



University of Colorado at Boulder



# ChE Alumni Newsletter



## From the Chair

With the upcoming Centennial Celebration (please plan on coming April 15 and 16 and go to [http://www.colorado.edu/che/centennial\\_celebration.htm](http://www.colorado.edu/che/centennial_celebration.htm) for further information), it provides a great time to reflect on where the Department of Chemical and Biological Engineering is and where it is going. Simply put, the people in the Department are all doing exceptionally well – from the undergraduate students to the graduate students to the staff and faculty, each of these groups of individuals is excelling. Our students, faculty and staff continue to be recognized inside the University and around the nation and world for their achievements. In fact, for the first time in the long (almost 100 years!) history of the Department, we were ranked in the top 20 in the U.S. News and World Report ranking of Chemical Engineering programs. This recognition of the program's excellence had us **ranked as the 18th best Department in the country** in April of 2004.

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Later in the Spring, we learned that Professor Anseth had been selected to receive the National Science Foundation's Alan T. Waterman Award. To provide a context for the importance of this award, the NSF announcement for the award states "The Alan T. Waterman Award is the *highest honor* awarded by the National Science Foundation. Since 1975 when Congress established the Award to honor the Foundation's first Director, the annual Award has been bestowed upon individuals who have demonstrated exceptional individual achievement in scientific or engineering research of sufficient quality to place them at the forefront of their peers. The purpose of the award is to recognize outstanding young researchers in any field of science or engineering supported by the Foundation. The Awardee receives a \$500,000 nonrestrictive grant over a three-year period for continued research." Professor Anseth received the award at a dinner in Washington in her honor on May 3, 2004. This award is only one example of the excellence recognized recently in our students and faculty.

Over the last year and a half, we have been immersed in the strategic planning process as well as a University mandated, once every seven years review of our program. This review entailed a self-study as well as internal University reviews and reviews by peers from other Universities. As a result of this study, we have a clear picture of where we are, where we want to go, and what needs to be done to get there. As indicated above, one of the observations was the high quality and performance of all of the people in the Department. The external review report, prepared by our visitors John Eckerdt from Texas and Carol Hall from North Carolina State, indicated that *"The Department faculty members are being recognized with national awards at an increasing rate and have a well-funded portfolio of research projects to offer graduate students. The undergraduate students are highly motivated to learn and feel they are getting a solid*

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*education and that the faculty are genuinely interested in their success as students and practicing engineers... The graduate students are outstanding as a group."* Unfortunately, there are also significant issues that remain to be resolved as also noted in the report. *"Foremost, the Department desperately needs more and improved space – space simply to accommodate the faculty and students they now have and space to allow the program to grow... It is clear... that the Department is under funded. Resources are needed for new faculty hiring and start-up packages, retention of existing faculty, undergraduate and graduate student scholarship/fellowship support, departmental staff support, and investment in new initiatives."* The external report goes on to summarize that *"This is a defining moment in the Department history with respect to what the Department will become as it fully integrates biological engineering with the traditional vision of a chemical engineering department."* The External Committee went on to recommend the construction of a new building for the Department, and the faculty are strongly in favor of such a move. This move will be the foundation on which the Department's next major step forward will be taken. We are presently conducting a feasibility plan to determine the needs and expenses of such a move with a five to seven year plan of moving into an entirely new building.

With respect to the other recommendations of the External Committee (as well as all of the other groups who evaluated the Department), I would like to ask for your direct help in providing opportunities for our students in several areas. Please consider giving a gift that would help our students in any one of the following areas. Your help in the past has been instrumental in improving the Department and moving it forward. I would be happy to talk with anyone who would like more information on these areas or on providing a more substantial gift that would help to endow a faculty position or be a foundational gift for the new building (our two greatest large-scale needs).

