ChE educator

Roger A. Schmitz

of

Notre Dame

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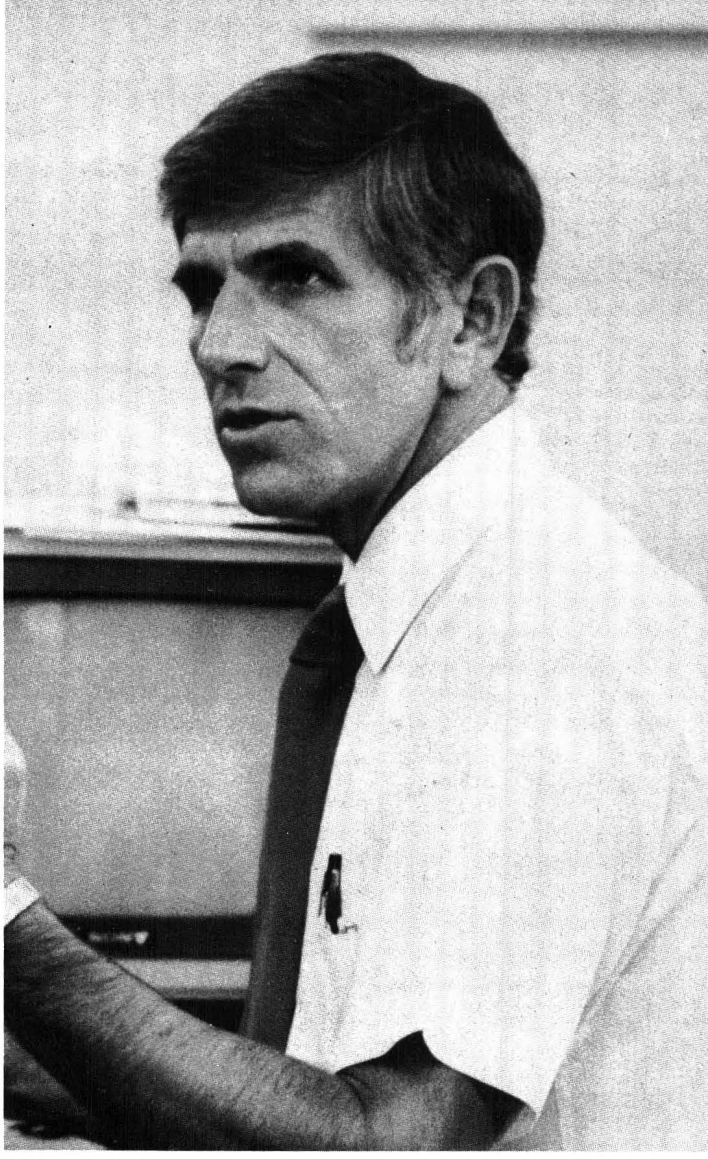

SOMETIMES GOOD GUYS *do* finish first. That seems to be the moral of Roger Schmitz's life and career. A further lesson suggests that success need not always depend on grand master plans and overweening ambition. Thirty years ago, when Schmitz surveyed his future, the prospect of a life devoted to academia seemed remote at best. Now dean of Notre Dame's College of Engineering, he modestly attributes his success to luck. Good fortune may have played its role, but Schmitz's history is much more a tale of hard work and dedication, of talent and opportunities exploited to the fullest, and of a family that has been at the center of all his aspirations and achievements.

Schmitz hails from Carlyle, Illinois, where he enjoyed a small-town boyhood in a closely knit family. In that environment and at that time, he says, it wasn't common for people to go to college. In fact, he never intended to go to college himself. After graduating from high school he took a job as a stock clerk at a local store. Then he struck out on his own and opened an ice service. His business career was short-lived; six months later he was drafted into the army. In retrospect he considers his induction a stroke of good fortune, since it was only after he served for those two years that he considered going to college.

Schmitz found that jobs were hard to come by when he emerged from the service and, since he was eligible for the Korean G.I. bill, he enrolled at the University of Illinois in the civil engineering program. The G.I. bill allowed for a frugal life-style: $110 a month covered room, board, tuition, and a $20 payment on a car. He married his wife Ruth while an undergraduate, adding to his financial responsibilities and prompting him to accelerate his education. He earned his bachelor's degree in three and a half years. Upon graduation in 1959 the university awarded him its highest academic honor by naming him a Bronze Tablet scholar.

