction of the company and its products will also put you in a position of strength in connecting your knowledge and abilities to the needs of the potential employer.

Your presentation need not be extensive and lengthy,
and it should not include any confidential information that will jeopardize your current position or employer. You can make those conditions clear at the beginning of your presentation so that your audience is aware of your guidelines.

Your presentation should cover no more than three to five topics lasting about 30-45 minutes, with time for a few questions from the audience. Remember to highlight your accomplishments in the presentation. The material you use for the presentation should be well prepared. Overheads should be uncluttered or a PowerPoint presentation carefully constructed and rehearsed. Pare down your information so that the audience can absorb the major points and important items.

Anticipate questions based on your work, and be prepared to substantiate answers to questions that may be asked. Listen attentively to questions asked by audience members. Your answers should be to the point, but make sure you fully respond to questions. Take questions from the audience in the order in which they are raised, and direct your response to the person asking the question.

Practice will improve your presentation. Record your delivery if you can, and listen to yourself. Ask friends or colleagues to act as the audience while you rehearse, and solicit their feedback on your performance. Practicing will also give you an idea of how long your talk will take. Following are some tips for your presentation:

- Practice your delivery. Be organized, to the point, and clear.
- Briefly describe your research. Indicate the objectives, goals, results and conclusions of your research.
- Deliver your presentation with enthusiasm, confidence, and professionalism.

During the Interview
1) Pay attention to your body language. Handshakes are usually initiated by the interviewer and should be firm. 2) Speak with confidence. 3) Speak clearly and slowly. 4) Maintain eye contact with the interviewer. 5) Be discreet with note taking.

After the Interview: Jot down important facts for future reference. And follow up by sending a thank-you note to the interviewer.

Selecting References for Employment
Be prepared with about four to six names of people connected with your past employment. References need not be restricted to former supervisors. They could be obtained from peers, former bosses, consultants, or any other person in a position to observe your performance associated with your workplace. Keep your references updated with a copy of your current résumé, and refresh them in regard to your position and responsibilities. Discuss with your referees how they perceived your performance on the job, particularly in difficult situations. Pay attention to their comments to make sure they convey an accurate picture of your strengths and weaknesses. In addition to technical skills, employers pay particular attention to interpersonal skills, work ethics, communication, ability to adjust to change, and dependability.

Employers will contact your references only if there is a genuine interest in hiring you. The final hiring decision could depend on favorable references, so do not neglect this aspect of the employment process.

Academic Positions
Academic positions may include the following: tenured and non-tenured positions; adjunct, affiliate, or visiting appointments; research professional appointments with academic responsibilities; research professionals without academic responsibilities; postdoctoral research associates; postdoctoral scholars; and research associates.

The terms of employment for these different kinds of positions vary. You should become familiar with the procedure followed by each academic institution. Usually, academic faculty appointments are tenured or non-tenured appointments with responsibility for academic instruction and curriculum development. In academic positions, a letter of appointment is issued to a person when the position is temporary and a term is specified in the letter. A “letter of hire” in most academic institutions refers to a letter confirming tenure-track employment and indicating terms, conditions, and expectations of an appointment as an initial document, pending a formal contract from the governing body of the university.

Non-tenured positions are usually subject to the availability of funds in an institution. A non-tenured position can be terminated if funds are exhausted before the date of termination on a letter of appointment. A non-tenured position has no protection or claim to reappointment. Continuity is at the sole discretion of the academic institution. Non-tenured service is usually not counted in tenure appointments.

Research Seminar (Academe)
Your research seminar takes approximately 45 minutes and should cover current research projects. Background material, techniques used, conclusions drawn, recommendations for future work, and types of support (including financial support) should be acknowledged. The problem under study should be concisely stated. Never lose sight of the fact that your audience will include people who are very knowledgeable in your field.

At an academic interview, you will be required to present your proposed research based on a written proposal. The time frame needed to complete the work and your sources for support should be included. Your work should be original, pertinent to the institution, and fundable by a supporting organization already identified. Again, practice and timing are important.

Planning for Career Success
Your promotions and career success will depend largely on you. An employer will not always recognize hard work as deserving a reward in the form of a promotion, even if you are recognized as a valued and hard-working employee. Cir-
cumstances beyond the control of your employer such as mergers, restructuring, and other corporate upheavals may hinder your career progress. The “insurance” in such situations depends on your ability to keep yourself marketable. Never become so comfortable in your position that you sit back and await promotions and new job offers to come to you. Be assertive and learn to manage your own career. In performing your job, you need to go beyond the technical qualifications for the position. Be reliable and dependable, and show integrity. Long-term professional relationships must be built during the course of your career. Good relationships with associates are an outcome of good interpersonal skills. Although it is important to take time to help others, draw the line at taking over responsibilities for which others are accountable. Do, however, share experiences and communicate well.

Develop public speaking and writing skills, and look for opportunities outside your work and daily routine to enhance your professional skills. Get involved in selected professional and service organizations. Take time to become known and visible. Volunteer for special projects. If you understand the factors that will work to your advantage in the long run, your efforts will be rewarded.