The Department has critical needs in three areas. First, we are constantly in need of upgrading our undergraduate laboratory facilities. While we have made large strides in this area (see article on page 5), we need to complete a second phase of renovations to bring in new experiments and to complete the physical renovations. This second phase will enable our students to have a modern, hands-on laboratory experience as a part of numerous classes in our curriculum.

In addition to the laboratory upgrades, we are in desperate need of being able to provide improved financial aid to our undergraduate students. Last spring, we initiated a campaign to have faculty call all of the high school seniors who had applied to Chemical and Biological Engineering at CU. We quickly realized from these conversations that numerous students were going elsewhere because of a lack of financial aid. This year's tuition increase (in particular the engineering college tuition differential) will exacerbate this problem further. One means for partially addressing this issue is the Earn-Learn Program, a unique student opportunity originated by our current Dean while he was Department Chair. This program provides students a work-study-like opportunity in which the student is paid more than they normally would while performing a job that helps them learn more about the Chemical and Biological Engineering field. One example of a student who was supported in this manner is Melinda Channel who spent most of last summer working on the undergraduate laboratory upgrade. She was able to design, construct, and implement various laboratory experiments while being well-paid in the College's Earn-Learn program. This program has been very well received by the students, and it provides them with additional, practical training that helps them to get a job at the end of their academic training.

Finally, we continue to need funds to enhance the competitiveness of our offers to incoming graduate students. We are currently in need of funds to provide supplements and stipends to the most outstanding graduate students, particularly those from underrepresented groups. Supplements are critical in recruiting the most outstanding students, and the amounts of those supplements have been cut significantly as the campus budget provided by the State of Colorado has been reduced over the last several years.

Thank you for considering a gift to the Department at this critical time. As indicated, I would be very happy to talk with any of you about these possibilities as well as others. Feel free to contact me about this or any other issue regarding the Department you would like. I can be reached by phone at 303-492-3247 or by email at [christopher.bowman@colorado.edu](mailto:christopher.bowman@colorado.edu)

Have a wonderful holiday season, and I look forward to meeting many of you at the Centennial Celebration next April!

Chris Bowman, Department Chair

## Undergraduate Update

by **David E. Clough,**  
**Professor and**  
**Associate Chair**



These are interesting and exciting times in the Department of Chemical and Biological Engineering. We are seeing a resurgence of interest in our ChE degree program and our new, emerging ChBE<sup>1</sup> degree program. Our total undergraduate enrollment bottomed out at about 200 students a year or so ago and has now recovered to about 240 students. Although some students find, early on in their program of study, that ChE is not for them, we have an equal or greater number of students transfer into ChE from other majors on the Boulder Campus and beyond. Our Department continues to attract outstanding students. We would claim, with ample evidence, that we have the best cohort of students on the Boulder Campus. The quality and enthusiasm of our students keeps the faculty going, and on their toes. Our students have diverse interests and follow many different career paths after graduation, from medical school, graduate school, and, yes, law school, to traditional employment in a wide variety of industries.

### Curriculum Changes

This year we introduced Biology for Engineers as a required course for all ChE students. It is typically taken in the Spring of the first year, and we accept alternates, such as Molecular Biology or Advanced Placement credit from high school. The course was developed by Professors Chris Bowman and Ryan Gill. The inclusion of this course in our standard curriculum reflects the important role that living systems are now playing in the ChE field. To make room in the curriculum for the biology course, we eliminated the physical chemistry laboratory course. We are certain that many of our alumni will lament the passing of this favorite course from their past.

### Study Abroad

There has been increased interest and participation in study abroad programs by ChE undergraduate students. The Department supports and encourages

this. Currently, about 15% of our students study abroad during their undergraduate program. Given the global economy and need for engineers to work on a global scale, we believe the study abroad experience provides valuable preparation for our students. During the current semester, we have students studying in Australia, Mexico, New Zealand, and Norway. In recent semesters, students have studied also in Italy, Russia, England and Spain.