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Schmitz reminisces, "I don't think I ever really looked at things and said an education should be good for me. If I had had an opportunity to get a job that looked reasonably good to me, that was well paying, I probably wouldn't have started college." He maintains that it was all a kind of accident that he went to school at all, but once he was there, he found that he liked it and did well. Mathematics, physics, and chemistry were the most appealing subjects, and engineering was the only major he considered pursuing. After one semester at Illinois he switched to chemical engineering and now he credits John Bailar, his first

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chemistry professor at Illinois, with directing him toward the field. Through that freshman course he discovered his affinity for things chemical as opposed to things mechanical. "I'm not one who spent a great deal of time under the hood of a car," he explains.

Schmitz's academic goals were further refined with the help of John Quinn, then a member of the chemical engineering faculty at Illinois. Under Quinn's direction, Schmitz worked on an undergraduate mass transfer project and later presented the results to an AIChE meeting. Simultaneously, he discovered the satisfaction of academic research and the impetus to pursue it further. He applied to graduate schools and decided to enroll at the University of Minnesota.

The theme of accidental good fortune arises often in Schmitz's account of his life and career. Although working with Neal Amundson at the University of Minnesota "did more for me than anything else," he did not apply to Minnesota with Amundson in mind. Minnesota appealed to Schmitz because it offered a good fellowship and was located in the Midwest. And he selected Amundson as an advisor simply because his work looked interesting. By the time he graduated, Schmitz explains, "Minnesota was recognized as probably the premier place in the country for graduate work in chemical engineering, with Amundson the king of his field."

When he started his graduate studies he and Ruth had one daughter, Jan, who was born in 1958. (Joy followed in 1961 and Joni was born in 1963.) With a one-year old daughter, Schmitz again felt rushed, thinking, "If I take as long as the usual graduate student, my daughter will start school before I get out." He finished his PhD in three years, graduating in 1962. Schmitz worked as an instructor during his second and third years at Minnesota and soon found that his plans for a career in industry could not compete with the great pleasure he found in teaching. He decided to pursue an academic career.

Another stroke of unexpected good luck came with his appointment at the University of Illinois in 1962. Again, the choice was made without much premeditation. Illinois was his alma mater and in his home state. His parents and in-laws lived nearby. These factors persuaded him to accept the appointment and, fortuitously, as a result he found himself a member of a strong department with top-notch colleagues and facilities, good graduate students, and solid support for research.

Schmitz prefers to emphasize the ways in which he benefited from the stimulating environment at Illinois. But he certainly contributed a fair share to the department's reputation. As a graduate student, his research had consisted largely of theoretical analyses which predicted a variety of complex steady-state and dynamic behaviors of chemical reactions and reactors and which concerned reactor control. Shortly after arriving at Illinois he and his graduate students set up laboratories to test those theoretical predictions. Their experiments demonstrated that the ideas that emerged from mathematical analysis represented real phenomena and were not merely speculative. The resulting articles, some of which were the first published on such topics, are now recognized as classics in chemical reaction engineering. Schmitz was awarded a Guggenheim Fellowship for 1968-69, which he spent as a visiting professor at the California Institute of Technology and with the department of electrical engineering at the University of Southern California.

Research has not had an undivided claim on [his] time and energy. He has been equally committed as a teacher. Schmitz was one of the first professors at . . . Illinois to receive the award for excellence in undergraduate teaching.

With doctoral student Ronald B. Root, he was among the first to demonstrate experimentally the existence of multiple steady states in flow reactors. This work provided a link with the theories that had predicted such phenomena since the early 1950s, notably in the works of van Heerden and Amundson. The pioneering nature of this work was recognized by the AIChE in 1970 when Schmitz and Root jointly shared the Institute's Allan P. Colburn award. Schmitz has received much recognition throughout his career, but when asked which has meant the most to him, Schmitz says without hesitation that it was the Colburn award, and compares it in importance to Rookie of the Year. Schmitz went on to publish experimental results which were among the first to demonstrate the occurrence of self-sustained oscillatory states in a flow reactor and the feasibility of stabilizing certain intrinsically unstable states by means of conventional feedback control methods.