Keep your technical skills current by staying abreast of developments in your field, and be familiar with emerging technology and innovations. Consider adding to your skill base by learning new areas, venturing into associated areas, and exploring other scientific disciplines. Science is not defined by clear boundaries, and your ability to interface in related areas will be of immense value over the course of your career.

Look for opportunities to cross-train in your workplace. There is no substitute for hands-on training and experience. However short term an opportunity may appear to be, something can be learned and a skill can be acquired that will stand you in good stead later. Volunteer projects can offer the opportunity for exposure, learning, and broadening your experience.

Be flexible in your approach to all areas of your job. It is important to be able to work with what is available and to take a flexible approach to changes, unexpected situations, and challenges. Cultivate an ability to work in diverse teams with a mix of people of different ability and skill levels. Above all, maintain your professional network and communicate well.

Bibliography:


Graduating Engineer & Computer Careers; Career Recruitment Media, Inc., Evanston, IL, winter, 2002
Harris, Philip R.; Moran, Robert T. Managing Cultural Differences; Gulf: Houston, TX, 1991.
Home Vision, “The Art of Dining,” “The Business Lunch,” “The Formal Dinner” (videos); Opera World: Concord, MA
Post, Emily, Emily Post on Etiquette; Poseidon: New York, 1983.
Harris, Philip R.; Moran, Robert T. Managing Cultural Differences; Gulf: Houston, TX, 1991.
Millar, Bruce, “Immigration: Under the Microscope,” Chemical & Engineering News, September 23, 2002; Vol. 80, no. 38, pp. 81-87

Graduating Engineer & Computer Careers; Career Recruitment Media, Inc., Evanston, IL, winter, 2002
Harris, Philip R.; Moran, Robert T. Managing Cultural Differences; Gulf: Houston, TX, 1991.
Home Vision, “The Art of Dining,” “The Business Lunch,” “The Formal Dinner” (videos); Opera World: Concord, MA
Post, Emily, Emily Post on Etiquette; Poseidon: New York, 1983.
Harris, Philip R.; Moran, Robert T. Managing Cultural Differences; Gulf: Houston, TX, 1991.
Millar, Bruce, “Immigration: Under the Microscope,” Chemical & Engineering News, September 23, 2002; Vol. 80, no. 38, pp. 81-87
Troutman, Kathryn K. & Sach, Laura; Ottenseyer, Mike; 10 Steps to a Federal Job, The Resume Place, Baltimore, 2002.
Troutman, Kathryn K., Electronic Federal Resume Guidebook; The Resume Place, Baltimore, 2001
ACS Career services are available to all ACS members, including full members and national and student affiliates. For more information or career assistance, contact ACS
Career Services by calling 800-227-5558 or by sending e-mail to career@acs.org. To order any of the products listed below, call the Office of Society Services at (800) 227-5558.

Publications

- Academic Professional Guidelines
- Career Transitions for Chemists
- Careers for Chemists: A World Outside the Lab
- Chemist's Code of Conduct
- Coping with Job Loss
- Professional Employment Guidelines
- Salary Survey (published annually)
- Starting Salary Survey (published annually)
- Targeting the Job Market
- The Interview Handbook
- Tips on Résumé Preparation
- What a B.S. /B.A. Chemist Should Consider Before Accepting an Industrial Position
- What a Chemist Should Consider Before Accepting a Government Position
- What an M.S. /M.A. Chemist Should Consider Before Accepting an Industrial Position
- What a Ph.D. Chemist Should Consider Before Accepting an Academic Position
- What a Ph.D. Chemist Should Consider Before Accepting an Industrial Position
- What a Chemist Should Consider Before Becoming a Consultant

ChemCensus 2000

Academic Chemists 2000

Industrial Chemists 2000

Women Chemists 2000

Lifetimes in Chemistry

Early Careers of Chemists

Appendix II: Suggested Reading

Resources for Job Searching

- Kennedy, Joyce Lain; Morrow, Thomas J. Electronic Job Search Revolution; Wiley: New York, 1994
- Wendleton, Kate. Through the Brick Wall: How to Job Hunt in a Tight Market; Random House, 1993

Resources for Self-Assessment

The following books are designed to help the reader assess skills and values that influence decision-making.

- Covey, Stephen R, The 7 Habits of Highly Effective People; Simon & Schuster Trade: Bethlehem, PA, 1990.

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Resources for Interviewing

Resources for International Employment

Appendix III: Resources and Services
Credential Evaluation Companies for Approval by the Immigration and Naturalization Service (I.N.S.) or for Employment
The following agencies will, for a fee, evaluate the curriculum of an educational facility abroad to determine an equivalent in the United States. ACS is not responsible for the customer service provided by these companies. The information is provided only as examples of such services.

