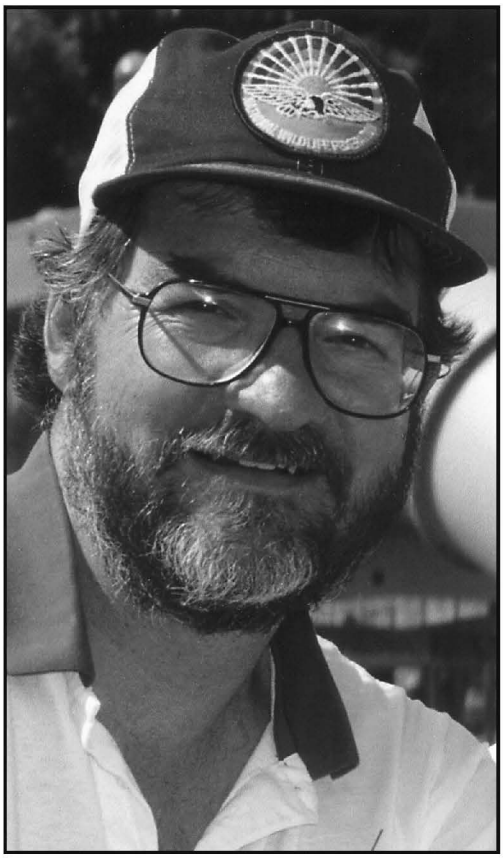

Robert H. (Rob) Davis

. . . of the University of Colorado

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As engineering faculty, each one of us is asked to perform at an exceptional level in research, education, and service to our universities and to our profession. These tasks often seem to be in conflict, and time pressures often force each of us to focus on one aspect at the expense of the others. For the eleven years that I have been at the University of Colorado, however, I have witnessed and worked with one faculty member who personifies those ideals—one who is committed to research at the highest level, to educating undergraduate and graduate students in the classroom and through the discovery process, and to serving his colleagues, his university, and his profession.

That person is Professor Robert H. Davis, Dean of the College of Engineering and Applied Science and Patten Professor of Chemical Engineering at the University of Colorado. He has been a prototype for what a faculty member should be during his twenty years on the faculty. In fact, he is the only faculty member in the 110-year history of the College of Engineering and Applied Science at the University of Colorado who has received all three College awards for Outstanding Research, Teaching, and Service. He has not only demonstrated exceptional performance in each of those individual areas, but he has also focused on the synergistic interaction that exists between them.

As a hallmark of his career, Rob has worked tirelessly to develop programs that use research to assist educational efforts and to develop educational programs that impact research efforts. In addition to numerous research, teaching, and service awards within the University of Colorado, he has also been recognized with several national awards, including (most recently) the American Society for Engineering Education's Dow Lectureship Award.

◄
Two of his favorite faculty from U.C. Davis, Ruben Carbonell (left) and Steve Whitaker (right) relaxing on a 1978 road trip with Rob.

Rob and his PhD advisor, Andy Acrivos, in Cesaria, Israel, in 1984.
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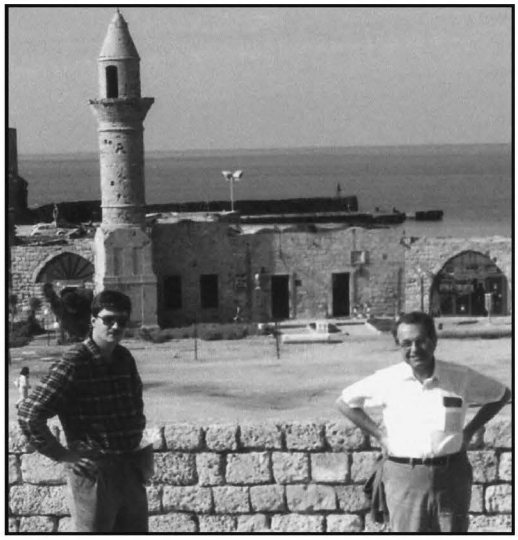


HISTORY

Rob was born on March 26, 1957, in Paris, France, where his dad was stationed as a military advisor at the U.S. Embassy. Within three months of his birth, his family moved back to the United States, first to Garden City, New York, and then further west to Walnut Creek, California, when he was three years old.