Through the years both this subject area and Schmitz's interests have broadened. Biologists, physicists, chemists, mathematicians, and engineers, he observes, once worked in parallel with few, if any, points of contact. But increasingly, similarities in the structure of the mathematical models they employ and in the phenomena they observe have provided fruitful bases for interdisciplinary cross-fertilization. The chemical reactors in complex oscillatory states that Schmitz studies are fundamentally similar to heart muscles in erratic fibrillations, and populations of predator-prey species in cyclic modes. Schmitz regularly joins the researchers in these and other seem-

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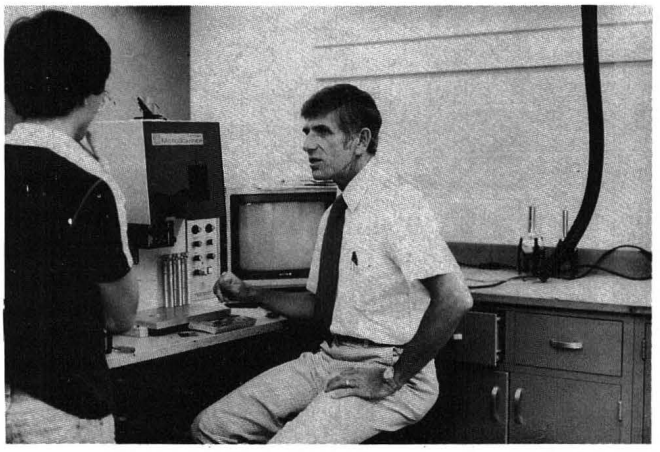


Even as Dean, Schmitz continues to direct the studies of three graduate students and one post-doctoral student.

ingly disparate fields who gather together at Gordon Conferences and other international symposia.

Most recently, his research has focused on the intrinsic oscillatory nature of certain reaction systems. His experiments were the first to exhibit very complex periodic patterns and even "chaotic" states in continuous flow reactors. These observations have attracted the attention of workers in other areas also—particularly those in biology and chemistry.

Not only is his work with complex oscillations attracting the attention of other disciplines to chemical reaction engineering, but that portion of it which deals with solid-catalyzed reactions has promise of providing new information about catalytic processes. Using infrared thermography to study local reaction dynamics on catalytic surfaces, he has observed surprisingly large spatial temperature variations, particularly when oscillations occur. Arvind Varma, chairman of the Notre Dame department of chemical engineering, notes that these large spatial variations in catalyst activity are not usually accounted for in theoretical studies, and added, "Roger has been unique in this area in that he has always been ahead of the game. This is what marks his research." Jeffrey Kantor, an associate professor of chemical engineering at Notre Dame who was recruited by Schmitz, comments, "Characteristic of him are elegant experiments which, for the first time, verify some theoretical predictions. That's his trademark. When he does his experiments, he also proves that there are a lot of phenomena for which there aren't good explanations. He leads the research as opposed to simply trailing others."

Research has not had an undivided claim on Schmitz's time and energy. He has been equally committed as a teacher. Schmitz was one of the first professors at the University of Illinois to receive the university's award for excellence in undergraduate teaching. He was also one of the first in chemical engineering to establish an on-line computerized laboratory designed both for undergraduate instruction in process dynamics and control and for his own research. In recognition of this effort, he received the American Society for Engineering Education's George Westinghouse award in 1977. With regard to the time commitment involved in such an enterprise, Jeffrey Kantor comments: "Innovative research and innovative teaching are both big time sinks and he's capable of doing both which is very much a testament to what he can do. It's a reflection of taking professional risk and exhibiting professional responsibility." Schmitz recalls the excitement of working on the earliest stages of computerization. "We had to fabricate devices because you couldn't pick everything off the shelf like you do now. And we had to do quite a bit of assembly-language programming. There were no software packages available for our applications. The project served a good pedagogical purpose, but most of all I enjoyed doing it. It has had spin-off benefits, even to this day, in some of my research."

Schmitz is emphatic about the importance of combining teaching and research. "Some people say that we lose something in undergraduate teaching by insisting that faculty be involved in research. I can't appreciate that concern because I've never felt that I slighted an undergraduate class to teach a graduate course, or to direct graduate students, or to write a paper or proposal. Granted, some outstanding researchers are absolutely horrible teachers," he admits. "But I feel that an active researcher is more likely to bring excitement and enthusiasm to the classroom and keep courses up-to-date over the years. We're much better off, in my opinion, if every faculty member is both a creator of knowledge at the leading edge, and a disseminator of that knowledge."