Education Credential Evaluators, Inc.
PO Box 514070
Milwaukee, WI 53203-3470
Phone: 414-289-3400
http://www.ece.org

International Consultants of Delaware, Inc.
625 Barksdale Professional Center, Suite 109
Newark, DE 19711
Phone: 302-737-8715
http://www.icdel.com

International Education Research Foundation Credentials and Evaluation Service, Inc.
PO Box 3665
Culver City, CA 90231
Phone: 310-390-6276
http://www.ierf.org

The Knowledge Company
13022 Monroe Manor Drive, first floor
Herndon, VA 20171
http://www.knowledgecompany.com

World Education Service, Inc.
PO Box 745, Old Chelsea Station
New York, NY 10113-0745
Phone: 212-966-6311

Directories to Research Companies
Numerous directories that supply this information are available in most libraries. Some of the directories are listed below with publisher and contact information (when available). In addition, see the “ACS Employment Outlook” published in Chemical & Engineering News every October. Also, Resources for Career Management, valuable information on career publications and online job searching, is available from the ACS’s Department of Career Services.
American Consulting Engineers Council Membership Directory (ACEC, 1015 15th Street, NW, Suite 802, Washington, DC 20005) Members of this council are consulting engineers who run their own businesses.
The Guide to America’s Federal Jobs (JIST Works, Inc., 8902 Otis Avenue, Indianapolis, IN 46216-1033) A comprehensive guide to more than 300,000 new job openings each year in the federal government.
Best’s Insurance Reports (Best Company, Ambest Road, Oldwick, NJ 08858) Gives in-depth analyses, operating statistics, and financial data of more than 1300 major stock and mutual property-casualty insurance companies.
Chamber of Commerce Directories Many chambers of commerce publish directories geographically restricted to the areas they serve.
Chemical Abstracts Service Author Index (American Chemical Society; call 800-753-4227 or 614-447-3600 for more information) Lists names of companies and their patents. Recent patents may provide indications of current research interests and/or future direction.
Chemical & Engineering News (American Chemical Society; call 800-227-5558 for more information) Lists a variety of science-related meeting programs that provide information about publishers and publications.
College Placement Annual Lists of Companies. Provides a description of specialty area and at what degree level hired. Only available through college/university placement centers
Directory of American Research & Technology (R. R. Bowker, a division of Reed Elsevier, New Providence, NJ) Lists 13,000 U.S. and Canadian facilities found in corporations, universities, and independent labs active in commercial or applied research.
Directory of Chemical Producers (S.R.I. International, 333 Ravenswood Avenue, Menlo Park, CA 94025) Lists commercial chemical producers, including the products and plant location where they are produced.
Directory of Directories (Gale Research, Inc., 835 Front Street, Detroit, MI 48226-4094) A guide to more than 10,000 business and industrial directories, professional and scientific rosters, directories, and databases
Directory of Executive Recruiters, 2002 (Kennedy Information, One Phoenix Mill Lane, 5th floor, Peterborough, NH 03458) Provides a list of recruiters by company specialty.

Job Hunter’s Source Book (Gale Research, Inc., 835 Penobscot Building, Detroit, MI 48226-4094): Provides profiles of professions and occupations as well as information about companies.

Million Dollar Directory (Dun & Bradstreet, Inc., One Diamond Hill Rd., Murray Hill, NJ 07974-1218) A one-volume directory consisting of corporations with sales of $1,000,000 or above

National Directory of Nonprofit Organizations, 2002 (The Taft Group, 12300 Twinbrook Parkway, Suite 450, Rockville, MD 20852) Lists more than 167,000 nonprofits in the United States with reported annual income of more than $100,000.

National Trade and Professional Associations of the United States (Columbia Books, Inc., 1212 New York Avenue, NW, Suite 330, Washington, DC 20005). A compilation of key, current facts about 7000 trade associations, labor unions, and professional societies

Reference Book of Corporate Managements (Dun & Bradstreet, Inc., One Diamond Hill Rd., Murray Hill, NJ 07974-1218) Lists directors and selected officers of 24,000 companies with annual sales of $10 million or more and/or 1000 or more employees.

Research Centers Directory (Gale Research, Inc., 835 Penobscot Building, Detroit, MI 48226-4094) A guide to more than 12,000 university-related and other nonprofit research organizations established on a permanent basis and carrying on continuing research programs.

Standard & Poor’s Register of Corporations, Directors and Executives (Standard & Poor’s, 25 Broadway, New York, NY 10004) A three-volume guide to the business community providing information on public companies of the United States.

Thomas’ Register of American Manufacturers (Thomas Publishing Company, 5 Penn Plaza, New York, NY 10001) This 12-volume guide is useful in locating specific large- and small-product manufacturers not listed in Dun & Bradstreet or Standard & Poor’s.

Value Line Investment Survey (Arnold Bernhard & Company, Inc.) Provides financial data on 1700 domestic and foreign companies.

Resources for Seeking International Employment

Career Systems International
PO Box 15788, Dept 1P-96/32
Philadelphia, PA 19103

International Career Information, Inc.
A full-service publishing and placement service specializing in recruiting bilingual staff for multinational companies in Japan and other parts of Asia
Jersey City, NJ 07310

Phone: 800-859-8535 (toll free from United States)
E-Mail: editor@intcareer.com

International Employment Gazette
Phone: 864-235-4444
Fax: 864-235-3369
intljobs@aol.com

International Employment Opportunities (weekly publication)
The Carlyle Corporation
1088 Middle River Road
Stanardsville, VA 22973
Phone: 434-985-6444
Fax: 434-985-6828

U.S. Department of Defense Dependent Schools
Recruitment and Assignments Section
4040 N. Fairfax Drive. Arlington, VA 22203
Phone: 703-696-3067

Résumé Broadcast International
Phone: 913-383-8261
Fax: 913-383-8028
E-mail: 102767.1412@compuserv.com

Appendix IV: Electronic Career Resources
These listings should not be considered a complete list of resources. Please check for updates on the following Web sites.