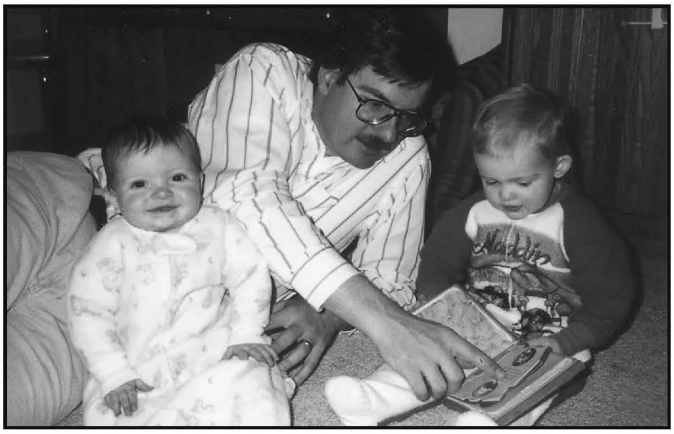
Fortunately, Rob was exposed to great educators throughout his life; his mother taught college mathematics and his father taught elementary school and piano after retiring from the Navy. Rob attended Ygnacio Valley High School in Concord, California, where he was named the outstanding senior in both mathematics and science. When he entered the University of California at Davis, intending to major in either math or chemistry, the teaching assistant for his freshman chemistry class suggested that he could combine those subjects and major in chemical engineering instead. Like many entering freshmen in our field, prior to that time Rob 'had not heard the words *chemical* and *engineering* used together in the same sentence!'

Rob displayed an early knack for leadership at Davis. During all four years he volunteered 15-20 hours a week to work with junior-high and high-school students through Young Life. In his senior year, he was President of the AIChE Student Chapter, which hosted the regional AIChE Student Chapter Conference. He also organized the First-Annual Kronecker Delta golf tournament, named in honor of a "favorite" tensor used by Professor Steve Whitaker in transport courses. Somehow, Rob also found time to study, and he received the University Medal in 1978 as the outstanding graduate from U.C. Davis in all disciplines.

For graduate school, Rob moved across the San Francisco Bay to Stanford, where he had the good fortune of working with Professor Andreas Acrivos. "I was the second in a line of several PhD students who studied the *Boycott Effect* with Andy," Rob notes, "which refers to the phenomenon of an enhanced clarification rate in sedimentation vessels with inclined walls." Rob's dissertation work involved a combination of theory and experiment, a hallmark of his own research program ever since that time.

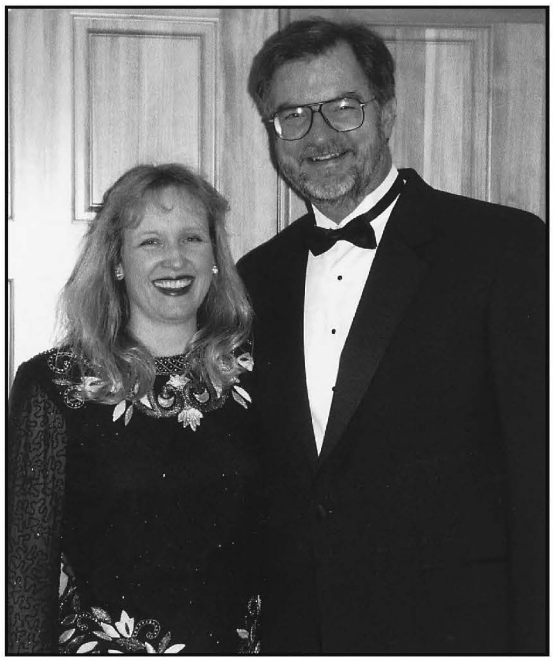
Before leaving Stanford for his postdoctoral position, Rob interviewed for a number of faculty positions and ultimately accepted an offer to come to the University of Colorado. Interestingly, this interview and selection process became the subject of an article written by Rich Felder regarding his observations while he was spending his sabbatical at Colorado.[1] At the time, it was clear that Rob would be an exceptional teacher, although his future research career and success was not as obvious. Rob notes, "I have always loved to teach, but I was less certain about research when I was interviewing for a faculty position. Fortunately, I quickly learned how much fun research can be, especially when working with students."

