ChE educator

Joe Hightower

of Rice University

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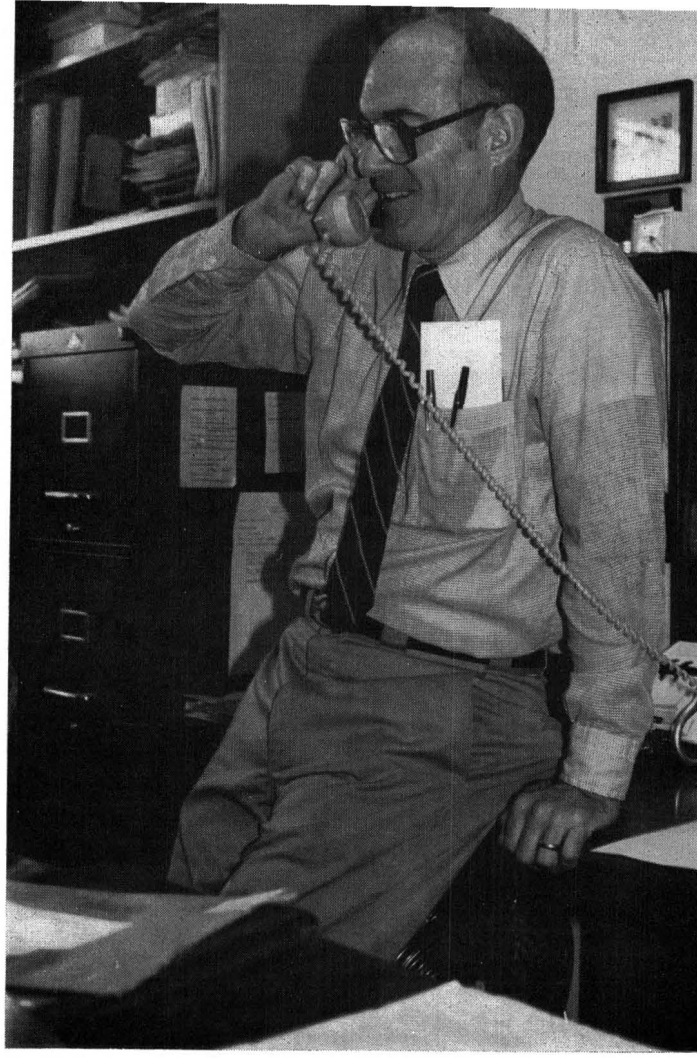


"I 'VE BEEN DELIGHTED to be where I am," says Dr. Joe Hightower in regard to his decision 17 years ago to become a chemical engineer and an educator as well.

Joe Hightower, of the chemical engineering department at Rice University in Houston, says he started out like many other members of engineering faculties: "I started as a child by taking things apart—bicycles, motorcycles, clocks, everything!" As early as the fourth grade he proceeded to take his clarinet apart and to rebuild it shortly after he began taking music lessons. Then throughout high school, in addition to becoming an accomplished musician as a member of the all-state band, he made a veritable career out of repairing the instruments of the other band members.

While he was in high school Joe also decided to study chemistry. Later he obtained his masters and PhD in chemistry from Johns Hopkins but couldn't decide if he wanted to do industrial research or academic work. It was during a three-year stint at the Mellon Institute that he decided to teach. "I found that I enjoyed the interaction with the students, the stimulation of the faculty, and the flexibility of the job."

He found he had to make another decision, however—whether to go into a department of chemistry or chemical engineering. "All my educational background was in chemistry, but I had a philosophical desire to work on things that have very practical uses," he says.

However, chemistry departments were moving in the direction of quantum mechanics and other more esoteric areas while chemical engineering was moving from unit operations into engineering science. Thus, chemical engineering embraced catalysis, and Joe Hightower embraced engineering.

It happened at that time that heterogeneous catalysis, the research area in which Joe was interested, was a field that had been explored primarily in chemistry departments. However, chemistry departments were moving in the direction of quantum mechanics and other more esoteric areas while chemical engineering was moving from unit operations into engineering science. Thus, chemical engineering embraced catalysis, and Joe Hightower embraced engineering.

