THE MIDLAND CHEMIST
Vol. 39, No. 5 August 2002

Chuck Roth, left, presents glassware to Gary Ronk, chemistry teacher at Shepard High School.

THE MIDLAND CHEMIST

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In This Issue ...

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Cover photography by Angelo Cassar.

Chair Column

Section Nominated for National Awards

Pat Cannady, Chair
ACS Midland Section

Summer is now the season, some of us have taken off and others will be using the last 2 weeks or so and will be shoving off for a bit (well, I know at least that I'm going!). Just remember a bit of common sense, non-chemical good sense, let's be careful out there!

A bit of news from the National Meeting front—first of all, the 224th National Meeting of the ACS will be held in Boston, MA, from Sunday, August 18, 2002, until Thursday, August 22, 2002. The final program was outlined in the July 22, 2002, issue of *Chemical & Engineering News*, so not much more will be heard about it here, except for one thing, that is. The Midland Section has been notified that Section projects have been selected for not one, not two, not even three, but *four* ChemLuminary awards. While we are still awaiting the final evaluation, I thought that you would like to hear about the four areas of activity that our fellow ACS members felt so highly of to nominate them and the leadership of each activity. They are:

- Committee on Local Section Activities—Best Activity or Program in a Local Section Stimulating Membership Involvement Award, for: The 57th Midland ACS Fall Scientific Meeting, Fred Vance.
- Committee on Local Section Activities—Outstanding Performance by a Local Section Medium Large Size Category Award, for: Sci-Fest, Dave Stickles.
- Division of Polymer Chemistry—Award for Innovative Initiatives in Polymer Science, for: Twelve hands-on experiments, entitled "Clowning Around with Polymers," John Blizzard.
- Minority Affairs Committee—Best Overall Local Section Minority Affairs Committee, for: Minority Affairs Committee, Lin Dorman.

These were excellent activities accomplished by various groups in the Section during 2001. It is very encouraging to see the larger, national group willing to recognize them as well. The final awards will be given at a program on Tuesday night, August 20, 2002. I hope you will be able to attend the meeting and enjoy the contribution of your fellow Midland Section members towards the overall success of the Society in explaining how chemistry is a benefit to everyone.

Pat Cannady

Lessons Learned: Facing Potential Job Loss

By Deb Bergstrom

As a new member of the unemployed, I have gained key insights which might be valuable to share with others. Although most of us would not choose to be downsized, right-sized, re-engineered, or reorganized out of a job, with our eyes wide open we might be able to see it coming and not be caught completely off-guard. There are many reasons why we may or may not be selected for separation from our employers. Although we may never completely understand the decisions, the ability to anticipate job loss will allow one to better prepare. Here are some possible job risk indicators. Are you…

- In an area with diminishing strategic importance
- Becoming less visible
- Suddenly outside key information loops
- Not being sought out for new work
- Getting no reassurances during periods of layoffs
- Not participating in planning and being asked to wrap up activities
- Newly redundant due to consolidations
- In a politically controversial area
- Experiencing a change toward less supportive management
- Being moved to a position outside your expertise
- Requesting a change during shrinking options
- Seeing diminished management interest in your work
- Disagreeing with key coworkers
- Working in an area of long-term focus but no early revenue
- Geographically isolated and not willing to move
- Doing work that could be outsourced

If you see yourself in several of these situations, perhaps you should open your eyes and carefully consider the strength of your position. These circumstances, perhaps less significant during good times, could indicate that your position is at risk in a shrinking organization. Additionally, these working conditions could provide an incentive to consider your broader options.

What Can You Do?

Whether or not job loss is imminent, there are certain things which should be done on a regular, continuing basis to be ready for the career transitions we all may face, expectedly or unexpectedly. Don't wait to start until your situation is compromised or you are released. Do as much

as you can before you lose your job. Here are some suggestions:

- Understand current résumé formats and keep your résumé up to date
- Keep records of measurable accomplishments in real dollar values
- Diversify and define yourself on a skills basis
- Keep your internal and external contacts active
- Maintain contact with those who have left your organization
- Publish or present papers if possible to keep an external track record
- Be aware of general industry trends, growing and declining areas
- Maintain good relationships with recruiters
- Contact a career consultant (ACS has good ones!)
- Maintain involvement with your professional organization
- Keep up on books on career management ("What Color is Your Parachute 2000")
- Store copies of personal records, professional records, and key contact information at home

In my years of work I felt I had little time to stay current on career information. In hindsight, I realize how naïve I had become. I had vague, inaccurate notions about job banks, Internet searches, résumés, and networking. My job searching perspective was primarily defined by my early career searches and lacked practical information on modern job searches, mid-career issues, and general career management.