More than twenty PhD students of Andy Acrivos have gone on to successful academic careers, including several (John Brady, Dave Leighton, Ashok Sangani, and Eric Shaqfeh) who overlapped with Rob. Many of these students did postdoctoral research in the Department of Applied Mathematics and Theoretical Physics (DAMTP) at the University of Cambridge, and Rob dutifully took up the call after completing his PhD in 1982. He was a NATO Postdoctoral Fellow at DAMTP for a year, working with



Rob enjoys teaching students of all ages, even if only half of the class pays attention! With daughters Grace (right) and Allie (left) in 1993.

Rob's first responsibility after becoming Dean in July 2002 was to buy a tuxedo for the black-tie functions that he and his wife, Shirley, would attend.

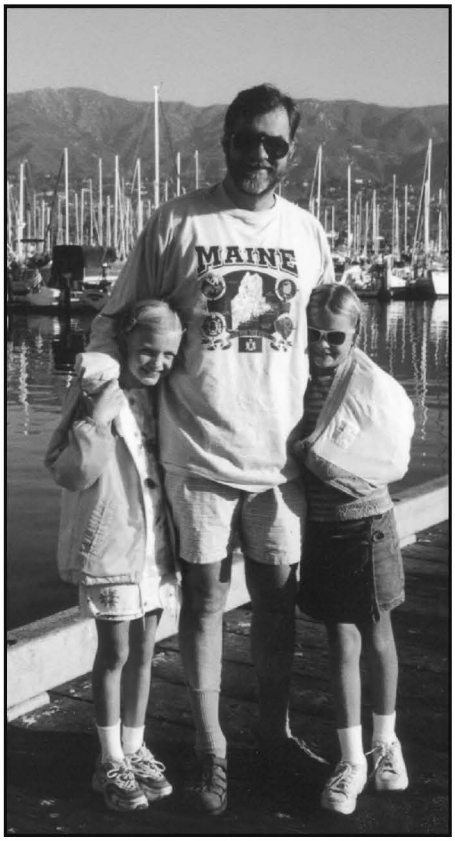


Professor George Batchelor on particle aggregation and with Dr. John Hinch on elastohydrodynamic collisions and rebound.

Rob has always enjoyed working with young people, both inside and outside of the university setting. While in graduate school, he continued to spend 15-20 hours a week (and often more) leading a Young Life club. Young Life is a nondenominational Christian outreach to primarily non-church kids, and Rob led weekly club meetings, Bible studies, camping trips, and social events, in addition to co-leading and training a team of other volunteers.

Near the end of his time in graduate school, Rob became a student leader of the Menlo University Fellowship and met Shirley Giles, a member of the group. They married in December 1982, a few months after Rob finished his PhD and then part of his Postdoctoral year, while Shirley completed a BA in Communications from Stanford and then a mission experience in Bangalore, India. Rob and Shirley returned to the United States in late summer 1983 and moved to Colorado for Rob to begin the faculty position he had lined up the year before.

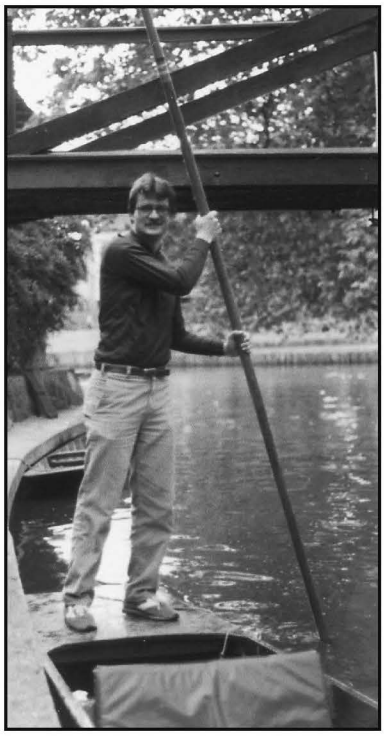
Daughters Grace and Allie today, well on their way to being teenagers, on a trip to Santa Barbara.



