ChE educator

J. C. Friedly

of Rochester

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JOHN C. FRIEDLY is a born gentleman, quite in contrast to M. J. Adler's "go-getting materialism of the American environment." He is always a patient, cheerful man who, it seems to those who know him, could not be otherwise even if he tried. Perhaps being aware that this personality trait could very well align his future with the inexorable fate of an endangered species, he learned how to transcend his phylogenic destiny through ontogenic inventiveness and his amazing (to others) quickness of mind. In daily interaction with his students and colleagues, he knows just when to be the anecdotal turtle and when the rabbit. And to bring this art to perfection, he never runs out of enthusiasm to test his flexibility against the demands of a situation, be it in the role of a teacher, a colleague, or an administrator. One speculation is that this is a legacy from his days on the championship teams of three different intramural sports, namely, basketball at Carnegie Tech, softball at UC Berkeley and handball at the U. of R. Even to this day, one colleague and long-time handball partner attests to his dexterity in the handball court.

Professor Friedly comes from a proud family in Glen Dale, West Virginia. His father was a banker who taught him the illusory character of money and inculcated in him the passion for the "finer things in life." Dr. Friedly seems to fit the overachiever's profile; he was a good student by all measures of competence in high school and college. His four years at Carnegie Institute of Technology (now Carnegie-Mellon) sharpened his skills and interest in mathematics. Without much second thought, he chose to study chemical engineering, perhaps lured by the campus

reputation of chemical engineering being the "toughest one." While an undergraduate, somehow he came to know about Charles Wilkes' research at UC Berkeley and ended up going to Berkeley for his graduate education.

Although he was attracted to UC Berkeley by Dr. Wilkes' work, he was eventually drawn into Professor E. E. Petersen's group. He reminisces about his days at Berkeley with such zestful relish that it is hard to understand why he was in such a hurry to finish his PhD dissertation in about four years. Professor Petersen gets high marks for his advising style. "He gave me plenty of independence," says Dr. Friedly. "But he was always there when I needed him. His approach to research and student advising has had an enduring influence. So much so, that to this day I try to follow his style." He believes that it is a teacher's privilege to let a fledgling mind grow at its "free will and free won't," and that the teacher should take every opportunity to facilitate that growth through exhortation and the catalyzing action of time-tested experience. For Dr. Friedly, however, the skeptic in him always keeps him on his toes with the caveat, "Am I overdoing my job?" Some, here in the department, have dubbed it as the "Berkeley Style" of research, teaching and advising.

After finishing his graduate education at Berkeley, he wanted to sample the real world as a research scientist at General Electric. It was in the Information Studies Section that he tried out some of his ideas in computerized process control. GE provided him with so much independence in the choice and conduct of research that he was "having a ball" and hardly noticed any difference between industrial and academic research in content or style. However, this research strategy took a turn when the GE management decided to pursue a more practical application-oriented research program, perhaps in anticipation of their withdrawal from the increasingly competitive computer market. At this point, Dr. Friedly chose not to take further stock in industrial research and said goodbye to GE. He applied to several universities for a faculty position and accepted an offer from Johns Hopkins University, hoping that he would be able to start his own program of research. It turned out that the Department of Chemical Engineering there was on top of the University Dean's list of departments soon to be disbanded because of their high cost of maintenance, overhead or otherwise, and low enrollment. Because of a nominal teaching load and no advising responsibility, he spent most of his time at Johns Hopkins doing research. That was when the idea of putting together his notes and scribbles and writing a book dawned on him. It was going to be a book on process dynamics—a subject he deemed to have a broader point of view and needed a treatment parallel to, but separate from, traditional process control. Although now he cringes at the thought of venturing into such a task (reading endlessly, writing at all hours, and dealing with the publisher) the end, according to him, more than justifies all the pains. For Dr. Friedly, his first brainchild, a lasting gift to generations of students and researchers of process dynamics, was his book *Dynamic Behavior of Processes* (1972). Surely one can feel the resonance of an inspired mind, with page after page of insightful discussion and ways to attack realistic problems with the approximate mathematical techniques available at that time. He introduced the use of asymptotic analysis as a way of approximating long-time response of certain model systems. His treatment was comprehensive, starting with the strategic steps of mathematical model development and concluding with nontrivial examples of exact and approximate analyses of linear and nonlinear systems. It was indeed a momentous intellectual debut.

