

William H. Corcoran of Caltech

Prepared by
WINIFRED VERONDA
California Institute of Technology
Pasadena, California 91125

WILLIAM H. CORCORAN HAS collected enough honors during his career as a chemical engineer and educator to fill several pages on a resume. But the award that means most to him is a handsome plaque hanging beside the door of his Caltech office and inscribed: "To our fearless leader: We promise to love, honor, and obey mass, energy, and momentum balances throughout our lives. Class of '77."

This plaque, inscribed with the names of all the students in Bill's senior Optimal Design of Chemical Systems course, is a token of the affection between him and his students; an affection undiminished by the copious amounts of work that he dispenses and the rigorous standards that he requires them to meet.

Bill's work as a teacher affords him great pleasure, but it is only one of the roles he has filled during his 37 years as a chemical engineer. He has been president of the American Institute of Chemical Engineers, Caltech's vice president for Institute relations and the executive officer of its chemical engineering department, an executive in the biomedical engineering field, and a consultant to the biomedical industry (he has consulted for

He has been president of AIChE, Caltech's vice president for Institute Relations and the executive officer of its ChE department, an executive in the biomedical engineering field, and a consultant to the biomedical industry.

© Copyright ChE Division, ASEE, 1980



the American Hospital Supply Corporation since 1952). Now Caltech's Institute Professor of Chemical Engineering, Bill has earned a reputation for energy and enthusiasm, hard work and self-discipline, superb organization and keen integrity, compassion for human need, and a sense of humor and a dry wit that include the ability to laugh at himself.

He has been variously described by his colleagues as one who "is a prophet in the field of chemical engineering" . . . "is overwhelmingly supportive of people he believes in and never holds a grudge" . . . "is dedicated to his students and suffers when they suffer" . . . "possesses no tolerance for any kind of slop" . . . "rewards you when you do a job well by giving you more work" . . . "puts all he has into everything he does" . . . "is decisive without being oppressive" . . . "is a wonderful colleague who's always helpful" . . . "is an unguaranteed baritone" . . . and "is enormously forthright and willing to give you his honest opinion on most any issue (if you don't want it, don't ask)."

THE EARLY YEARS

BILL IS ONE OF THOSE rather rare individuals in his generation who is actually a native of Los Angeles. His father, a California farmer, died when he was a year old and he was raised by his mother, who worked as credit manager for a wholesale grocery company, and his grandmother,

a retired teacher whom he describes as "almost a mother and father to me at that time."

He attended Los Angeles public schools, including Norwood Grammar School a few blocks from the University of Southern California. In his neighborhood, at the vulnerable age of four, he began to form what would become a lifelong addiction to USC football.

His enthusiasm for the natural world, and his fascination with the way things worked, were stimulated at Fairfax High School by his biology and physiology teacher, Doris Siddall. So keen was her passion for nature, and so determined was she to give her students fresh insight into its marvels, that she frequently would rise at 3 a.m. to travel by Pacific Electric car to San Pedro to collect fresh samples of sea life from the tide pools to illustrate her lectures. "Her style was a tremendous inspiration to me," says Bill. "She was a living example of the impact of a teacher on her students."

Last year, after what he terms "40 years of thinking about it," he found Mrs. Siddall, now 87, and brought her to Caltech for a reunion with lunch and a look at the Institute's facilities. Meanwhile he had had other reasons to recall his high school days: In 1976 the Los Angeles School District honored him as one of its 50 outstanding graduates during the Bicentennial celebration. He shared recognition in the field of science and medicine with Nobel laureate Glenn Seaborg and astronaut Walter Cunningham.

With college approaching, Bill weighed careers in medicine and chemical engineering but chose the latter. He believes he is fortunate in the decision he made, although he has never lost his keen interest in medicine and has worked extensively in biomedical engineering. "But if I had become a doctor," he speculates, "I'd have lived and died with every patient."

At Caltech Bill studied hard but also found time to write for the school paper and to indulge his love for sports. He played four years of inter-collegiate baseball and participated in all of the intramural sports, spending almost every afternoon on the practice field. Here he deepened a belief in the importance of keeping fit as essential for an effective life, and in the influence of physical vitality on emotional attitudes. This perspective is one that he often expresses to students whom he advises.