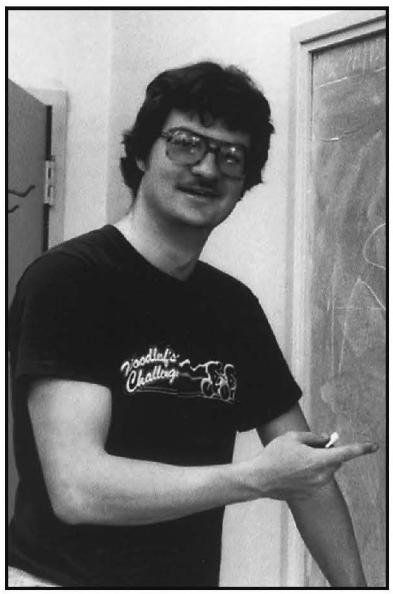
Shortly after moving from England to Colorado, Rob and Shirley began doing volunteer work with the high school program of the First Presbyterian Church in Boulder. After a year, they began working with the University Christian Fellowship, a program for CU-Boulder students sponsored by the same church. Rob was the volunteer director of this program for several years, and he and Shirley continue to be associates in the program. Their activities over the years have included teaching a Sunday class, leading Bible studies, housing interns, organizing retreats, and chairing the Messenger Committee to send teams of university students on summer projects in foreign countries.

Rob was promoted from Assistant to Associate Professor after only five years on the faculty and was promoted to full professor in 1992. In 1990-91, he received a Guggenheim Fellowship for his first sabbatical, which he took at the Massachusetts Institute of Technology. At MIT, he enjoyed interactions with Professors Bob Armstrong, Howard Brenner, Bob Brown, Clark Colton, and Greg Stephanopoulos, among others, as well as with Howard Stone at Harvard University. "I also enjoyed getting to know several bright PhD students and postdocs," Rob recalls, "including Nick Abbott, Stephanie Dungan, Gareth McKinley, and Ron Phillips, who have all gone on to

"Punting" on the river Cam, a welcome break from postdoctoral studies at the University of Cambridge in 1982-83. ▼



Rob (on the left) leading songs for a Young Life retreat in 1980, with Robert Aguirre (now a Professor of English).



Rob in his Stanford office in 1982, explaining the concept of inclined settling. The T-shirt depicts his love of bicycling—he still rides a bike to work every day!

successful academic careers."

During this year at MIT, Rob and Shirley lived in the Back Bay area of Boston. While Rob walked across the Massachusetts Avenue bridge over the Charles River to MIT, Shirley walked upriver to Boston University, where she completed an MA degree in broadcast journalism.

After they returned to Colorado, their first daughter, Grace, was born in December of 1991, followed by their second daughter, Allison, born in June of 1993. "I never thought that I would enjoy young children as much as I enjoyed high-school and college students," Rob says, "but I've changed my mind, now that I have my own children." In the year between his daughters' births, Rob became Department Chair (1992). Although his teaching load was slightly reduced to accommodate his new activities, throughout his ten years as department chair, Rob maintained his research program at its usual high level.

Rob took his second sabbatical in 1997-98, this time at the University of California at Santa Barbara, hosted by Professor Gary Leal. Besides providing time for uninterrupted research, it was also a great opportunity for Rob to spend more time with Shirley and their young daughters. He notes that they had a picnic in their backyard or at the Goleta beach several evenings every week. The close-knit family now often travels with Rob for conference/vacation trips, especially to foreign countries. Closer to home, they love to camp, hike, bike, and ski, and Rob often brings the girls with him when he can't stay away from the office on Saturdays!