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Although the idea of the book had its inception in Baltimore, Dr. Friedly moved to the University of Rochester in New York to nourish the idea. At that time, James M. Douglas (the author of two volumes as *Process Dynamics and Control*) was getting ready to leave Rochester for the University of Massachusetts at Amherst. There was a brief communion of similar minds alive with the idea of writing books on process dynamics, but destined to go their separate ways.

Dr. Friedly's thesis work at UC Berkeley was on the dynamics of chemically reactive systems. He sees his subsequent interest and research initiative in other areas as a logical continuum; they all grew, like branches from the main trunk of a tree, into the dynamics of distributed and multivariable systems, system stability, optimal process control, dynamics, and control of food processing. He concedes that the area of research one launches into after completion of graduate work is at least half determined by chance. There is always the pull of intellectual inertia to stay

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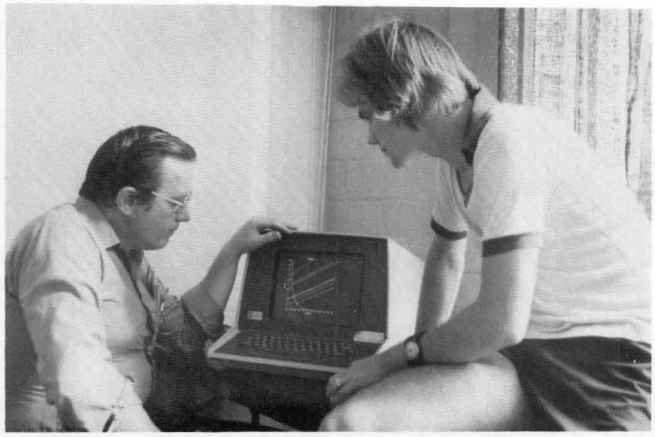
on the safe and familiar road and the push from circumstantial contingencies. One must develop intellectual flexibility while at graduate school and through exposure to the whole gamut of perspectives necessary for independent scholarly work. Those who practice conservatism at this point in their education are missing out on some of the exquisite thrills of discovery and they end up paying a high price for this error of omission through regret for not making enough errors of commission while at school.



Dr. Friedly and a graduate student studying a computer-generated graphical representation of a process model.

At the University of Rochester, Professor Friedly developed his new interests by teaching both graduate and undergraduate courses on heat transfer while continuing research in heat exchanger stability, heat transfer in food processing, combustion, and solar heater dynamics. He has also been teaching courses on process dynamics, advanced process control, and stability in distributed parameter systems, and he became involved in many other emerging areas along the way. For instance, his interest in environmental pollution abatement led him to learn about solid waste management and groundwater pollution. Interest in chemical process system analysis led him to learn more about computer-aided design, artificial intelligence and, more recently, design and development of expert systems for process control applications. If nothing else, this example gives us some idea of how an active mind makes its forays into unexplored territory and how it values the learning experience in and of itself.

Professor Friedly's approach to teaching is coextensive with his research style. He considers that the success of his method is in direct proportion to the extent that students shy away from "telephone-book memorization." Of course, an engineer ought to know where to look things up, but the challenge is more often with problems that are not in handbooks or other standard references in the library.