Employment Guides on the Web
Career Action Center, http://www.careeraction.org/
Career City, http://www.careercity.com
Catapult/NACE (site of the National Association of Colleges and Employers, formerly the College Placement Council), http://www.jobweb.org/catapult/catapult.htm
Job Star Central, http://jobstar.org
Monster Trak, http://campus.monster.com

Online Job Listings
Academe This Week (from the Chronicle of Higher Education), http://chronicle.com
America’s Job Bank, http://www.ajb.dni.us
Career Builder, http://www.careerbuilder.com
Career Site, http://www.careersite.com
CareerWEB, http://careerweb.com
Job Options, http://ww1.joboptions.com
Internet Career Connection, http://iccweb.com
Monster, http://www.monster.com/

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Résumé Posting and Database Recruiting Sites
Career Site, http://www.careersite.com
CareerWEB, http://careerweb.com
Monster, http://www.monster.com

Researching Companies and Academic Institutions Online
EINet, http://galaxy.tradewave.com
Hoover’s Online, http://www.hoovers.com/
Thomas Register, http://www.thomasregister.com

Sites for Researching Geographic Information
Online Chamber of Commerce, http://online-chamber.org/

Science- or Chemistry-Specific Electronic Job Listings
ACS Career Services, http://www.chemistry.org/careers
Science a Go, http://www.scienceagogo.com
Science Magazine, from the American Association for the Advancement of Science (AAAS), includes job listings from the two most recent issues, http://science-mag.aaas.org
Chemical Engineering Opportunities, http://www.sts-aiche.org

Sites for Federal Employment Opportunities
Federal job vacancies: http://www.jobsfed.com
http://www.usajobs.opm.gov/
http://www.fedworld.gov/jobs/jobsearch.html
Synthesis of Solvated Molybdenum Clusters from Molybdate.

Travis Pribusauskas* and Steven C. Haefner, Department of Chemical Sciences, Bridgewater State College

Introduction

A fundamental goal of synthetic chemistry is the deliberate manipulation of small molecular building blocks into larger, more complex architectures. Of special interest are polymeric metal complexes of the second and third transition series which possess a metal-metal bond. As evidence by their rich electrochemistry, such metal-metal bonded complexes are capable of acting as electron reservoirs: able to both supply and store electrons.1 There is rapidly growing interest in incorporating such species into supramolecular frameworks for nanoscale devices and structures.2 Consequently, metal-metal bonded complexes are capable of acting as electron reservoirs: able to both supply and store electrons.1

Our laboratory has successfully prepared and isolated the solvated dinuclear molybdenum(II,II) cations [Mo2(DMF)8]4+ and [Mo2(DMA)8]4+ from low valent Mo(II) precursors (Fig. 1).4 These species represent the first examples of metal-metal bonded complexes supported solely by DMF and DMA. As expected, 1H NMR studies of both species reveal that the DMA and DMF molecules are highly labile (i.e. easily displaced) in a variety of solvents. This demonstrated lability makes these complexes valuable synthons to a variety of other molybdenum containing compounds. Preliminary studies suggest that [Mo2(DMF)8]4+ readily undergoes oxidation to give a mixture of molydenum-oxo species, Mo2O4(DMF)62+ (II), and Mo3O4(DMF)93+ (III).4 (Fig. 2) However, the exact pathway of this process remains unknown. In an effort to provide a direct synthetic route and to help gain insight into the relationship between clusters II and III, we set out to study the reduction of molybdate ion, MoO42−, in DMF. Based on prior work in aqueous solutions,5 we anticipated that reduction of MoO42− in DMF would lead to one of the two clusters found above, providing us with a high yield, one-step synthetic route into these solvated systems.

Results and Discussion

Synthesis of [Mo2O4(DMF)6]2+. Reaction of “(NH4)2MoO4” with excess of zinc powder in DMF followed by addition of HBF4 diethyl etherate produces a red-orange solution with slow evolution of hydrogen gas. After four hours of stirring at room temperature, the reduction is complete. Addition of THF followed by refrigeration, produces a slightly oily orange solid. This solid can be recrystallized from methylene chloride by slow addition of THF to produce an orange solid. [Mo2O4(DMF)6][BF4]2 (II), in 70-80% yield. HBF4 facilitates the reduction of the molybdate ion by assisting in the removal of the oxo-groups through protonation. The BF4− ion then remains behind as the counter ion. The use of the non/weakly coordinating BF4− is critical in that it allows the DMF molecules to occupy the newly opened coordination sites on the molybdenum.