As a student, Bill found Caltech and its faculty and student body fascinating ("one of the great

things about Caltech has always been the high density of interesting people here") and he elected to continue his graduate work at the Institute after earning his BS degree in 1941. During his first year as a graduate student he met Martha Rogers, secretary to chemical engineering professor Bruce Sage. The couple became engaged six weeks after their first date and they were married on Sadie Hawkins Day, exactly a year after that first date. Bill notes that among the many desirable traits that Martha brought to the marriage—including intelligence, wit, charm, beauty, and a love of all kinds of sports—she came equipped with a handy knowledge of chemical engineering terminology, thanks to her work in Sage's office.

Bill's graduate work was well under way during the fall of 1941 when World War II erupted to change the pattern. He joined Cutter

In 1976 the Los Angeles School District honored him as one of its 50 outstanding graduates . . . He shared recognition . . . with Nobel laureate Glenn Seaborg and astronaut Walter Cunningham.

Laboratories in Berkeley as a development engineer in biomedical-chemical engineering. But in the fall of 1942 he was called back to the Caltech campus to become a research supervisor and development engineer for the National Defense Research Committee of the Office of Scientific Research and Development. He worked on processing propellant and interior ballistics for artillery rockets and for the Manhattan Project on the firing mechanism for the atom bomb.

With the war at an end he returned to graduate studies, working toward his PhD as a National Research Council Predoctoral Fellow. His graduate work completed in 1948 (he was one of the first two people to receive PhDs in chemical engineering from Caltech), he and Martha again left for Berkeley where he had accepted a position as director for technical development for Cutter Laboratories.

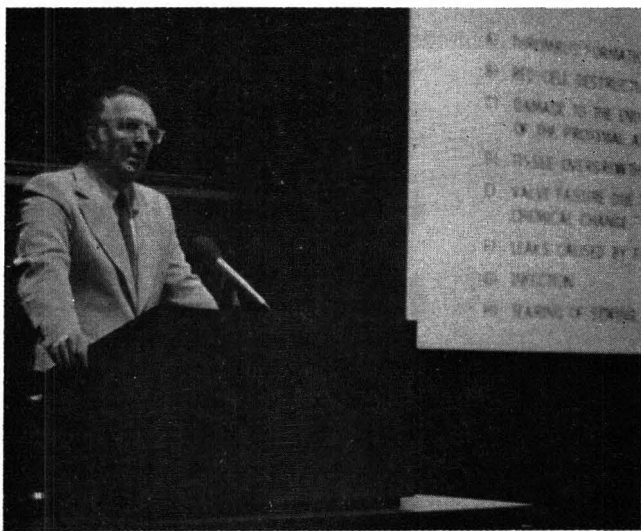
Predictably, Corcoran found work as a chemical engineer in industry to be exciting. "I love the atmosphere of industry," he says. "It is creative and there's an immediacy about the work that's very gratifying, whether, for example, it's drying blood plasma or manufacturing pharmaceuticals. A chemical engineer in industry can go to the end of the production line and see the product of his

efforts, and if that product makes a contribution to society, then the work is doubly exciting. Moreover, the hours, the pay, the support staff, and the equipment are usually better than at a university. To turn away from all this requires a very special reason.”

AN ACADEMIC CAREER BECKONS

In 1952 he was asked to return to Caltech as an associate professor. He accepted. Making the decision was difficult, he acknowledges, but a very special reason prevailed; he couldn't pass up the opportunity to work with students. The rewards from teaching bright, creative young people filled with drive and enthusiasm and helping them develop their talents were irresistible. (Bill made just one more foray into industrial chemical engineering. He worked from 1957 to 1959 as vice president and scientific director for Don Baxter, Inc., while retaining a professorial appointment at Caltech.)

In addition to the chance to work with students, he cherished the independence of an academic



Dr. Corcoran describes his studies of heart valves at a seminar for alumni.

career. “My genes are very Irish,” he explains, “and in my soul I'm a free spirit. I relish the opportunity to be myself. In the industrial world, if it becomes necessary for a company to make a 90-degree turn in direction, then its engineers must turn 90 degrees with it or get out. But at a university there's more freedom to choose one's own direction and little to block opportunities except oneself.”

Bill then began an academic career that would carry him to the top of his profession. He combined teaching, research, and consulting, and a commitment to the evolution of the chemical engineering profession. He has expressed his views, and articulated his knowledge, via authorship or coauthorship of two books and more than 85 papers.