More recently, Rob was appointed Dean of Engineering and Applied Science at the University of Colorado (July, 2002). While he took this position out of a sense of duty to the institution that has served him well for the past twenty years, he has found his new responsibilities "surprisingly fun." In the current economic climate of limited resources for the traditional "dean-type" activities of adding new buildings, supporting new initiatives, and increasing the faculty, he remains excited about the challenges of nurturing faculty for excellence in both teaching and research, educating students in both traditional and active-learning environments, and allocating resources wisely to invest in excellence for the long term.

"I expect to be Dean for ten, plus or minus eight, years," Rob jokes, "so making personal plans for the future is difficult." He anticipates continuing a vibrant research program, although perhaps more modest in size. His current research group consists of nine PhD students and two research associates. Rob hopes to return to classroom teaching someday and plans to remain active in serving the profession. Most importantly, we expect Rob to continue to balance his priorities of family and faith along with his service to students, faculty, and the profession.

The research that he has performed and the

EDUCATION

Rob is an outstanding classroom teacher and has won several departmental and college-wide teaching awards. He is respected by students for his high standards, superb organization, compelling lectures and demonstrations, as well as his compassion and fairness. In fact, Professor Bill Bentley (University of Maryland), a former PhD student who also had Rob as a professor, indicates that "Rob was singularly the best educator I've ever encountered, anywhere."

The lasting influence of Rob's educational work includes a half-dozen publications on teaching methods in peer-reviewed journals, the development of six new courses (five that are now taught by other faculty), organization of a special issue of *Chemical Engineering Education* on teaching fluid-particle technology, and development of the Interdisciplinary Biotechnology Program at the University of Colorado. Additionally, he directs or co-directs three Graduate Assistantships in Areas of National Need (GAANN) programs funded by the U.S. Department of Education, which support graduate-student training throughout the Department of Chemical Engineering. As part of these programs, Rob thoroughly enjoys taking the students on retreats and road trips. Despite his recent ascension (descension?) to the Deanship, Rob has continued to be active in these programs, including attending the retreats and other student interactions.

Rob is also an outstanding mentor and spends countless hours helping students and young faculty to think critically, to learn through discovery, and to communicate effectively. For the past three years, he has served as a faculty mentor to graduate students participating in an NSF-funded outreach program to local high schools and middle schools. He has also been research mentor to over 120 undergraduates, 50 graduate students, and 10 postdocs. As one significant measure of his success and lasting impact, ten of his former graduate students and postdocs are now full-time faculty members. As has been noted by several of these former students, the framework that Rob established, his mentoring style, and his concern for his students are all aspects that these former students hope to emulate.

RESEARCH

Rob's research philosophy is to perform fundamental research on problems selected from or motivated by practical engineering applications. He is a world leader in the hydrodynamics of complex fluids, and his group has applied fundamental theory and principles in this area to an astonishing variety of problems.

Rob with some members of his research group on a hike in the Colorado Rocky Mountains in 2000.

In his twenty-plus-year academic career, Rob has published more than 160 papers and has received over $18 million in grants to support his research program. Worth noting is the fact that, as evidenced by his references, publications, and funding, he has had a significant impact on three distinct research areas: fluid mechanics, biotechnology, and membrane separations. As one example of his creativity, Rob and a PhD student, Kim Ogden (now at the University of Arizona), showed that productive cells could be separated from unproductive cells and recycled in a continuous-flow bioreactor by coupling genetic markers for flocculation with the gene for the product of interest, so that the productive cells settled rapidly as flocs with fractal structures. Rob and his group later became the first to apply fundamental engineering principles to pioneer new bioreactor strategies for enzymatic production of ribonucleic acids, by immobilizing DNA templates on small beads and then recovering both DNA and enzyme (due to binding) along with the beads to achieve substantially improved yields of RNA product.

As another example, Rob applied fundamental transport principles, including the newly recognized phenomenon of shear-induced hydro-

impact he has had on other lives will last for many lifetimes.

dynamic diffusion, to establish widely used models for crossflow membrane filtration. More recently, his group has developed and analyzed several novel strategies for membrane-fouling control: rapid backpulsing, dynamic secondary membranes, and surface modification by photografting.