The isolation of II is quite sensitive to the relative amounts of DMF and acid employed. Use of too much HBF4 results in intractable oils upon addition of THF, making isolation of pure product all but impossible. Similar problems were encountered when a precipitating solvent (THF, ether) was included in the initial reaction mixture. Previously, this technique had proven successful for the isolation of acetonitrile complexes of MoO42− (M = Mo, Tc, Rh, Re) from concentrated HBF4 solutions.3

Use of Na2MoO4 instead of the ammonium salt resulted in lower isolated yields. It is unclear at this time whether the lower yields were the result of complications caused by the presence of the sodium ion or whether the nuclearity of the initial molybdenum-oxo species plays a role. The ammonium salt of molybdate formally exists in the solid state as the heptanuclear cluster [Mo7O24]6− which potentially serves as a ready-made source of the Mo2O4 core during the

*2003 Norris/Richards Scholar

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Fig. 1
Formation of Mo2(DMF)84+ (I) and Its Oxidative Decomposition to II and III

Fig. 2
Synthesis of Mo3O4(DMF)62+ (II) and Mo3O4(DMF)93+ (III) from Molybdate
Molybdenum Clusters
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formation of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$. We expect, however, that under the acidic conditions of the reaction, some hydrolysis of the molybdate ion takes place and the two sources of Mo$^{VI}$ will have similar compositions. Use of [Bu$_4$N]$_2$[Mo$_6$O$_{19}$] also resulted in substantially lower yields.

[Mo$_2$O$_4$(DMF)$_6$]$^{2+}$ is moderately air sensitive. Solutions of II show evidence of decomposition after 10-30 minutes of air exposure. Solids are slightly more stable and can be handled briefly in air. Single crystals of II have been obtained by slow diffusion of THF into either DMF or CH$_2$Cl$_2$ solutions of II. A full crystallographic structural study is forthcoming.

The ability to obtain relatively large amounts of solid [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$ represents a significant advantage over the aqueous analog, [Mo$_2$O$_4$(H$_2$O)$_6$]$^{2+}$ which is only stable in strongly acidic, aqueous solution.

Spectroscopy of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$. The infrared spectrum of [Mo$_2$O$_4$(DMF)$_6$][BF$_4$]$_2$ shows absorptions for both terminal Mo=O and bridging Mo-O-Mo stretching vibrations at 970 cm$^{-1}$ and 745 cm$^{-1}$, respectively. These observations are in line with those found for other Mo(V) oxo species and confirm the existence of the Mo$_3$(µ-O)$_2$O$_2$$^{2+}$ core.

The presence of the coordinated DMF ligands is evident from the strong ν(C=O) stretching absorption at 1651 cm$^{-1}$. Not unexpectedly the shift in the C=O stretching frequency to lower energy indicates that ligation occurs via the carbonyl oxygen. An intense absorption resulting from the ν(B-F) stretching vibration of BF$_4$$^{-}$ appears at 1080 cm$^{-1}$ and confirms the cationic nature of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$.

The electronic spectrum of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$ in DMF and CH$_2$Cl$_2$ exhibits weak absorption bands at 380 nm. A second more intense absorption appears at 310 nm. These bands are analogous to those reported for the corresponding aquo complex [Mo$_2$O$_4$(H$_2$O)$_6$]$^{2+}$. Furthermore the similarity between the electronic absorptions spectra of II in DMF and CH$_2$Cl$_2$ suggests that the Mo$_2$O$_4$$^{2+}$ core is retained and its coordination environment is unchanged by dissolution in methylene chloride.

The $^1$H NMR spectrum of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$ in d$_7$-DMF exhibits only three resonances corresponding to free DMF indicating that complex undergoes facile exchange of all coordinated DMF ligands with the deuterated solvent. Similar behavior occurs in d$_6$-DMSO where the coordinated DMF molecules readily dissociate to give free DMF. This demonstrated lability represents an important aspect of the chemistry of [Mo$_2$O$_4$(DMF)$_6$]$^{2+}$ that we intend to fully exploit inorder to construct larger functionalized Mo clusters.

Comproportionation of Mo$_2$O$_4$(DMF)$_6$$^{2+}$ (II) and Mo$_3$(DMF)$_8$$^{4+}$ (I)

Examination of the structures of Mo$_2$O$_4$(DMF)$_6$$^{2+}$ (II) and Mo$_3$(DMF)$_8$$^{4+}$ (III) and shows that they differ by a single Mo(DMF)$_3$ fragment. (Fig. 3) Based on our earlier observations regarding the oxidation of Mo$_2$(DFM)$_8$$^{4+}$ (I), (Fig. 1), we anticipate that I may serve as the source of this Mo(II) fragment. Accordingly the reaction of Mo$_2$O$_4$(DFM)$_6$$^{2+}$ (II) with 0.5 equivalents of Mo$_2$(DFM)$_8$$^{4+}$ (I) in DMF yields a red solution after 30 min. Work-up and preliminary characterization suggest that the solvated, trinuclear Mo(IV) ion, Mo$_3$O$_4$(DFM)$_9$$^{3+}$ (III), is indeed formed in good yield. We are currently continuing our investigations into this intriguing reaction. Formation of III from this reaction will provide valuable insight into the oxidative decomposition of I (Fig. 1) and demonstrate that larger solvated clusters may be deliberately synthesized from smaller, solvated metal-metal bonded precursors.