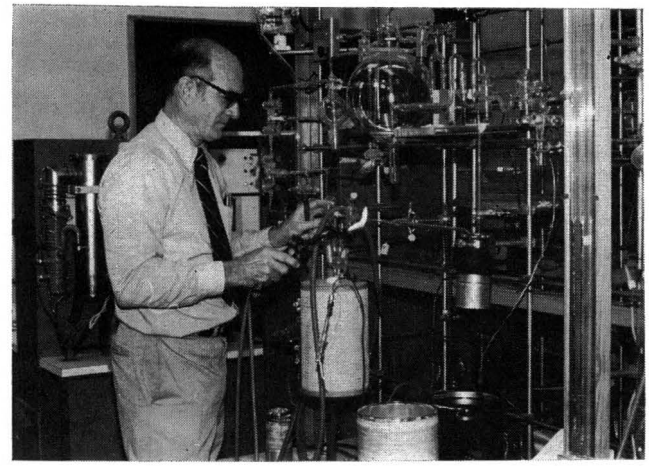
Since then, Joe's research philosophy has been directed toward providing new insights into how existing catalysts work as opposed to discovering new catalysts. "We try to ask the question 'Why?' " he says. Using his chemical training, Joe has worked at gaining information about the chemical nature and concentration of active sites, the influence of solid state parameters in determining activity and selectivity, and the mechanisms of reactions that occur over solids that are of interest to the petroleum and petrochemical industries. He and his students have extensively used isotopic

tracers (both stable and radioactive) to study the kinetics, reaction networks, rate limiting steps, and incorporation of surface species into product molecules. (Some of his work has been summarized in an earlier issue of this journal, Vol. XVI, No. 4, p. 148, Fall 1982). A few of the catalyst systems that his group has studied include cracking catalysts, auto emission control catalysts, partial oxidation catalysts, and zeolites.

But Joe's research does not stop at the graduate level. Several years ago he incorporated some research techniques into a sophisticated undergraduate experiment. While taking his kinetics and reactor design course, junior level students now investigate all the kinetic parameters for cumene dealkylation over a silica-alumina cracking catalyst, explore the reaction mechanism with deuterium tracers and a mass spectrometer, and determine the surface area of the material. From their results the students are able to calculate the true surface reaction rate constant, the concentration of active sites, the turnover frequency, and the role of intraparticle diffusion on the kinetics (*Chem. Eng. Educ.*, p.118, Summer, 1969). This experiment allows the students to determine experimentally many of the parameters that are useful in scaling up such reactions from laboratory to plant size.

Joe's research has led him into other situations which he has especially enjoyed. In the early 70's, for example, he was chairman of several National Academy of Science panels which were assigned the task of assessing the feasibility of using catalytic converters to decrease pollutants from automobiles. "No one had ever applied catalysts in this way, and we were assigned the task of determining if these devices would in fact work," he says. "It was fascinating. There was a lot of secrecy. No company would tell us directly what they were doing, but they would tell us what they thought the other companies were doing, and we had to try to put together a clear picture. Once I was asked to testify before the House of Representatives Committee on Science and Technology which was chaired by Representative George Brown of California. The congressman from Detroit would say things like, 'I want you to know that people from my district are being put out of jobs because of government regulation and control.' Brown would respond, 'People in my district in California are dying because we don't have enough controls, and pollutants are killing people.' How can one give an objective testimony in an atmosphere like that!"

Involvement in professional societies has been another rewarding part of Joe's career. He is currently chairman of the 24-member Petroleum Research Fund Advisory Board, a group that is responsible for a corpus of $150 million. This year the foundation will donate $11 million for university research in petroleum-related areas. In 1971 he received the National Award in Petroleum Chemistry from the American Chemical Society.



Joe finds time to enjoy simple, relaxing activities, such as blowing glass in his lab.

As a councilor for the American Chemical Society, he represents the southeastern Texas local section. He has been on the national research committee and is on the national awards committee of the American Institute of Chemical Engineers. He has also served as chairman of the petroleum chemistry division of the American Chemical Society.

Dr. Hightower has over 50 publications to his credit and is also very much involved in presenting short courses for industry. "Catalysis," he says, "is a field that is not taught in many universities as an area of specialization. Yet, 80 or 90% of all commercially important chemical reactions are catalytic reactions. People are trained as organic chemists, physical chemists, or chemical engineers and then learn about catalysis on the job. This creates a great demand for the types of short courses that we instituted at Rice years ago and that are being continued in cooperation with other schools such as the University of Houston."

It would appear that Joe's day would have to last more than 24 hours in order to accomplish his many activities. Yet, there is still another part of his life that is as important to him as his pro-

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fessional work. In 1968 he was a leader in establishing the Human Resources Development Foundation. The foundation provides free temporary housing for needy families who come for treatment to the Texas Medical Center hospitals. The foundation started as a project at Dr. Hightower's church and has expanded to serve over 700 families from over 38 states and 26 foreign countries in the last 16 years. Joe is president of the foundation whose facilities have grown from an old army barracks into 15 beautiful apartments. He heads a group of approximately 40 dedicated volunteers who minister daily to the needs of families who are under enormous stress.