For example, a common misconception is that the simplicity of the Internet has made job hunting easier. In fact, the ease of submission of documents electronically has resulted in databases (Monster.com) choked with both job ads (many old) and thousands of résumés, making them ineffective and possibly even detrimental to a more focused job search later. The success rate for this approach is very low. On the other hand, the Internet is extremely valuable for finding critical information on target companies and is the fastest tool for providing cover letters, résumés, references, and other documents once contact is made. Unfortunately the Internet is not a substitute for the emotionally tougher job of person-to-person networking, the most effective way to find a job.

Speaking of Networking

I have a new appreciation for how much career health requires building a permanent, enduring, global network of friends, colleagues, current and former coworkers, and family. Creating and sustaining an effective network is an on-going and time-consuming but critical activity which I will now continue until I retire. An effective network is the most critical tool for understanding the job market, getting a better fit in your positions, and career success into the future.

In a mid-career transition we find ourselves in different circumstances

than in our younger working days. People are generally in a higher income bracket, which drives both the worker and potential employers to look for a closer job fit. Armed with what I have learned on the job, I find myself more interested in the health of the company, its sense of direction, team cohesiveness, style, size, and culture. We all have more personal ties, commitments, and complications in our lives to consider in any mid-
career decision also. This all requires much careful consideration.

What else have I learned through this difficult process of losing a job?

- There is little or no stigma associated with job loss in today's market.
- It's more of a liability to work a long time in one place than move around.
- One gets quickly out of touch if not actively networking.
- The Internet is a valuable tool, but not necessarily the most important one.
- Large industries are moving to a more mobile, flexible work force.
- Smaller companies are numerous, exciting, and growing.
- It is easy to ignore the need to develop and maintain skills.
- We need to be aware of what is happening in the industry.
- It is important to help others on the job market. (One may be there next.)
- One should always be prepared and always looking for a better fit.
- Few people really expect job loss to happen to them, but it does.

In the end, although job loss is difficult, we still live in a big world, full of great opportunities. One of the important things in today's environment is to keep those opportunities in mind throughout your career, not just when you face unexpected roadblocks.

[Editor's Note: We will be featuring another article on downsizing by Deb Bergstrom in the September issue of The Midland Chemist. The article is entitled "Professionalism during Downsizing."]

Mid-Michigan Technician Group Update

By Debbie Bailey

MMTG continues to focus on giving back to our members. This year our technician affiliate group (TAG) implemented "Who is … and what does he or she do?" This is a 5 to 10 minute presentation on one of the members and what their role is as a technician. This presentation also includes past experiences and some personal information (e.g., married, single, children, pets, hobbies, etc.). This short presentation is given at our monthly meetings and gives other members the opportunity to get to know what other technicians are doing, gain new contacts, and network.

Social events are another opportunity for members to get know each other on a social and a technical level. So far this year we have had two social events. The first was a karaoke night and the second was a dinner at a traditional Japanese steak house (where they cook the food right in front of you). Our TAG is planning to continue these social events (approximately every other month).

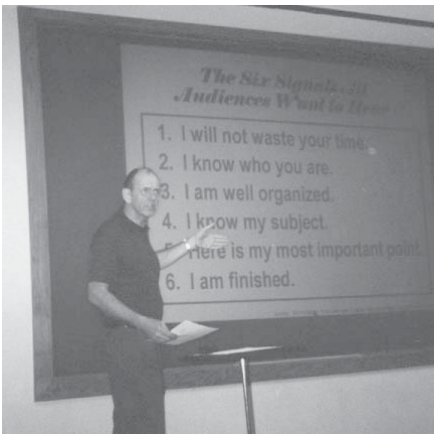
MMTG members enjoy a personally prepared dinner at the new Genji restaurant in Midland.

Each year our TAG presents an award to a deserving student enrolled in the chemical technology program at Delta College. This year the award went to Sarah Bottke at the Midland Section ACS Spring Science Education Awards Banquet. Sarah's credentials are truly outstanding. She maintained a 3.6 grade point average and made the dean's and/or vice president's list almost every semester she was at Delta. Along with her full-time college schedule, she worked as a co-op for Dow Corning Corporation in the Resin Technology Platform. Her co-op supervisor, Glen Gordon, praises her for her dedication, initiative, and professional attitude. Sarah graduated this semester and started a new position as a technologist for The Dow Chemical Company in the glycol ether department. She is also continuing her education as a part-time student at SVSU

Sarah Bottke (left) accepts the Outstanding Chemical Technology Student award from Debbie Bailey.

working toward a bachelor's degree in business chemistry. Our congratulations to Sarah!

Another way our TAG has been giving back to our members is through training seminars. This year we have had one lunchtime seminar and one 4-hour training seminar (new this year!). The lunchtime seminar was "Weighing the Pros and Cons of a Career Switch for Chem Techs: Is the Grass Really Greener?" and was presented by MMTG members Tina Leaym and Janet Smith. This was an excellent seminar for technicians who may be considering a career change. The 4-hour training seminar was titled "Your Point Is…?" and was presented by Gene Anderson, a retiree from Dow Chemical. Anderson is not just a retiree from Dow Chemical; he is a motivational speaker, trainer, and magician. He has led this training seminar in fifteen countries on six continents, both inside and outside of Dow Chemical. This seminar covered presentation skills, new technology, and the growing use of poster presentation.