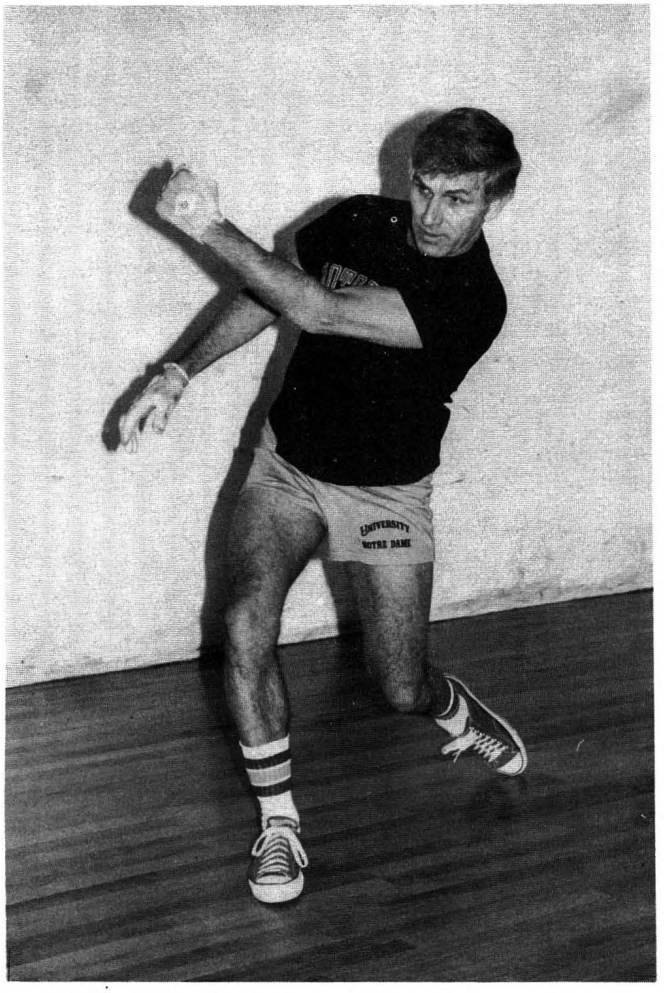
Schmitz joined the Notre Dame faculty in 1979 as Keating-Crawford Professor of Chemical Engineering and as chairman of that department. He says that an important factor in his choice of Notre Dame, and earlier of Illinois, was his feeling of emotional attachment

to the institution. It's important to Schmitz to feel a certain pride in the university, to believe that he can contribute to its growth. "I don't think I'd ever care to go to a place where I didn't feel that way. It would seem like just a job. Or it would seem that I'm just interested in myself and what the institution does for me." Illinois' appeal was obvious, offering both a familiar locale and the reputation of its fine chemical engineering department. Nevertheless, Notre Dame had hovered in the back of his mind since childhood. He recalls hearing discussions of the Notre Dame football team's exploits in front of his family's church on Sunday mornings. He felt attracted to the university, happy though he was at Illinois—especially as Notre Dame's College of Engineering increased its potential for achievement.

Throughout 1979, his first year at Notre Dame, Schmitz was also finishing up his eighteenth year at Illinois. This required a once-a-week, four hundred-mile commute between South Bend and Champaign-Urbana. Hardest of all, though, was the resistance of his family to the move. "The tears and the anguish—you would have thought I was ending their lives! Now they all say it was the best thing that ever happened to us." During this demanding period he was also selected to give the Wilhelm lectures at Princeton University.

When asked about how he coped with the stresses of combining a challenging career with family responsibilities, Schmitz concedes that there are compromises in time and that it is all too easy to neglect one's family. He made it a habit to bring work home with him but, at the same time, refused to let it supercede the needs of his children. He puts up with a lot of teasing at home about never getting away from his briefcase, but considers it a fair price to pay. "I've seen many family problems develop simply because a person thinks he can't work away from his office or laboratory. If he goes home at all, he goes home for dinner and then returns to his office. And everybody's neglected. I've never appreciated the necessity for doing that. As every academician knows, it's very easy to get wrapped up in what you're doing, to overemphasize its importance, and to think that the university can't get along without you. I've always devoted long intense hours to my work, but on the other hand, I wouldn't be able to concentrate on my work at all if I didn't feel there was harmony at home."