### Co-Op

Our cooperative education program continues to attract more than 10% of our undergraduate students. The program is directed by Dr. Bev Louie and Professor Al Weimer. Participating companies range from local firms, like Roche Colorado, and those located at some distance, such as Chevron-Phillips in the Houston area.

### Facilities

During the summer of this year, we took on a major renovation of our undergraduate laboratory. Experimental units were renovated and relocated. This project will be completed during the coming summer with the relocation of the triple-effect evaporator unit. Lest you should be concerned, the triple-effect will persist on into the future as the favorite experimental unit of our students.

### Teaching

We should take special note of the efforts of our faculty to provide excellent instruction and stay on the cutting edge of pedagogical techniques and technology. Professors John Falconer, Al Weimer and Dr. Janet deGrazia have pioneered the use of "clicker technology" in the classroom. Students use small electronic transmitters, about the size of a pen, to respond on-the-spot to quiz questions in the classroom. The results are tabulated instantly by a computer that receives the transmitted signals. Within moments, the instructor and the students can see a histogram of their responses, providing rapid feedback on learning. These three faculty presented a talk at the Rocky Mountain Section meeting of the American Society for Engineering Education (ASEE) in April, and their talk was judged to be the best of the meeting, and, later, the best in the western US. They will compete for a nationwide prize at the national conference of ASEE next June.

The faculty continue to teach with a strong "hands-on" theme. Long lectures have been replaced with shorter ones, covering the high points, followed

<sup>1</sup> ChBE: Bachelor of Science in Chemical and Biological Engineering

by hands-on workshops. We make ample use of the Integrated Teaching Laboratory of the College of Engineering and Applied Science. ChE Fluids was taught this past summer with 24 live experimental exercises, one during each class meeting. Instrumentation and Process Control continues its 14-session full-featured laboratory and design-and-build projects, and our design course, under the leadership of Professor Al Weimer, continues to work with industrial clients for the senior capstone projects. We have not lost our focus on fundamentals, but we work hard to teach the interconnection between fundamentals and practice. Our students respond well to this approach and demonstrate remarkable learning achievements.

We would be pleased to receive comments and feedback on our ChE undergraduate program. Please email [David.Clough@Colorado.edu](mailto:David.Clough@Colorado.edu)

### What's New at CU? – Robert H. Davis, Dean

Although headlines often focus more on athletics, there is plenty of noteworthy news from the College of Engineering and Applied Science at CU-Boulder. Our Discovery Learning Center opened in October 2002 to promote undergraduate involvement in research – an area where the Department of Chemical and Biological Engineering has provided leadership for many years. The College also initiated its Earn-Learn Program this past spring. This program provides opportunities for undergraduate students to work closely with faculty in service-learning opportunities such as course assistance and outreach to help local high schools teach science and technology. It is modeled after the Honors Earn-Learn Program (HELP) that was developed by the Department of Chemical and Biological Engineering.

The past year was also one of tremendous accomplishment for our faculty. The National Science Foundation's Waterman Award to Kristi Anseth of Chemical and Biological Engineering and the National Academy of Engineering's Gordon Prize to Frank Barnes of Electrical and Computer Engineering are singular honors that brought great



national attention to these individuals and CU. Faculty also achieved a record \$43 million in new research grants for the College of Engineering and Applied Science. For further details, see our strategic plan and recent assessment report in the faculty and staff link of the college web site ([www.colorado.edu/engineering](http://www.colorado.edu/engineering)).

In looking ahead, CU-Boulder is launching a bold, interdisciplinary initiative in chemical and molecular biotechnology, led by Molecular, Cellular and Developmental Biology, Chemistry and Biochemistry, and Chemical and Biological Engineering. This initiative will include new faculty, an interdisciplinary graduate program, and a modern building equipped for research in bioinformatics, molecular biotechnology, and related fields. A campus-wide initiative in nanotechnology is also underway, with the initial focus on building a state-of-the-art fabrication and characterization facility to open later this year in the Discovery Learning Center. Chemical and Biological Engineering, with a strong emphasis on molecular-state phenomena, surface modification, and ultra-fine particles, is expected to be a primary user of this facility.