Gene Anderson covered the basics for preparing and delivering great presentations.

Our TAG has two more lunchtime seminars planned for this fall. These seminars will be open to all technicians and will be presented by Ann Birch. Ann is the founder and co-owner of Editech, a technical communications firm in Midland, Michigan. She has 11 years experience as a research chemist and 17 years experience as a free-lance technical writer and editor. She works extensively with technical authors, and she writes, edits, and formats technical documents. Descriptions of the seminars are provided on the next page. Check our website for upcoming activities http://membership.acs.org/t/tag/default.htm.

New MMTG Members

By Debbie Bailey

Welcome to the following people who have joined MMTG since March of 2002!

- Andrew Banks
- Tanya Habitz
- Harold Heath
- John Kohn
- David Plante

MMTG Technical Communication Seminars

Taking (some of) the Pain out of Technical Writing

September 10

Writing technical reports is not a popular pastime for many technical professionals. Most would rather be in the laboratory or plant *doing* science rather than *writing* science. However, documenting research is an invaluable part of doing science, enabling the researcher to decide on an experimental approach, draw valid conclusions, and ultimately, receive recognition for their efforts. Without documentation, there is no research.

This lunchtime seminar provides a plan for writing a technical report and recommendations on making the writing process more efficient and less painful. It also discusses problems to watch for in reports, showing how to ensure that the report is accurate, understandable, and professional. RSVP by August 30 to Debbie Bailey at d.k.bailey@dowcorning.com or call 989-496-6337.

Using Microsoft® Word for Technical Writing: things your mother never told you

October 16

Many researchers spend as much, or more, time formatting their reports than writing them. With figures that won't behave, numbers that won't line up, and multimegabyte files that crash computers, researchers are becoming increasingly frustrated with the writing process.

This lunchtime seminar shows how to use MS Word to organize a technical report. It also gives guidelines on inserting tables and figures and keeping electronic file size to a reasonable level. MS Word features that make report writing more efficient will be demonstrated. RSVP by October 4 to Debbie Bailey at d.k.bailey@dowcorning.com or call 989-496-6337.

New Developments in Career Services Featured at Boston Meeting

By Don Miller

Jean Parr, assistant director for career services for ACS, has announced new capabilities for job seekers and employers. The Department of Career Services (DCS), in collaboration with JobSpectrum and Boxwood Technologies, has developed a remarkable new database for the national employment clearinghouses that are held at ACS national meetings. The new NECH database, debuting in Boston, will be fully computerized and represents a major upgrade of NECH—perhaps the most substantial overhaul in its 65-year history. The improvements are broadly intended to enhance the communication and interaction between job seekers and employers, both before and during national meetings. NECH's new way of doing business includes direct access to résumés and positions, a private e-mail system, and interview scheduling, all beginning on the first day of registration. Rather than having to wait until the national meeting to schedule interviews and communicate with one another, job seekers and employers will arrive at the meeting with their interview schedules set.

Because the focus of the on-site activities will be on scheduling and holding interviews, there will be no on-site NECH registration. It is vitally important that anyone who wants to attend NECH in Boston register in advance. Please review the program from the July 22 issue of *C&EN* and take a look at the online demo of the new NECH at http://chemistry.org/portal/Chemistry?PID=acsdisplay.html&DOC=careers%5Cboston2002%5CNECH_home.html

If you wish to participate, you must register for NECH by August 14 or you'll miss the opportunity to participate in the largest on-site employment center for chemical scientists. During the Boston national meeting, DCS will also be presenting a full line-up of career workshops, mock interviews, résumé reviews, and career consultations.

Call For Nominations

2002 Midland Section Awards

Outstanding Achievement and Promotion of the Chemical Sciences

Each year the Midland Section honors an individual residing within the Section's geographical area who has demonstrated outstanding achievement and promotion of the chemical sciences. This award recognizes dedication and service to the chemical profession. The recipient need not be an ACS member. Nominations should include a biographical sketch, list of pertinent publications, evidence of professional growth and involvement, and letters of support from colleagues. Previous recipients of this award are:

1976	Turner Alfrey, Jr.	1989	Do Ik Lee
1977	Etcyl H. Blair	1990	Joseph E. Dunbar
1978	David C. Young	1991	Thomas H. Lane
1979	Vernon A. Stenger	1992	Donald A. Tomalia
1980	Daniel R. Stull	1993	Dale J. Meier
1981	Bob A. Howell	1994	Philip T. Delassus
1982	Wendell L. Dilling	1995	Duane B. Priddy
1983	Donald R. Weyenberg	1996	Hans G. Elias
1984	Edwin P. Plueddemann	1997	Ludo K. Frevel
1985	Raymond P. Boyer	1998	Patrick B. Smith
1986	Stanley P. Klesney	1999	David E. Henton
1987	Warren B. Crummett	2000	Steven J. Martin
1988	A. Lee Smith	2001	Edwin C. Steiner