In 1981, after only two years at Notre Dame, Schmitz was appointed Mathew H. McCloskey Dean of the College of Engineering. That same year he received the R. H. Wilhelm award from the American Institute of Chemical Engineers in recognition of his theoretical and experimental work in the areas of chemical reactor stability and dynamics, and kinetic oscillations. In 1984 he was elected to the National Academy of Engineering. Recently appointed special assistant to the provost for computing, he will serve as the chief architect of Notre Dame's campus-wide computer, data processing, and management information systems, as he continues to serve as Dean of the College of Engineering.



Three days a week, Schmitz takes a break from his administrative duties to play a competitive game of handball and, South Bend winters permitting, runs two to four miles every day.

Jeffrey Kantor comments that the chemical engineering department is a very good environment for research right now, and he attributes that to the influence of Roger Schmitz, first as chairman and later as dean. "There's a very clearcut statement of what he wants. He's responsible for effectively leading the college and making his goals felt." Arvind Varma also speaks of Schmitz's dedication to improving the research climate at Notre Dame. While everyone recognizes that a good faculty and funds for good facilities

are essential ingredients for continued, developing research activities, Schmitz, Varma says, is capable of attracting both.

Schmitz discusses the topic of academic leadership with vigor. "You have to get administrators, I'm convinced, from academicians. They have to be respected by the academicians whom they are trying to lead. They have to be able to recognize academic quality and to articulate goals that make sense—and they have to make decisions that are consistent with those goals. Every dean says the same thing, 'We want to be excellent; we want good teachers and researchers.' But most of them will never develop outstanding colleges. Defining goals is important, but the most difficult part is knowing what steps to take to achieve them."

He pauses and shakes his head. "It's not easy to find satisfaction in the things you do as an administrator. It's not like making a discovery in research or publishing a paper you're proud of." Admittedly not inclined to dwell on the past, Schmitz prefers to act purposefully in the present and plan for the future. "I think its important to have a model in mind. I have a vision for the College of Engineering at Notre Dame—what I think the College could be, what its potential is, what it would be like if we got there. Even though the vision may never become a reality in all respects, I still like to have a model that guides policy and decision making." He concludes, "I used to say that every administrator should be required to do some teaching and research so that he would better appreciate the professor's situation. Now I say that every faculty member should have a turn at being dean."

In addition to filling his administrative roles on campus, Schmitz currently is supervising three graduate students and one postdoctoral student. Such a balancing act requires an unusual degree of organization and focused concentration, and his efforts in that regard have not gone unnoticed. Schmitz's current group of graduate students report that he characteristically appears at every meeting or discussion carrying a yellow pad filled with messages to himself. Throughout the meeting he jots down notes, equations, and diagrams—then often throws them away. Feeling that the doodles might be useful, one student finally summoned up the courage to ask for them, telling Schmitz that he would use them as wallpaper.

Schmitz's highly organized style of working is testified to by Mark McCready, who started graduate school during Schmitz's last year at Illinois and is now a colleague at Notre Dame. McCready especially recalls Schmitz's polished lectures at Illinois. He was renowned for working out a problem two different ways at the same time on the chalk board. One approach would require many steps and the other would have fewer, but when he had finished, both would occupy exactly the same amount of board space. No student could ever duplicate the performance.

Schmitz's students have found that he is an adroit practitioner of the Socratic method of teaching. Peter Pawlicki, a current graduate student, comments on Schmitz's unerring ability to draw more out of him than he realized he knew through a series of insightful questions and suggestions. Laughingly, his students agree that his most characteristic question, the question that follows every project, discussion, or achievement, is "What's next?" Their laughter is slightly rueful because often, even when they don't feel ready to face the next project, they know he will ask of them just what he demands of himself—to face forward and move on.