In more basic research on multiphase flow, Rob developed the first elastohydrodynamic theory (with coupled solid and fluid mechanics) for particle collisions with other particles or surfaces in liquids or gases, to predict whether particle rebound or adhesion occurs, and then later elucidated the friction/lubrication nature of particle contacts in liquids. This pioneering work is now used in diverse fields such as granulation, wet granular flow, suspension flow, and air filtration. Moreover, his group has analyzed the related problems of drop and bubble interactions in near contact, showing how small deformations due to lubrication forces retard coalescence and how large deformations may promote alignment, breakup, and/or coalescence.

SERVICE AND LEADERSHIP

When Rob became the Department Chair, it was one of the best possible things that could happen to our department. As Chair, Rob undertook a major program to improve the Department in all areas and at all levels, including undergraduate students and programs, graduate students and programs, and faculty. Since Rob took over, the number and quality of the undergraduate and graduate student populations have improved, funding and publications per faculty member have more than doubled, and the faculty has grown in size—half of the current faculty were hired while Rob was Chair. Faculty have also received numerous national and international awards from professional societies (Materials Research Society, AIChE, ACS, and ASEE) and foundations (Dreyfus, Packard, Sloan, Howard Hughes Medical Institute) that recognize its progress, with most of these awards based on nominations that Rob carefully prepared for his colleagues. In fact, in just the last three years, three different faculty have won singular national awards from ASEE (two Curtis W. McGraw Awards and Rob's selection as the 2002 Dow Lectureship winner). The State of Colorado has also twice designated the Department as a Program of Excellence.

Rob is a tireless advocate for chemical engineering education and research, as well as for the people involved in those activities. In addition to numerous responsibilities at the University of Colorado (including his service as Chair (1992-2002), with only one sabbatical break, and now as Dean), his professional activities have included organizing the IUTAM Symposium on Hydrodynamic Diffusion of Suspended Particles in 1995, the technical program of the AIChE Annual Meeting in 1999, and the technical program of the North American Membrane Society Annual Meeting in 2000. He co-organized a series of workshops on "Teaching Fluid-Particle Processes" for the 1997 ASEE Summer School for Chemical Engineering Faculty, and he served as Guest Editor of a special-feature section of *Chemical Engineering Education* in 1998, which contained seven articles related to the recommendations of this workshop. He also served as the Director of the Colorado RNA Center (1992-2001) and co-Director of the Colorado Institute for Research in Biotechnology (1987-2001), in statewide efforts to promote research, student training, and industry/university cooperation, including management of an annual symposium, seed grants program, graduate fellowships, and student internships. Rob was the co-Chair (along with Scott Fogler and Mike Cutlip) of the 2002 ASEE Summer School for Chemical Engineering Faculty, held last July at the University of Colorado.

In 1995, Rob was invited to make a presentation at the AIChE Young Faculty Forum, and he chose the subject "Getting Along With (and the most out of) Your Department Chair." Based on session evaluations, his presentation received the Outstanding Paper Award for the 1995 AIChE Annual Meeting. As the co-Chair for that session, it was readily apparent to me that Rob's advice to the younger faculty, as well as to those aspiring to be young faculty, was extremely well received. He was also not afraid to challenge the common assumptions about what young faculty should do—he challenged them to participate in service activities that had a high outcome-to-input ratio and not to simply neglect service until after being tenured. Excerpts of his advice to young faculty are soon to be submitted as an article in *Chemical Engineering Education.*

SUMMARY

If your vision is for one year, plant wheat.
If your vision is for ten years, plant trees.
If your vision is for a lifetime, plant people.
Old Chinese Proverb

In fact, that is exactly what Robert Davis has spent the last twenty years doing! As a researcher, he has trained PhD and undergraduate research students who will lead the next generation; as a teacher, he makes sure that his students know the basic principles and fundamentals; and as a Department Chair and Dean, he has mentored faculty and provided a framework in which all are encouraged and enabled to be successful. The research that he has performed and the impact he has had on other lives will last for many lifetimes. ❐