Conclusion

The Mo(V)-Mo(V) solvated oxo-cation, [Mo$_2$O$_4$(DMF)$_6$][BF$_4$]$_2$ (II), has been prepared in good yield via reduction of high valent, molybdate precursors. Spectroscopic data confirms the presence of a Mo$_3$(µ-O)$_2$O$_2$$^{2+}$ core that is supported by labile DMF ligands. Preliminary reactivity studies indicate that Mo$_2$O$_4$(DFM)$_6$$^{2+}$ undergoes a comproportionation reactions with Mo$_2$(DFM)$_8$$^{4+}$ (I) to produce a higher nuclearity cluster believed to be Mo$_3$O$_4$(DFM)$_9$$^{3+}$ (III). Complex II represents a rare example of a cationic polyoxo-metalllate cluster and a potentially powerful building block in the assembly of higher nuclearity clusters. Furthermore the demonstrated lability of the DMF ligands provides additional opportunities to functionalize the surface of these clusters, a task that has proven difficult for traditional polyoxometallate clusters.

Experimental

General Considerations. All manipulations involving air or moisture sensitive compounds were carried out using standard Schlenk techniques except where noted. THF and dichloromethane were either purchased in anhydrous form or distilled in the...
Molybdenum Clusters
Continued from page 24

presence of CaH₂ under argon. Tetrafluoroborate diethyl etherate was purchased from Aldrich and used without further purification. All other reagents were purchased from commercial sources and used as received. ¹H NMR data were collected on a Bruker Avance Spectrometer operating at 300 MHz. Chemical shift data are reported relative to TMS using the residual proton impurity of the deuterated solvent. IR spectra were recorded as KBr pellets using a Perkin-Elmer Spectrum GX FTIR. UV-vis spectra were collected using a diode-array spectrophotometer.

[(NH₄)₂MoO₄], 0.096g (1.47 mmol)

UV-vis spectra were collected using a Perkin-Elemer Spectrum GX FTIR. UV-vis spectra were recorded as KBr pellets using a Perkin-Elmer Spectrum GX FTIR. IR spectra were recorded as KBr pellets using a Perkin-Elmer Spectrum GX FTIR. UV-vis spectra were collected using a diode-array spectrophotometer.

[Mo₇O₂₄(DMF)]₆[BF₄]₂ (II). To a heterogeneous mixture of 0.250 g (0.20 mmol) [NH₄]₆[Mo₇O₂₄] • 4H₂O (“(NH₄)₂MoO₄”), 0.096g (1.47 mmol) zinc dust, and 5mL DMF under argon atmosphere 1mL of HBF₄ (48% solution in diethyl ether) was added. The mixture was stirred at 25°C for 4 hours. Addition of 30mL of THF to the red-orange solution followed by cooling to -58°C for 2 hours, and then storage for 8 hrs at 0°C produced a crude orange solid. The remaining solution was decanted by cannula. The crude orange product was then dissolved in 5mL dichloromethane and filtered through a medium frit to remove insoluble contamination. Slow addition of 4 to 7mL THF to the dichloromethane solution produced an orange precipitate. The solid was collected by filtration, washed with copious amounts of Et₂O and dried under vacuum. Yield 0.468 g (82%). Single crystals of II can be obtained by slow dissolution of THF into a CH₂Cl₂ solution of II. IR (KBr) 3390, 2950, 1651, 1493, 1434, 1364, 1251, 1080, 745, 702, 521 cm⁻¹. ¹H NMR (300 MHz, d₆-DMSO, ppm) δ 2.73 (s, 3H), 2.89 (s, 3H), 7.95 (s, 1H). UV-vis (DMF) 286, 309, 319, 339, 350, 380 nm.

Acknowledgements
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References

Who wants to be a Mole-ionaire?

This is a chemistry game based on the game show of similar name and plays pretty much like it. http://www.utdallas.edu/dept/chemistry/acs/index.html

Click on this, go all the way to the bottom of the page and click on the mole icon when it comes up. Read the directions carefully and answer 15 in a row to accumulate 1,000,000 micromoles.
Digital cameras are being used by increasing numbers of scientists; the Internet is just one of many potential outlets. Images should be created with knowledge of the camera as a tool, full consideration of the guidelines of photography, and of the role of images in communication.

Images can be very powerful. Vision accounts for up to 80 percent of the information processed by the average person. They can draw readers into an article or engage them in presentations or advertisements. Images have the unique ability to persist long after other memories have faded.

Scientific images can be just as memorable, provided they engage and evoke a response from the viewer. Images should not be an afterthought; but ought to support your writing or presentation. Images should be an integral part of the process. One poorly exposed or sloppily composed image can confuse the viewers and cause them to question your attention to detail and possibly, the quality of your work or product.

With this in mind, a review of basic photographic principles may be in order, particularly as they relate to digital imaging in the laboratory.