Outstanding Service to the American Chemical Society

The Section sponsors an annual award to recognize outstanding service to the Midland Section of the ACS. This award recognizes achievement in the promotion of the goals of ACS. Nominees shall be members of the Midland Section. Nominations should include a biographical sketch, a history of service to the Midland Section, and supporting letters from fellow ACS members. Previous recipients are:

1989	David C. Young	1996	Fran K. Voci
1990	Linneaus C. Dorman	1997	Thomas H. Lane
1991	Donald R. Petersen	1998	Vicky S. Cobb
1992	Wendell L. Dilling	1999	Theodore E. Tabor
1993	Bob A. Howell	2000	Peter and Patricia Dreyfuss
1994	Eldon L. Graham	2001	George W. Eastland, Jr.
1995	Gretchen S. Kohl		

Outstanding Chemical Technician

The Section presents an annual Outstanding Chemical Technician Award to an individual who has demonstrated an extremely high degree of professionalism as a chemical technician. The ACS defines a chemical technician as a person whose training includes successful completion of a two-year post-high school level chemistry curriculum leading to an Associates Degree, or the equivalent course work in a Baccalaureate program, or the equivalent knowledge gained by experience. The primary work of a chemical technician is conducting experimentation and/or correlating information to help solve chemical problems and/or discover new chemical knowledge. Criteria used to judge the award include job skills, safety, teamwork, leadership, publications and presentations, reliability, communication skills, and additional professional and community activities. Nominees must have worked for five years as a chemical technician. Chemical technicians do not need to be a TECH Division Affiliate or ACS member to be eligible for this award. Nominations should include a biographical sketch and supporting letters that address each of the criteria above.

Previous recipients are:

1997	Connie J. Murphy	2000	Kurt A. Bell
1998	David Stickles	2001	Gordon R. Roof
1999	Ronald L. Good		

Nominations for all three awards are invited. The deadline for receipt of nominations and all supporting materials is September 13, 2002. Nominations should be sent to:

Philip J. Squattrito
Department of Chemistry
Central Michigan University
Mt. Pleasant MI 48859
Fax (989-774-3883) or electronic nominations are also welcome.

If you have questions or need additional information, please contact Phil at 989-774-4407 or p.squattrito@cmich.edu. Nominators should provide their address and phone number in case the committee needs to contact them. The Awards Committee encourages all section members to nominate deserving colleagues and appreciates your efforts in helping these individuals receive recognition for their efforts. We look forward to hearing from you!

Congratulations to MMTG!!!

By Debbie Bailey

At the national ACS meeting in Boston, MMTG will be receiving an ACS "Salutes to Excellence" award for our TAG's contributions to the National Chemistry Week program over the past several years. A message from V. Michael Mautino (2002 TECH Chair and ACS NCW Task Force Member) reads:

> "Please extend my congratulations to all of your TAG members for helping the ACS's NCW program complete its mission 'to reach out to the public, particularly elementary and secondary school children, with positive messages about chemistry; to make a positive change in the public's impression of chemistry; to promote a mechanism for effectively mobilizing ACS local sections; and to motivate the ACS membership through local section activities.' "

I would personally like to thank all the members for your support. Without dedicated members this TAG wouldn't be successful!

Dow Chemical Awarded National Medal of Technology

President of the United States George W. Bush presented the National Medal of Technology to The Dow Chemical Company in a June 12 ceremony at the White House. Dow President and CEO Mike Parker accepted the medal on behalf of the company.

Dow was honored "for the vision to create great science and innovative technology in the chemical industry and the positive impact that commercialization of this technology has had on society." The medal recognized technical breakthroughs in advanced materials development such as metallocene catalysts/polyolefins and the invention of new polymers for use in electronics manufacturing, such as SiLK dielectric resin and polymeric light emitting diodes.

The National Medal of Technology is the highest honor bestowed by the President of the United States to America's leading innovators. First awarded in 1985, the medal is given annually to individuals, teams, or companies for accomplishments in the innovation, development, commercialization, and management of technology, as evidenced by the establishment of new or significantly improved products, processes, or services.

—From *Around Dow*, Vol. 8, No. 4, August 2002

Call for Posters

2002 Fall Scientific Meeting

ACS Midland Section

Date: Friday, October 11, 2002
Location: EDC of Dow Chemical

Please consider presenting a poster at the Fall Scientific Meeting. Abstracts are being accepted now through **September 13th**. Abstracts must be e-mailed to:

Dr. David S. Karpovich	989-790-4349
Department of Chemistry	fax 989-790-2717
Saginaw Valley State University	dsk@svsu.edu
or	
Dr. Dale LeCaptain	989-774-3993
Department of Chemistry	dale.lecaptain@cmich.edu
Central Michigan University	

For additional information check out the local section website: http://membership.acs.org/m/midl/. An example of the abstract format is depicted and described below.