"He's hard to upset and hard to impress," Pawlicki contributes. Kathi McDonald, another graduate student adds, "One of the best comments you can hope for from him is, 'That's good.' That is high praise." Always available to them, despite his arduous schedule, Schmitz never fails to return a call or pause for consultation. Most importantly, Schmitz's graduate students realize that, in studying with him, they are participating in an important academic tradition. This was underscored for two of the students, Monica Dutton and Kathi McDonald, when, at a conference, they met Neal Amundson. All three agreed that the two women were probably his first academic granddaughters. With reference to that academic tradition , Schmitz feels that he would not have accomplished much without the forty-nine graduate students with whom he has worked, both at Illinois and Notre Dame (twenty-nine of whom are PhDs).

Schmitz speaks with enthusiasm about the excitement in his graduate students' laboratory right now. That air of anticipation may be due, in part, to his standing promise to treat the group to a Cubs game at Wrigley Field as soon as their infrared imaging studies reveal some critical new knowledge about catalyst behavior. One breakthrough that might send them all to the game is the observation of interacting oscillating spots or standing patterns arising from spatial instabilities.

That promised ball game is a key to Schmitz's lifelong second love. Satisfying as his academic career has been, he reveals that he has always harbored a secret ambition for an altogether different career. "I would still like to be a baseball player!" he confesses with a chuckle. As a boy he was sure that his future promised major league stardom. But he says now that he would have been thrilled just to play Class D professional ball. The left-hander was a first-baseman, an

Membership Forum . . .

WHY I BELONG TO ASEE

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THE PROFESSION OF chemical engineering is in a period of rapid change, where the graduates of our universities are entering a much wider variety of industries than in the past. Employment is on the upswing in the areas of microelectronics components, biotechnology, environmental control, analytical instrumentation, pharmaceuticals, food processing, and various materials-oriented industries, while opportunities in the traditional chemical and petroleum industries have lessened. There is little likelihood that this trend will reverse any time soon.

In addition to these exciting changes, rapid developments in hardware, software, and networks for personal computing have created opportunities for instructional innovation which are only beginning to be identified and used.

The changing roles of our graduates and the potential of personal computers are just two of the reasons why it is imperative that chemical engineering faculties critically examine and revise their curricula and pedagogical methods. Educators must communicate with one another. Good ideas must be spread so that they can be used elsewhere.

The Chemical Engineering Division of ASEE provides for this communication and exchange of ideas. In addition to full programs at all annual ASEE meetings, the division arranges a Summer School for Chemical Engineering Faculty every five years. The next one of these, to be held in North Dartmouth, Massachusetts, in the summer of 1987, specifically emphasizes changes warranted in response to the evolving uses of chemical engineers. It affords a fine opportunity to get a broad overview of possible new directions. Finally, the division's journal, *Chemical Engineering Education*, has for years very successfully relayed new educational concepts and teaching methods, and is a valuable resource for members.

Surely we cannot expect that every faculty on its own will conceive and implement the best curricular changes and developments. The Chemical Engineering Division of ASEE provides the only major forum in this area, and for that very reason we should all support it and add to and partake of what it has to offer. □

Editor's Note: In an effort to encourage non-member chemical engineering faculty to become members of ASEE, we invite members to submit short commentaries on their reasons for joining the organization and the benefits they derive from that membership.

outfielder, and an occasional pitcher, but at present he is satisfied just to play catch with his son-in-law. It's not difficult to imagine Schmitz as an athlete. Lean and self-disciplined, he is recognized as one of the two or three top handball players on campus. In addition, he has recently added to his regimen. South Bend winters permitting, he runs two to four miles every morning, perhaps inspired by his middle daughter Joy who is in training to run the marathon.

One last question reveals the heart of Schmitz's success—both personal and public. When asked what matters most to him, he muses, then speaks decisively. "There's no question. On the whole, the most important thing in my world is my family. That's where my pride and satisfaction are centered. As far as work is concerned, I like to feel that I'm doing something interesting and important, that someone's benefitting from what I do, and that my work is more than merely a 'job.' Accumulating awards is not one of my priorities." Laughing, he concludes, "I'll accept an award or prize anytime anyone wants to give one to me. But it's not a big thing to me. My happiness and fulfillment don't depend on it."

To Arvind Varma, Roger Schmitz is "a quality person, a person who believes in high quality in everything he does: research, teaching, administration, interaction with people, handball, everything. I think the key word for him is 'quality'." One can imagine Schmitz's reaction to such praise. Not one to invite eulogies, no doubt he would mask his discomfort with self-deprecating humor and, turning to the pile of papers on his desk, would ask, "What's next?" □