His capacity for leadership, hard work, and superb organization led to his becoming, at various points in his career, president of the AIChE, chairman of the council for the Engineers' Council for Professional Development (ECPD) and a member of its Board of Directors, national director of AIChE, chairman of the Engineering Education and Accreditation Committee of the ECPD, chairman of the Ad Hoc American Society for Engineering Education Committee on Review of Engineering and Engineering Technology Studies, chairman of the Air Force Institute of Technology Subcommittee Air University Board of Visitors, chairman of the Education and Accreditation Committee of the AIChE, a trustee and member of the Executive Committee of the Association of Independent California Colleges and Universities, and associate editor of the *Journal of Quantitative Spectroscopy and Radiative Transfer*.

He has also been a member of the Editorial Advisory Committee of *International Chemical Engineering*, the Editorial Committee of *Engineering Education*, the Advisory Board of *Industrial and Chemical Engineering Fundamentals*, and a member of the Board of Directors of the Huntington Institute of Applied Medical Research.

His contributions have won him honors including election as a fellow of the AIChE, the Lamme Award of the ASEE for excellence in his profession, the Western Electric Fund Award for excellence in teaching, the Founders Award from the AIChE for impact on his profession, and Educational Achievement Award from the California Society of Professional Engineers, an award from the Associated Students of Caltech for teaching excellence, and election to the National Academy of Engineering.

In 1969, in addition to a full load of teaching, advising, and research, he became vice president for Institute Relations with responsibility for Caltech's development and public relations programs at a time when universities throughout the country were faced with skyrocketing costs and the need for some painful belt tightening and ad-

"I relish the opportunity to be myself . . . at a university there's more freedom to choose one's own direction and little to block opportunities except oneself."

ditional funds. He accepted the position with the stipulation that he could continue to teach and do research. This July, after a decade, he relinquished that role to become Institute Professor of Chemical Engineering and to be responsible for examination of Caltech's and JPL's interactions in helping with the United States' energy program.

As vice president for Institute Relations, Bill guided Caltech toward the successful conclusion of a \$130 million development campaign and, as administrative chief for a staff producing prodigious amounts of written materials, he found ample opportunities to implement his views concerning the need for clarity and precision in use of the English language. "Please clean this up by getting to the point," "Please eliminate 'tangible' as an adjective in describing dollars," and "No self-respecting grammarian would ever start any sentence with the very ambiguous 'it'," were among directives from him that were preserved and affectionately presented to him in a scrapbook when he retired from the position.

STUDENT CONTACT HAS TOP PRIORITY

THROUGHOUT THIS PERIOD when he handled two full-time careers, he maintained two offices, one in Caltech's executive chambers and another in the chemical engineering building where he could be more easily accessible to the 30 or so students that he advised. He frequently told them, "Don't ever con me by telling me you can't find me. I'm available all the time." His staff soon learned that an appointment with an undergraduate ranked equally in importance with an appointment with a major donor, and that a trustee could be kept waiting if a student was undergoing a genuine personal crisis and needed extra counseling time.

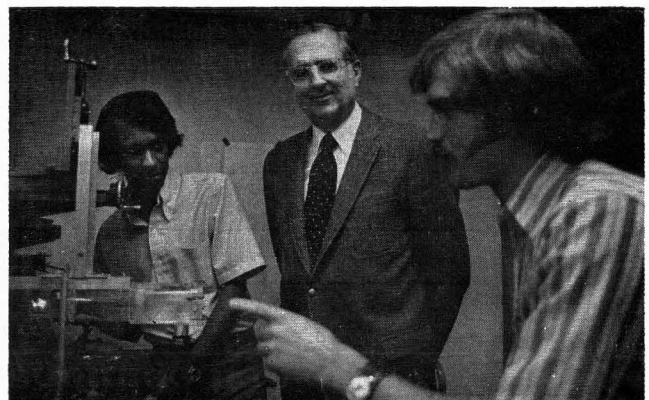
During this era, fund-raising responsibilities often made it necessary for Bill to travel out of town. On these occasions he left his senior engineering class and his graduate students a number where he could be reached, inviting them to call him collect if they encountered a problem that couldn't await his return. "Call me any time, day or night," he always tells his students, adding,

"but if you call after midnight you'd better have a relatively good question."