White balancing the digital camera ensures accurate color balance in the final image. The white balance corrects for the black body temperature profile of the illuminant. Today’s film, tungsten bulbs are orange and fluorescent lamps are typically green; white balancing corrects the digital image for these sorts of color casts. Rather than using preset values for each illuminant type, some cameras will allow you to measure white balance directly, thus compensating for mixed lighting conditions.

Digital point and shoot cameras have zoom lenses permanently mounted on the camera body. An adapter will allow the use of other lenses. These can extend the range to the very wide (8 mm) or telephoto (1000 mm). In the laboratory, the range of 28-105 mm is adequate for most purposes. Close focusing or macro capability is desirable, since small subjects are often photographed. Some cameras will close focus at only 1-1.5” from their subjects.

Lighting should be evenly distributed throughout the frame. Avoid hot spots where the lighting is reflected or the flash is intense; digital sensors like CCDs are intolerant of such sins. The end result of overexposure in these areas is lack of detail. A built-in flash can be harsh, providing not only hot spots, but deep shadows, too. A better solution is to use a separate camera flash that is “bounced” off the ceiling. A diffusion dome on the flash can also help provide softer, more even diffuse lighting.

For working distances of less than a few inches, ring lights are often employed. These lights surround the camera lens and provide a source of even lighting that cannot be obtained by conventional means.

Photography of glassware is a special situation, requiring careful attention in the setup of your lights. Consult instructional photography books under brightfield and darkfield illumination.

Point and shoot cameras are often used in their automatic mode, which provides the best compromise of shutter speed and f-stop. However, under certain circumstances, you will want to give preference to one setting over the other by using either shutter or aperture priority. While shutter control affects the camera’s ability to stop action, aperture priority can be more useful. It controls the depth of field.
Effective Images
Continued from page 26

where objects are in sharp focus. Tripods must be used when you are shooting at close range especially when the shutter speed is less than 1/100th - 1/60th of a second.

With specially designed adapters, some cameras can be used for photomicroscopy. Eyepiece vignetting (reduction in image size) is a concern when using adapters. When image quality is important, connect the camera body directly to the microscope to ensure a minimum of intervening lenses.

While learning the technical aspects of photography is relatively easy, creating effective images requires patience, practice and attention to detail, three attributes common to most scientists.

Since the goal of images is to communicate, keep the subject matter as simple as possible. An information-rich image need not be complicated. Carefully set up the area being photographed; remove all non-essential equipment and clutter. Isolate your subject with framing and perspective; do not include extraneous details to confuse the viewer. Use selective lighting to highlight your subject.

Most beginning photographers include too many points of interest in their photos. With digital, you no longer have to worry about film or processing costs, so shoot with abandon! Allow yourself to make mistakes and learn; take the first photo and then get closer and shoot again, then get closer still and shoot again. Think about your subject and what you are trying to show. Consider that what you have in mind may be several images, not just a single one.

Another guideline is the “rule of thirds”, in which the subject of interest falls on the intersection of two imaginary horizontal and vertical lines in the frame. While this rule can be “broken”, in the majority of cases, it is better to use one of these four locations for subject placement.

Lines leading from the corners to the points of interest can also be used to engage the viewer. It is not just the content of your images, but also how the viewer’s eye ‘travels’ that determines visual interest and the attention of your audience. Next time you look at an image you find compelling, think about these “rules” and see if any of them are being used. The chance is high that they are.

With the advent of digital cameras came the ability to control image quality, but as with any tool, one must be careful how processing software is used. As in the computer field where the “garbage in - garbage out” adage was used, this saying also applies to digital photography. For best results, one must start out with a well-exposed, fairly sharp image. This is even more important with respect to scientific images where image processing should be kept to a minimum. Image modifications should be noted in the description of the image as determined by the context. It is reasonable to expect that over-processing will induce artifacts not present in the original.

Without a doubt, the image-making process can be time-consuming for the researcher who often is under enormous time-pressure and budgetary constraints.

But when given its due, images can rise to their full potential and compliment high quality research. Well-constructed images can engage and hold the interest of your readers, audience, and customers. The power of anything that gives you a competitive edge in this media-rich world is not to be underestimated.

The bar and the stakes are now higher than ever. Don’t be left behind.

Further Reading:
Digital Photography Review (news, reviews, cameras, forums) www.dpreview.com
Frankel, Felice, Envisioning Science, MIT Press, 2002
Linus Pauling DNA Website:

The Oregon State University Libraries Special Collections has launched, a new website, “Linus Pauling and the Race for DNA: A Documentary History.”

The website, http://osulibrary.orst.edu/specialcollections/dna, explores one of the greatest scientific achievements of the 20th century, the discovery of the structure of deoxyribonucleic acid, (DNA), the basic foundation of life. More than 800 original letters, manuscripts, photographs, audio-clips and video excerpts form the heart of the site. Unique items are: 1) An extremely rare prepublication typescript of James Watson and Francis Crick’s groundbreaking DNA paper; 2) A prepublication typescript of Rosalind Franklin’s DNA paper, published in the same issue of “Nature” as Watson and Crick’s, with handwritten additions by Franklin 3) Linus Pauling’s contemporaneous laboratory notes outlining his DNA work, and a much-corrected manuscript of the paper relating his mistaken structure 4) Manuscript letters written at the time, including correspondence between all the major players in the race for DNA.