Finally, my vision for the College of Engineering and Applied Science involves synergistic excellence in both research and education. I am proud of the Department of Chemical and Biological Engineering's leadership and example toward achieving this vision.

Robert H. Davis, Dean

### Cooperative Education Works for Students and Employers

Chemical and Biological engineering students have been participating since 2001 in the College's first Cooperative Education Program. In the May 2004 Engineering Recognition ceremony, four students – Robert Dahl, Jenna Estwin, Megan Mallozzi, and Adam York – graduated with Cooperative Education certificates and nearly a year's worth of professional experience under their belts, the first official Co-op grads of the program!

CBEN's co-op students alternate academic and work semesters starting in either the spring or summer of their sophomore year. By alternating semesters, they stay in sequence with their core courses. Co-op students have undertaken work assignments in heat transfer, reactors and reaction kinetics, scale-up, facilities, distillation, synthetic blood development, membrane technology and

quality control, among many other tasks using their academic knowledge. Most co-ops have a mentor who monitors work progress and provides insight and guidance for many jobs. Students often give an oral presentation to their co-workers and supervisors at the end of their work assignments. They also write a co-op report to fulfill their CBEN requirements. Employers get a great opportunity to know their co-op students, and many make permanent offers to them upon graduation.

Currently, there are 15 co-op students. Seven will graduate this year, and eight students will be added starting in Spring or Summer 2005. You can help us to expand our program! We are looking for more co-op opportunities across the country for our students. Please contact the Co-op Coordinator, Bev Louie (beverly.louie@colorado.edu) for more information.

### Melissa Mahoney Joins Department

Melissa Mahoney has joined the chemical and biological engineering faculty as an assistant professor beginning January 2003. Melissa received her Ph.D. under the direction of Mark Saltzman at Cornell University in 2000, and received her B.S. in chemical engineering from Northwestern University in 1995. As a post-doctoral researcher, she was selected to participate in the summer neurobiology program at the Woods Hole Marine Biology Laboratory and as a fellow in the Department of Neurobiology at Duke University. Most recently Melissa has been serving as a Howard Hughes Medical Institute research fellow in Dr. Kristi Anseth's laboratory at the University of Colorado.



Melissa's research focuses on the development of polymer-based protein and cell delivery systems to promote regeneration in the central nervous system. At least 50 growth factors have been identified as molecules that can protect vulnerable cells from death during the progression of neurodegenerative disease in the central nervous system. Cells already lost may one day be replenished by transplantation of embryonic stem cells, a potentially unlimited source of neural tissue for grafting. The success of this

approach will depend on the extent to which cell proliferation and differentiation can be controlled. Growth factors influence the survival, proliferation, and differentiation of embryonic stem cells and may be used for this purpose. However, the potential of growth factor therapy is currently limited by the extent to which delivery can be targeted to tissue containing vulnerable neurons or transplants while minimizing toxic effects to healthy tissue. To address these issues, Melissa's group is developing synthetic polymer materials that present potent molecules to neural cells in a spatially and temporally programmable manner. The long-term goal of this research is to identify and use patterns of chemical cues to control the survival, proliferation, and differentiation of endogenous and transplanted neurons as a treatment for neurodegenerative disease or injury in the CNS.

Outside of work, Melissa swims as a member of the Boulder Aquatic Master's Swimming Team. She is an avid hiker and enjoys summer backpacking and winter snowboarding. Melissa is excited about joining the department this Spring.

### Big Changes in the Undergraduate Lab – for the better!

A remarkable transformation is taking place in the Undergraduate Lab. Did the Triple Effect Evaporator disappear? No! Has the Distillation Column been replaced? Nope! The Undergraduate Lab has been reshaped and refined into a bright, cheery environment. Yes, it is hard to believe for those of us who ran such beloved experiments like the fluid friction apparatus, the steam jacketed tank, and the liquid-liquid heat exchanger in the formerly cavernous, dark and definitely sketchy old basement area.