Because he believes in an effective counseling program for effective undergraduate education, he is known for his willingness to talk with his students about any problem from confusion over transport phenomena to a romance gone sour to how to budget one's time at a rigorously demanding academic institution. One student with a problem in the latter area was advised to write down a schedule showing how he planned to use his time during the coming week. The schedule revealed that the student was dating three girl friends, and Bill advised him to go the painful route of cutting down to one.

"I told him his first priority was to stay healthy," Bill says, "and his second to attend to his school work; that extracurricular activities would have to come third if he was going to be successful here."

As a teacher Bill is known for dispensing prodigious amounts of work ("I can't help feeling sorry for his students," says Martha, and a colleague adds, "He teaches them to be well organized; they have to be, to get his assignments in on time") and who tolerates no nonsense from procrastinators or goof-offs. But he is equally known for his willingness to give extensions of time when a student has a genuine problem, to go out of his way to make professional contacts for his students and to help them find jobs, and even to serve coffee and doughnuts on Friday mornings at an 8 o'clock class. ("This isn't a bribe to get you here," he'll tell them. "I just want to wake you up.")



W. H. Corcoran with graduate students Ajit Yoganathan and Russell Bone, examining measurements of the fluid mechanics of heat valves. (Yoganathan, at left, recently completed his PhD and is now an assistant professor at Georgia Tech.)

Along with the many other responsibilities he's assumed, Bill has also found some time for excursions into musical comedy.

In his teaching, Bill consistently reminds his students that, through their impact on energy, the environment, food production, medicine, and so on, they are going to play roles as leaders in society whether they want to or not. "I believe it's my responsibility to remind them that they don't live under a rock," he says, "that they can't simply concentrate on chemical engineering and ignore the rest of what's happening around them. They should be able to read the Wall Street Journal, for example, and to understand the significance of its contents. They should be able to discern the connections between a decision of the President and the impact of that decision on engineering design and ultimately on society. I believe they get my point."

It was partly because of his desire to have students understand the economic and sociological aspects of engineering problems that Bill developed an introductory chemical engineering course for sophomores that was built around the study of problems based on hemodialysis and artificial kidneys. It allowed introduction to students of such basic concepts as mass, energy, and momentum balances, and stoichiometry, chemical equilibrium, and chemical kinetics, by applying them to treatment of kidney failure.

About one-third of three class hours per week was taught by a member of the chemical engineering faculty on basic principles of chemical engineering as applied to the problem of kidney dialysis; another one-third of the hours was devoted to lectures by medical and professional people on renal function and failure, the design and function of equipment for dialysis, and the social and economic problems of home and institutional dialysis. The remaining class time was spent on field trips to a hospital or manufacturing company to illustrate applications of the information presented in the course.

The artificial kidney demonstrates exceptionally fine examples of chemical engineering problems, Bill explains, and the costs of its maintenance and efficient use provide a good focus for the need to keep economics in mind while designing chemical systems. And finally, he adds, in dealing with human beings, students gain new insights into sociological needs and human problems—highly important for individuals who will make significant contributions to society through their creations.

In his work with senior students, Bill stresses the importance of an understanding of the nine

elements of design: economics, material, energy and momentum transfer, chemical equilibrium, chemical kinetics, the properties of materials, process control, and safety. In the two terms of his senior course, Optimal Design of Chemical Systems, students apply these elements through independent problems and case studies. In the third term the course is entitled "Simulation and Design of Chemical Systems." In that course, the students simulate chemical processes, using Monsanto's FLOWTRAN programs. Bill doesn't give mid-terms or finals, considering them unproductive in a course devoted to problem solving. He says, "By the end of the year my students should understand the elements of design so thoroughly that they can explain the concepts to another person in their own words in a clear, unambiguous way. When they can do this, then they're ready to be employed as beginning engineers or to go on to graduate school."

Bill's selection of an artificial kidney as a teaching device is symptomatic of his belief that chemical engineers had been too parochial in the scope of their efforts. "Chemical engineering is concerned with the control of chemical reactions to produce something useful for the benefit of society," he says. "Chemical reactions take place in many different places: in chemical plants, in food processing, in human kidneys, in rocket motors. And wherever these reactions occur, that's where the chemical engineer should be. I believe that members of the profession now recognize this, and that chemical engineering is now doing what it should be doing about diversifying its concerns."