Instructions for Preparing Abstracts for the Fall Scientific Meeting of the Midland Section of the American Chemical Society

John Doe and Joe Smith, Department of Chemistry, Saginaw Valley State University, University Center, MI 48410

Begin typing your abstract here. Use Microsoft Word (IBM or Mac) or WordPerfect(IBM or Mac) to create your files. Limit abstracts to one per file. Use Times font, 12 point size. Single space your work and double space between paragraphs. Do not use any indentations. **Bold** the title only. Body copy of the text should be typed in normal type. Use superscripts, subscripts, and correct symbols where appropriate. Use *italic* only when required. All copy should be typed flush left. Do not center or justify your type. Use a four and one half inch wide line. Each abstract is limited to a maximum of a 4-line title and 1300 characters in the body of the abstract. The information should appear in the following order: title, author list with complete address; presenter underlined; one blank line between title and abstract. Electronic submissions are required and the e-mail address of the submitter will be the contact person unless otherwise noted.

Project Science Literacy Furnishes Glassware to Shepard High

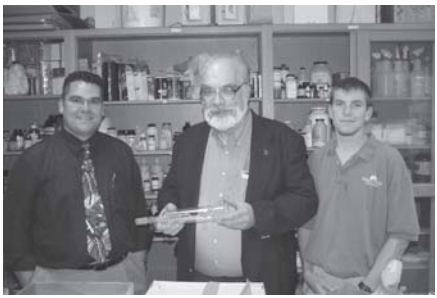
Article and photos by Angelo Cassar

Gary Ronk, chemistry teacher at Shepard High School, was presented with much-needed glassware for his chemistry class. The Dow Chemical Company and Dow Corning Corporation donated the glassware to the Midland Section ACS.

Gary Ronk attended one of Midland Section's Project Science Literacy "Bringing Science to Life in the Classroom" teacher workshops. This workshop shows K–12 teachers how to demonstrate hands-on chemistry experiments using everyday household items such as vinegar and red cabbage. Gary learned through Gretchen Kohl, one of the instructors, that surplus glassware is often donated by area businesses. John Blizzard, Mike Ferritto, Joan McMahon, Marv Tegen, Don Miller, and other Project Science Literacy volunteers collect, wash, inventory, and store the glassware for teacher requests. Chuck Roth volunteered to pick up the requested supplies and deliver them to Shepard High.

Chuck Roth, left, presents glassware to Gary Ronk, chemistry teacher at Shepard High School.

Eight boxes of chemistry-related items were delivered, which included a desiccator, condenser, boxes of pipettes, a Soxhlet extractor, and plastic ware. Attending the presentation were the principal, Nathan Bootz, and Rick Cahoon, another science teacher.



Shepard High teachers were happy to receive needed laboratory equipment. From left to right: Nathan Bootz, principal; Gary Ronk, chemistry teacher; and Rick Cahoon, science teacher.

Many high schools cannot afford to purchase equipment needed to teach chemistry effectively. On the other hand, area businesses often discard or landfill unneeded, but still usable, glassware and equipment. In fact, Dow Corning recently donated two 5890 HP GC units, which also happened to be on Gary Ronk's wish list for Shepard High. I asked Gary if he could use those models and he responded with a definite yes!

Sounds like we'll soon be making another trip to Shepard, Michigan!

Midland Section Officers Protest Use of Patent, Trademark Fees

By Bob Howell

[Editor's Note: The letter below was sent on June 3 to Senator Debbie Stabenow, Senator Carl Levin, and Representative Dave Camp and signed by Midland Section Chair Pat Cannady, Past Chair George Eastland, Chair-Elect Mike Owen, and Councilor Bob Howell.]

It has become common practice for fees paid to the Patents and Trademark Office (PTO) to be diverted for deficit reduction or other use. Again this year a significant portion of the fees collected by the PTO will be withheld by Congress and will not be available for use by the PTO. This is an unfortunate and deplorable practice. It prevents the PTO from providing better service to its users. The PTO is unable to hire more examiners, to better train examiners, to modernize search capabilities, etc. This often means that prosecuting a patent application takes far longer than it should, that prior art searches are incomplete or inadequate, that initial action by the PTO is rather cursory (applications are often denied initially simply because the examiner is overworked, is not knowledgeable in a particular area, or inappropriate prior art is cited), and that much of the work rightly the responsibility of the PTO is shifted to the applicant. This situation tends to impede the process of innovation that the PTO was founded to stimulate and that our country is dependent upon to maintain its place of leadership in the world.