A comprehensive, day-by-day account of all of Pauling’s personal and professional activities in the years 1952 and 1953 is included, with scanned images of documents and photographs accompanying the text.

Have you looked at the NEW NESACS website?
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http://www-chem.harvard.edu/events/
http://www.umassd.edu/cas/chemistry/ [new url]
http://www.dartmouth.edu/~chem/

Feb 3
Dr. Robert DiCosimo (DuPont Experimental Station)
“Process Development Using Biocatalytic Nitrile Hydration and Hydrolysis”
Tufts Univ., Pearson Chemistry Building, 62 Talbot Ave., Medford, Room P-106, 4:30 pm

Feb 4
Prof. Vern Reinhold (Univ. of New Hampshire)
“Chemical and Analytical Strategies for Complete Glycoprotein Characterization”
Northeastern Univ., 320 Shillman Hall, 11:45 am-1:20 pm

Feb 5
Prof. Taekjip Ha (Univ. of Illinois, Urbana-Champaign)
Woodward Lecture Series in the Chemical Sciences; Physical Chemistry Seminar
Tentative Title: “Single Molecule Biophysics”
Harvard Univ., Pfizer Lecture Hall, 12 Oxford St., 4:00 pm to 5:00 pm

Feb 9
Prof. Roderick MacKinnon (The Rockefeller Univ.)
The 2004 Max Tishler Prize Lectures; Tentative Title: “Biophysical Aspects of Ion Channel Function”
Harvard Univ., Pfizer Lecture Hall, 4:15 pm to 5:30 pm

Feb 10
Prof. Roderick MacKinnon (The Rockefeller Univ.)
The 2004 Max Tishler Prize Lectures; Tentative Title: “Biophysical Aspects of Ion Channel Function”
Harvard Univ., Pfizer Lecture Hall, 4:15 pm to 5:30 pm
Prof. Shana Kelley (Boston College)
“DNA Damage Promoted by Amino Acids”
Tufts Univ., Pearson Chemistry Building, 62 Talbot Ave., Medford, Room P-106, 4:30 pm

Feb 11
Prof. Omar Yaghi (Univ. of Michigan)
Harvard/MIT Inorganic Chemistry Seminar
“Reticular Synthesis and Applications of Metal-Organic Frameworks”
Harvard Univ., Pfizer Hall, 12 Oxford ST., 4:00 pm
Prof. John Essingmann (MIT)
“Synthesis of Novel Toxins that Block DNA Repair and Hijack Transcription Factors: Applications to Cancer Chemotherapy”
Northeastern Univ., 320 Shillman Hall, 11:45 am-1:20 pm

Feb 12
Randall Wetzel, PhD (Cell Signaling Technology)
"The Use of Signaling in Diagnostics"
American Assoc. for Clinical Chemistry Doubletree Guest Suites Hotel: Waltham at 128 Social: 6 PM; dinner, 7 PM; lecture, 8 PM

Feb 17
Prof. Charles Riordan (Univ. of Delaware)
“Nickel Coordination Chemistry: Biomimetic and Bioinspired Transformations”
Tufts Univ., Pearson Chemistry Building, 62 Talbot Ave., Medford, Room P-106, 4:30 pm

Feb 18
Prof. Anne Baranger (Wesleyan Univ.)
Boston College, Merkert 130, 4:00 p.m.
Prof. Robert Campbell (Northeastern Univ. Dept of Pharmaceutical Sci.)
“Targeting Tumor Vessels and Angiogenesis with Liposomes: Implications for Anticancer Therapy”
Northeastern Univ., 320 Shillman Hall, 11:45 am-1:20 pm

Feb 19
Prof. Edward S. Yeung (Ames Lab., Iowa State Univ.)
“Dynamics of Single Biomolecules in Free Solution”
Harvard Univ., Pfizer Lecture Hall, 12 Oxford St., 4:00 pm to 5:00 pm

Feb 23
Prof. Wendell Lim (Univ. of Calif. San Francisco)
“Switches and Scaffolds: Understanding the Logic of Modular Signaling Proteins”
Harvard Univ., Pfizer Lecture Hall, 4:15 pm to 5:30 pm

Feb 24
Prof. Dr. Michael Wolfe (Harvard Medical School)
“Biochemistry and Inhibition of Ë¡-Secretase”
Tufts Univ., Pearson Chemistry Building, 62 Talbot Ave., Medford, Room P-106, 4:30 pm

Feb 25
Prof. Tom Tullis (Boston Univ.)
“Adding Another Dimension to the Genome: Chemical Maps of DNA Structure”
Northeastern Univ., 320 Shillman Hall, 11:45 am-1:20 pm

Feb 26
Prof. Arup Chakraborty (UC Berkeley)
Woodward Lecture Series in the Chemical Sciences; Physical Chemistry Seminar
“Intercellular Communication in the Adaptive Immune System”
Harvard Univ., Pfizer Lecture Hall, 12 Oxford St., 4:00 pm to 5:00 pm

Notices for the Nucleus Calendar should be sent to:
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