Besides his teaching and research activities, Professor Friedly has always enjoyed pitching in whenever there was a call for administrative responsibilities and making things happen in that role. He once headed, in congruence with his innovative research interest, a flexible student-oriented interdepartmental engineering program. Then the certain prospect of heavy administrative chores did not dissuade him from serving as the Associate Dean of Graduate Studies for the College of Engineering and Applied Science. Since 1981 (the beginning of the twilight years for the employment of graduating chemical engineers), he has been at the helm as department chairman and has weathered the storms of criticism from professional accreditation boards, industry, and government for updating and expanding nationwide chemical engineering curricula within the four-year span of undergraduate education. Dr. Friedly seems to subscribe to the ancient Chinese doll's method of encapsulating breadth within multilayered depth. Instead of offering separate courses for small topics of emerging interest, they are assimilated into appropriate ChE courses and treated in the overall context of fundamental principles of chemical engineering. If and when a topic demands a more comprehensive coverage, he is quick to invite experts from local industry and to recruit new faculty members to do the job. For example, the recent surge of interest in biotechnology, materials science in general, and polymer science and technology in particular, called for the addition of two new faculty members. He looks forward to capitalizing as much as possible on the great resources and fine reputation of the university's Institute of Optics and various optics-based concerns such as Bausch & Lomb, Corning, Kodak and Xerox. He believes the department's emphasis on optical (polymeric) materials is only natural for Rochester.

Providing a suitable research atmosphere for the community of scholars and scholars-in-making (*i.e.*, the graduate students and post-doctoral fellows) is also a responsibility of the chairman of the department. Marshalling the available resources for the maintenance of excellence in research and teaching is no small task. Although there is the higher call for efficiency, Dr. Friedly is bent on making allowances for the adventurism of young investigators in pursuing untried avenues of research.

Dr. Friedly's open door policy has a counterpart for a pair of finches who take advantage of his "open window" policy in the spring. When they came in as freshmen to occupy the hanging ivy-plant pot in his office, he was ambivalent about what to teach them; nevertheless they had a bird's-eye-view of the rows of books on his open shelves and perhaps read titles like *Odyssey of a Chemical Engineer* and *Principles of Heat Transfer*. Although there is no way of knowing how much they learned about chemical engineering, they certainly have mastered the techniques on how to incubate newborn nestlings and to hatch and nurture the little ones until they could be on their own. We can only speculate about the extent to which they might have utilized their "textbook knowledge" of heat transfer during the incubation phase. Upon completion of the freshman year, their return as sophomores took everybody by surprise, so much so that their second visit not only made the local news but was also covered in an Audubon society publication in Oregon.

When he finds time to relax, Dr. Friedly likes to listen to classical music. He also likes to unwind by solving English crossword puzzles which, he never fails to point out, are quite different from those in American newspapers. For some time he has been developing this type of less interlocking, yet cryptic on a theme, English crossword puzzle and hopes to publish one some day. He also enjoys travelling with his family. He is particularly fond of the countryside—even today he talks endlessly about a small village near Oxford in England where he stayed during his last sabbatical at the University of Oxford. Another private passion of his is restoring old houses and doing the carpentry work himself. He tries to keep up-to-date on the "vernacular architecture" of the Rochester area and is devoted to maintaining the historical landmark status of his house in Penfield, New York.

The picture of this man would be an utterly truncated one if we failed to mention his professional involvement and active participation in societal affairs. Although he is a member of several professional organizations, he seems to enjoy his association with the AIChE the most. For the Rochester Section of the AIChE, he has served in positions varying from employment coordinator to director of the section. He was once a member of the US-USSR Study Group on Helium Fluid Flow and Heat Transfer Research and recollects the pleasures and frustrations of communicating with the Soviet scientists and engineers through the iron curtain. He is an activist in consumer protection and has been a member of the Consumer Health Protection Committee of the Monroe County Health Department.

Dr. Friedly admires a tapestry embroidered with Chinese pandas, a gift from Mr. Tong Chen, a visiting scholar from China.

When Professor Friedly, a teacher, researcher and administrator ponders the future of our profession, he concludes we have a long way to go. Public perception of engineers in general and chemical engineers in particular needs to be improved. Since we have to depend on government financing for research in academia, the importance of public opinion looms large in who gets what share of the government's budget.

Last but not the least important responsibility of educators in chemical engineering is to write books and monographs. Textbooks and the allied literature indeed go a long way in redefining the boundaries of our profession, and this redefinition influences potential employers and the decision-makers in research-supporting institutions in their expectations of what we as chemical engineers are not only trained to do, but also are capable of doing. This is no puny task. But Dr. Friedly is no naive idealist and says, "Did I say it was going to be easy?" And that is, at least in the author's opinion, an apt counterpoint to complacency. □