"All a person needs to move in are pajamas and a toothbrush!" Joe laughs. But his statement

Human Resources Development Foundation apartments.

is very accurate. The apartments are furnished down to the pots and pans. A local church even provides meat once a week for the residents. Social workers, ministers, and even former residents refer potential patients. Selection is made on a first-come, first-served basis without regard to race, creed, sex, religion, age, or level of disability. Need is the sole criterion used to determine eligibility. Residents are allowed to stay for up to three months.

"The project is valued at over a half-million dollars, and most of it has been given because of something Joe has done," states Marge Norman, Vice-President of the foundation. "Joe never hesitates to go speak to a group if there is some chance that they might have an interest in the foundation. His work takes him to the far reaches of the U.S. and overseas; on every airplane trip he takes he makes sure his seat partner is very well acquainted with his pet project, and it often leads to very good things for this foundation."

Senator Orrin Hatch was one of the latest people to hear about the foundation because of one of Joe's "airplane contacts." Joe sat next to a member of Senator Hatch's staff on one flight, and later he received a letter from the senator, who had been informed by the staff member about the foundation. The letter commended Dr. Hightower for his charitable work.

Continues Mrs. Norman, "Even though we have a foundation board which is functioning very well, without Joe I don't know if the Board would have been as effective or if this place would have become what it is today. He loves it so much, and he works so hard. A couple of times each year we have a work day when all our volunteers come to clean, repair, and paint. All kinds of people are represented in the workers. Joe is always the first here and the last to leave, working at anything that needs to be done. Even before he comes over, he gets up before dawn and bakes bread so that at 10 a.m. we can have hot bread and butter and coffee. We've been acquiring land to build more apartments next door, so you can be sure he's on the campaign trail again! We have parties for our residents, and again, Joe is always here with bread he has baked. He even brings his mandolin and plays and sings. There's not much Joe can't do!"

On any given day the facility may house people from Florida, or from various towns in Texas, Columbia, or Indiana. There are no class distinctions. Last winter a brain surgeon from Mainland China was allowed to leave his country with only $200 when he came to care for his quadriplegic daughter in the medical center. As a resident of the foundation's apartments, he scrubbed floors and took a lot of good-natured ribbing when he painted an outside door with interior paint. Something all residents share, however, is gratitude to Hightower, who personally greets each newcomer with a loaf of bread, and gratitude to the foundation he helped establish.

Wrote one resident, "What a tremendous help this facility has been to us. Each of us is faced with an extremely serious medical problem, and the expenses are staggering. To be sure, the financial savings are important, but even more, we have a place to call 'home' and people with whom we can talk as friends. I'm one of the lucky ones. Two weeks ago I had a kidney transplant, and now I am hoping and praying that my body will not reject it. I have been so impressed by the consistent care and visits that I've had from the jogger (Dr. Hightower) and his friends even during my recovery from surgery. I hope in some way I can repay the favors done for me. Right now, though, I'm going to sit back and enjoy another slice of the hot bread Joe Hightower has brought me before it has time to lose its flavor!"

In his professional life also, colleagues have only good things to say about Joe Hightower. Dr. T. W. Leland who was department chairman when Joe came to Rice says, "I was impressed with him right from the start, and I had a great interest in getting him to come to Rice. I think it's been a first-rate choice. He's done a remarkably good job over the years. He's an excellent teacher and has had an active research career. He is well thought of by his students and has perfected a graduate course in kinetics and catalysis to a high degree. He has been effective in giving short courses and he is outstanding in his volunteer public service. Personally, he is outgoing, friendly, and extremely well-organized. He has excellent rapport with people in all walks of life, from the top of the technical ladder in terms of ability to students not doing too well in their courses. He's a remarkable individual who has been a great addition to our department."

Joe is modest in describing his daily activities. "I just enjoy it all," he says. He gets up at 4:45 every morning to jog and share breakfast and a Bible reading with his wife Ann, a chemical engineer who works for the Exxon Chemical Company. By 6:30 a.m. he is at work, doing all the things he loves to do. "From the very beginning I couldn't make up my mind about what I wanted to do. I wanted something in both industry and the academic world. Now I have both, and I'm grateful for that. I probably border on getting involved in more things than I should . . . but they're all so interesting! I guess I just like being where I can interact with people and see them grow, whether it's at the university or whether it's with people who are hurting." □