The new lab space is still in the department basement and is about 80% complete. The various apparatuses have been moved to the northwest section of ECCH 1B70 adjacent to the lab classroom. Brighter lighting, ample work bench space, judicious use of paint and the inclusion of some unique architectural features make determining a rate constant much more pleasant. A storage unit in the corner houses all the supplies, including extra experimental modules that can be wheeled into place. Each experiment is connected to a computer that uses LabVIEW to monitor or control conditions. Experiments that need ventilation will have hood units that exhaust fumes along the north wall. Still to

be moved in the coming year to northeast corner of the new lab space is the triple effect evaporator, a sixty year old apparatus that unites all CU chemical engineering grads. When you're in town next time, we'll be happy to show you the remodeled lab space that combines a little of the old and a lot of the new.

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### **An Undergraduate's Perspective of the Department of Chemical and Biological Engineering, by Melinda Channel, Undergraduate Student Representative**

The Department of Chemical and Biological Engineering is one of the smallest departments on the University of Colorado, Boulder campus. Over the last couple of years we have seen a steady increase in the number of undergraduate and graduate students alike. Even with an increasing population, our department has managed to maintain a strong sense of community, which is not generally seen on the collegiate level.

The strong sense of community within our department has been strongly influenced by a very passionate and well-liked faculty. Our faculty members have always been willing to help the students and do not require an appointment to do so. It has always been said "If the door is open, come in."

Our faculty members have been instrumental in providing students with several on-campus job opportunities. Jobs provided within the department include undergraduate teaching assistants, co-ops, internships, and laboratory research positions. Each of these positions, provide undergraduate students with the valuable experience required to obtain the best jobs after graduation.

With award winning research, the need for laboratory space is at an all time high. This has led to several renovation projects within the last two years. One of the major renovation projects occurred this last summer on the undergraduate laboratory. The goal of this project was to move all of the reactors into close proximity to one another and redesign them to function better. We were able to move the distillation column into the newly renovated lab space. We also plan to move the triple effect evaporator in the summer of 2005. Yes, believe it or not, the TEE is still in use today and probably will be for the next 100 years!

### **A Graduate Student's Perspective of the Department of Chemical and Biological Engineering, by Bobby Sebra, Graduate Student Representative**

Graduate school in Chemical and Biological Engineering at CU is unique, due to the diversity of people and interests involved in our department. Each student and faculty member plays an important role in the department, as we are all from a variety of backgrounds and interests. Sharing this assortment of perspectives makes graduate student life intriguing academically, socially, and culturally. With such an eclectic group, many communities are created from a wide array of research, academic, athletic, and social interests. Provided this diversity of interests, chemical engineering graduate students have been known to frequent local coffee houses and bars, play ultimate frisbee, and climb the Flatirons. We are also given the valuable opportunity to interact with the chemical engineering community by presenting award-winning research at both national and international conferences, and collectively interact a great deal with the undergraduate population in classroom and lab environments.

The integration of each individual into the department and the chemical engineering community plays an important role in facilitating an environment that leads to success. When each person is encouraged by faculty and friends to be enthusiastic about their research and personal goals, graduate school is a very exciting time. CU Chemical Engineering really emphasizes these elements, hence making our department more comfortable and as graduate students, we are proud of our department's accomplishments. Further, these accomplishments lead to a variety of opportunities after graduate school, allowing us to integrate aspects of what we learned at CU into both academic, research, and industrial work environments. Overall, the relationships and knowledge collected as a graduate student here in Chemical and Biological Engineering at CU, leaves you with a fundamental understanding of chemical engineering and research, but more importantly a feeling that you have developed a network of relationships that will remain true throughout your life.

# CU-ChE ALUMNI RESPONSE FORM

Enclosed is my gift of: \$ \_\_\_\_\_

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