Innovation is the engine that drives our nation's economy, preserves our national defense, and provides for the well-being of the nation's citizenry. A modern, efficient, well-functioning PTO is essential to facilitate and maintain the innovative process. We in mid-Michigan are acutely concerned that a climate in which innovation can flourish be preserved. The industry of mid-Michigan is preeminently the chemical industry—both The Dow Chemical Company and Dow Corning Corporation have major manufacturing, research, and headquarters functions in the area. More broadly, much of the industrial foundation of the state is based in chemical or related areas. Innovation in this industry is highly dependent upon the effective administration of the patent system. This industry annually pays significant fees to the PTO to support its activities, i.e., it willingly assumes the cost of the services which the PTO provides. While the cost of patent issuance and maintenance has increased rather dramatically over the past few years, diversion of PTO fees has prevented a corresponding enhancement of service by the PTO. Further, the diversion of PTO fees represents a form of double taxation. The portion of PTO fees

diverted for use outside the office represents a surcharge on earnings for which tax has already been paid.

If the PTO is to function effectively, fee diversion must not continue. We would ask that you use your best efforts to limit this practice. Further, we urge you to support and promote the establishment of the PTO as an independent corporation such that fees it receives may be retained to support its functions.

This is an important issue for our region, our state, and the nation. We will be very appreciative for your assistance in assuring that PTO fees are used for their intended purpose.

Chemistry Demonstrations

Sponsored By

American Chemical Society

&

Mid Michigan Technician Group

Theme Is

"Chemistry Keeps Us Clean"

Date: August 12th & 14th
Location: 4-H Gerstacker Building
Midland County Fairgrounds
6:00–7:00 p.m. Glass Blowing
7:00–8:30 p.m. Chemistry Demos

Come Join in on the Fun……Many Giveaways to Collect
Questions?? Call Wendy Mathews at (989) 636-3934

New Chemistries

Recombinant Protein Purification

By Kristine Danowski

Increasing numbers of proteins are commonly purified from recombinant* sources. Recombinant protein purification involves two major steps: the molecular biology of gene isolation and expression and protein isolation from recombinant cells. Either step can be first: one can begin with the protein of interest and work towards gene isolation or begin with a gene and work towards protein isolation. Recombinant proteins produced on an industrial scale are commercially valuable and/or medically important, such as insulin, growth factors, antibodies, and vaccines. However, recombinant proteins are also purified on the laboratory scale for biochemical analysis. Recombinant protein technology is a major advance in chemistry. It provides new ways of identifying novel proteins and their functions, faster isolation, higher yields, and opportunities for additional manipulation.

One main reason for purifying a protein using recombinant expression instead of from its natural source is quantity. The natural source (or cultured cells) may contain too little of the protein of interest to make conventional purification worthwhile. By using a recombinant system, the protein of interest is abundant compared to the host cell's proteins. Another reason is that, because of complete genome sequencing for several organisms, many genes encode completely unknown proteins. Recombinant techniques are essential for identifying and characterizing these proteins. Additionally, the protein of interest can be modified (engineered) by altering its amino acid sequence or combining it with another protein. In this case expression systems are usually custom-made for a particular protein.

There are some disadvantages to using recombinant systems. One major problem is correct post-translational modification. Eukaryotic proteins are frequently glycosylated, aminated, or phosphorylated, and some types of host cells might be unable to modify foreign proteins in these ways. Another major problem is that the recombinant protein may not behave exactly like its native counterpart or even retain biological activity. Post-translational modification may be the cause, but occasionally the cause is not clear. The recombinant protein may even be toxic to the host cell. Other problems include correct protein folding, stability, and solubility in the host cell.

* *Generally, the term "recombinant" describes the technology of transplanting a gene from its natural organism to a host organism. "Expression" is the directed synthesis of protein from foreign DNA in the host organism. "Recombinant protein" refers to this foreign protein.*