Bill's own PhD work was associated with heat transfer in fluids, and as a faculty member at Caltech he worked on the experimental measurement of the coefficients of diffusion for heat transfer and momentum and on applied chemical kinetics. He has conducted work on the pyrolysis of hydrocarbons and is now working on the reaction kinetics of the desulfurization of fuel oil and coal. At the same time he continued work in bioengineering and biomedical engineering and was involved in the development of disposable hospital equipment, fermentation processes for penicillin and vaccines, and the development of

mass parenteral solutions and peritoneal dialysis. Most recently he has worked on the studies of artificial heart valves. During his teaching career he has counseled about 30 doctoral candidates who have gone on into leading roles in academic and industrial work.

SONG AND DANCE MAN—AND MORE

ALONG WITH THE MANY other responsibilities he's assumed, Bill has also found time for some excursions into musical comedy. He's been a regular in the Caltech Stock Company, a sturdy band of extroverted eggheads who lead double lives as professors, faculty wives, and other members of the Institute community. The musicals generally have commemorated anniversaries, retirements, and the awarding of Nobel prizes to Caltech luminaries, and Bill, picked for a solid baritone voice, has played such roles as a geologist, an illegal alien, a trustee, and a social worker, belting out lyrics like these: "Gneiss is a laminated metamorphic rock/the only stone a man can trust./ All the others are crude if not faintly lewd/They fill a good man with disgust./You can't trap us with your lapis/It's not gneiss."

"Some people think of Bill as an eminent educator," says Caltech's professor of English J. Kent Clark, who wrote the lyrics for all stock company productions. But to me, Bill will always be a song and dance man. A tremendous talent was wasted when he went into fund raising."

During the years that he's been deeply involved in professional activities, Bill has always remained close to his family. He and Martha have two children: Sally, 32, a mathematician and graduate of Pomona College and now the mother of two, who lives in Solana Beach, California, with her husband Ray Fisher, a plasma physicist from Caltech and now working for General Atomic in La Jolla; and their son, Bill, 29, who majored in soil science at Purdue and now lives (coincidentally) in Corcoran, California, where he is an operations manager for the J. G. Boswell Company. Bill and his wife, Leslie, are the parents of two young sons. As a college student Bill Jr. was a member of the Purdue football squad; Bill's colleagues began to notice that whenever the young man was to play in a Saturday game his father made an effort to be called to the Midwest on a speaking engagement that same weekend.

Bill's own love for sports—as spectator and participant—has remained undiminished through-

out his career. He continues to follow USC football religiously (one student being stalked by Bill for an overdue paper claims to have diverted him from his objective by launching into a discussion of the fine points of Saturday's game), and he can describe the contributions of a quarterback with the authority he would use to explain which free radical is essential in a chemical reaction.

On vacation in Hawaii for three weeks each September he switches from sports spectator to participant. He wallows in golf and swims over a mile each day in the ocean. At home he enjoys badminton, he bicycles with Martha occasionally, and recently, intrigued with a burgeoning California fad, he bought a pair of roller skates to try around the neighborhood.

For many years, Bill revived his college baseball experience each year by pitching overhand softball in the faculty-senior game. This annual rite was eventually terminated, partly because of student discouragement over the fact that the faculty consistently won. He also kept his hand in baseball while his son was a teenager by managing Senior League and Babe Ruth League teams for boys 13 to 20. During the same period he and Martha taught high school Sunday school at St. James Presbyterian Church where they are members.

The Corcorans also have been involved in working on their avocado and lemon ranch near Fallbrook, California, an endeavor in which their children joined them when they were living at home. This environment gives Bill the chance to enjoy farming as a hobby and also to indulge a serious interest in the technology of agriculture.

Bill's tendency to find life full of exciting things to do has never diminished. And although his schedule is brim full, there are other activities he'd like to take on if he had the time. He'd like to master a musical instrument, for example, and to become proficient in Spanish (he's studied Latin, French, Spanish, and German). He reads for entertainment and would like to read more: "I'd read every moment of every day if I could." Bill feels activities like these he enjoys away from Caltech are essential. "We all have to recharge our batteries," he says. "If we don't, we miss really important parts of living."

His feelings about all the diverse elements that have characterized his interests, the challenges he has met, the places he has met them, is simple: "Everything that's happened to me has been good. I don't know why I've been so damn lucky!" □