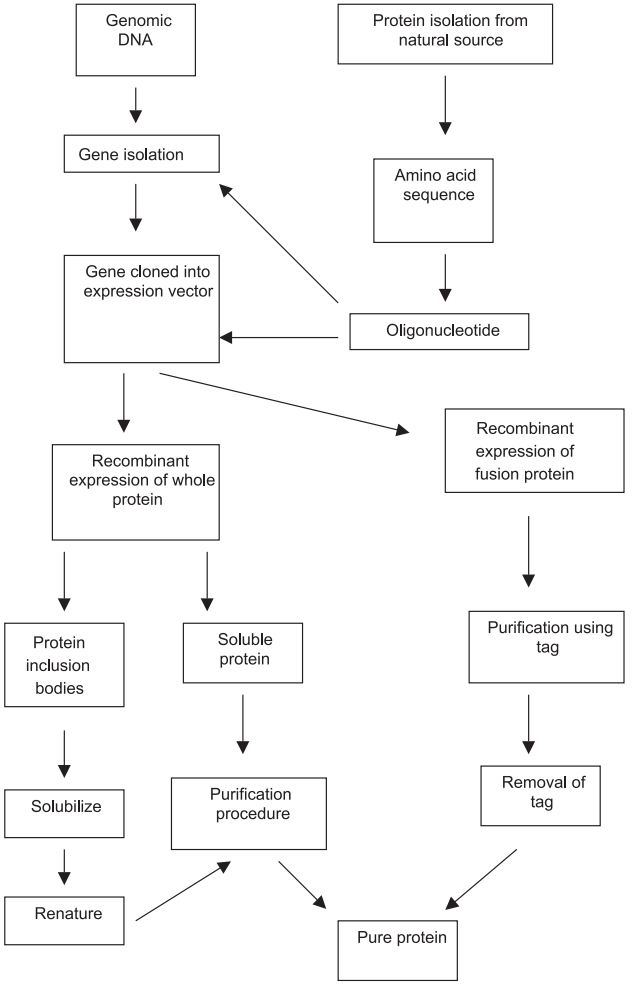


Figure 1. Some possible generic steps in recombinant protein purification (adapted from Scopes.)

Figure 1 shows some steps in the purification process. Briefly, a gene encoding the protein of interest is cloned into a plasmid, virus particle, or other expression vector. The vector is the means by which the gene is reproduced inside the host cell. The vector is then introduced into the host cells by transformation or transfection. Sold by many vendors, expression vectors should contain all the necessary genetic mechanisms to direct the synthesis of the foreign protein in the host. Some of these mechanisms allow for autonomous replication of the vector within the host, allow host cells containing the vector to be preferentially selected, or increase the

efficiency of foreign protein synthesis. Then the host cells are grown, and cells containing the recombinant DNA are selected and grown. Recombinant protein expression is induced (turned on); after an appropriate length of time the protein is isolated.

Within the host cell, the recombinant protein can be soluble or insoluble. If the recombinant protein is soluble, the host cells are lysed (ruptured), and the recombinant protein is separated from the host cell proteins. The expression vector can position the recombinant protein in the periplasm or completely secrete it into culture medium. Insoluble proteins form "inclusion bodies" or aggregates of incorrectly folded protein that occupy much of the host cell. Inclusion bodies can be isolated by centrifugation; however the recombinant proteins are denatured (not in their native state) and must be renatured. This process can be difficult; one investigator compared it to "unboiling an egg." But it can be done, and native protein can be recovered.

Another recombinant protein purification method is a fusion method or tag. To facilitate purification, the expression vector may add an additional few amino acids or even an entire other protein to the protein of interest. Many different tags are used in purification; some can be cleaved from the protein of interest and some cannot. The expressed fusion or tagged protein is then passed through an appropriate affinity column. The tagged protein binds and untagged (host) proteins do not. The tagged protein is then eluted by cation or affinity exchange.

A large number and type of recombinant protein expression systems are currently available. Host cells include various strains of *E. coli* (bacteria) and *S. cerevisiae* (baker's or brewer's yeast), insect cells, Chinese hamster ovary cells, fungi, and plants. Whole animal systems can even be milked or bled to produce industrial quantities of the protein of interest. The intended application of the recombinant protein usually determines which expression system is most suitable.

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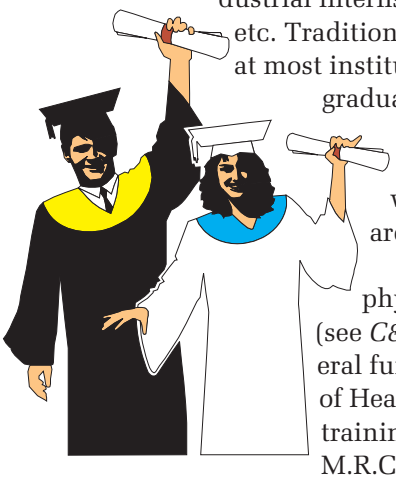
The State of the Physical Sciences in America

by Bob A. Howell

Several recent incidents/events have again called attention to the sorry plight of advanced training in the physical sciences in the U.S. As president of the ACS, Ron Breslow tried to begin to address the issue. His efforts were not met with great enthusiasm. The Committee on Professional Training (CPT) reluctantly agreed to consider the problem and completed a survey to reflect the adequacy of training at Ph.D.-granting institutions in the U.S. Not surprisingly, most responded that they were doing a fine job. Few saw a need for greater emphasis on interdisciplinary training, a materials/polymer science component in the program, an industrial internship as an integral part of the program, etc. Tradition and inertia seem to be firmly entrenched at most institutions. This despite the fact that most graduates (at all degree levels) in the chemical and related sciences will ultimately work in industry, and most of these will work in a polymer or a polymer-related area.



Federal funding for training in the physical sciences also continues to decline (see *C&EN*, April 29, p.22; pp. 19–21). Most federal funding comes from the National Institutes of Health and this influences the nature of training and research done at universities. M.R.C. Greenwood, chancellor of the University of California, Santa Cruz, has noted that, "Nearly two-thirds of federal R&D at colleges and universities comes from the National Institutes of Health, a reality that strongly influences the mix of science and engineering disciplines in their R&D portfolios. Other disciplines, such as engineering and the physical sciences, now account for far smaller shares of the total academic R&D than in past years, and are now at only 15 and 9%, respectively, of the total university R&D portfolio." The National Science Board has also highlighted this decline in support (*C&EN*, May 6, p. 13) and has suggested that training in the physical sciences is the furnace that drives the science and technology enterprise. Continued severe underfunding in this area "could lead to the creation of new centers for research excellence aboard." Lee H. Hamilton, director of the Woodrow Wilson International Center for Scholars and a former congressman from Indiana, has asserted, "Underfunding of the physical sciences could eventually undermine America's leadership position in the world." Some will

recall a similar situation in the 1950s. In 1957, Americans awoke to the presence of the Soviet satellite *Sputnik* regularly passing through the heavens over their homes, and the nation realized that it was decades behind in many areas of scientific R&D. One response to the crisis was passage by Congress of the National Defense Education Act, which provided support for large numbers of students to become scientists and engineers during the 1960s. Perhaps we need a version of that today.

The availability of federally funded fellowships might help to address another problem that is currently limiting training in the physical sciences. This has to do with the decrease in interest in science and the lack of preparation for the study of science and engineering on the part of our youth. There are many reasons for this: inadequately trained elementary teachers, lack of emphasis on science and mathematics in secondary school, the perception that science is "hard," etc. However, a significant cause may be the perception by today's youth that the "good life" can be achieved with a lot less effort than might be required to pursue a profession requiring a basis in science. The Midland Section has been extremely effective in addressing part of this problem. The Project Science Literacy program has reached many teachers, both locally and across the state, and has provided knowledge, methods, materials, and confidence to permit teachers to bring effective science instruction to their classroom. This effort may serve as a model for the state and nation. It represents the "best" of the Section. As Tom Lane has noted, "the participation of a single individual can make a difference." If enough individuals make an effort the impact will be felt.

Largely because of a lack of preparation, many students entering college are precluded from any serious study in the physical sciences. In addition, many who do study in this area do so to support preparation for entry into a professional school, i.e., they do not pursue graduate work in science. As a result far too few science B.S. graduates enter graduate school. The impact on the practice of science in the U.S. and the well-being of its citizens would be severe indeed if it were not for the large number of international students willing to come to U.S. universities for graduate work in the physical sciences. Most universities have been able to attract increasing numbers of well-qualified international students. G. Wayne Clough, president of Georgia Institute of Technology, recently noted that, "Forty percent of science and engineering Ph.D.s are international students." Fortunately, most of these enter the U.S. workforce after receiving degrees. Were if not for this, the demand for scientifically trained individuals as either industrial scientists or university faculty simply could not be met. John H. Marburger III, President Bush's science advisor, has acknowledged the gravity of the situation. "What would hap-

pen if all foreign graduate students returned to their country of origin immediately after receiving their degrees?" Marburger asked. "A catastrophic loss of technical capability would ensue. Already many industries are having difficulty recruiting technically trained personnel."

With respect to training in the physical sciences, the U.S. enterprise is not well. We all need to pay greater attention to the situation and work to improve it (through activity in professional organizations, frequent interaction with congressional representatives, educational outreach to a local kindergarten, and a myriad of other ways). The chemical sciences sit at the very base of development in this country. The standard of living enjoyed by U.S. citizens would not be possible without the innovation the sciences provide. Consider only the materials in any modern home that would not have been there prior to WW II, which were generated by activities in the physical sciences. We in ACS must be ever diligent in pressing for a higher national priority for funding for training in the physical sciences.

Analytical Conference Scheduled

The 23rd Annual ALMA (Analytical Laboratory Managers Association) Conference is scheduled in St. Louis on Thursday, October 17, 2002. The mission of this Association is to share and disseminate information about the management of analytical services and instrumentation laboratories. Preceding the conference will be three workshops that may be of particular interest to ACS Members. Both the conference agenda and the workshop descriptions can be viewed at www.labmanagers.org. Contact: John Pivinski, ALMA Publicity Chair (jpivinski@cs.com).

Important Dates on the ACS Midland Section Calendar

August 5	Midland Section board meeting, Saginaw Valley State University, 205 Science East, 7:00 p.m.
August 6	Deadline for September issue of *The Midland Chemist*
August 12, 14	Midland County Fair ACS Activities, 4-H Gerstacker Bldg., 6:00 p.m.-8:30 p.m.
September 2	Deadline for October issue of *The Midland Chemist*
September 9	Midland Section board meeting, Delta College Midland Center, Room 12, 7:00 p.m.
September 13	Deadline for Section award nominations (Phil Squattrito, 989-774-4407)
September 13	Deadline for Fall Scientific Meeting poster abstracts (David Karpovich,, 989-790-4349)

All meetings are open to all ACS members and the public.

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