way to do that, he feels, is to tell them to read the book and then to pose questions or problems based on that reading and discuss them in class. This allows the students to do their own intellectual work instead of relying on the faculty to do it for them. It is easy to teach that way in small engineering classes.

In Noel's courses, the class hour begins with several students writing on the board their solutions to the assigned homework problems, and the rest of the class period consists of a discussion of those solutions. When some of the students try unsuccessfully to work the problems, there are lots of questions, and through the discussion they find out why they had trouble. If the students can all work the assigned problems, then Noel changes the problems to more difficult ones and sees if the students can figure them out on the spot. It is harder to use this ("Socratic") procedure in humanities and harder with big classes, but, in Noel's opinion, it can be done. "It is like the ancient Chinese proverb, 'If you give a man a fish, you have given him a meal. If you teach him how to fish, you have given him a way to get his meals for the rest of his life.' Making students into self-teachers is like teaching them to fish.

"I believe that learning is an active process. One more ancient Chinese proverb (why are proverbs always ancient *Chinese*? Are we not making up any new proverbs today?): 'Tell me, and I will forget. Show me, and I will remember. Involve me, and I will understand.'

"Similarly, I think that learning goes on in the following way: 'From the known to the unknown, from the simple to the complex, one step at a time.' I heard that in a course for ski instructors, but I think it applies equally well to learning engineering or anything else."

COLLEAGUES

"Noel is a big-city guy who fell in love with the great outdoors," says one of his colleagues. Others consider him the designated traveler for the department. Shortly after returning from his excursions, Noel prepares a slide presentation to share with interested persons who can then experience his travels vicariously. The slides are generally very good and the narrative always lively. If he is interested in a particular subject, in any of several fields, *i.e.*, travel, history, geography, religion, he endeavors to learn enough about it to be conversant, if not an expert, on the subject. Noel also keeps well informed on politics. Utah is practically a small city-state so that anyone interested in politics can easily get to know all the elected and party officials. His politics are about "centrist," which in Utah passes for liberal. He regularly wins election bets because most of his colleagues and friends are not as interested in politics as he is, and they will bet on what they think *ought* to happen, against what Noel thinks *will* happen. "When Noel serves on the University Senate, we can rest assured that the opinions of the College of Engineering will be heard." He is not one to sit quietly and let things slide by.

Of himself, Noel says: "I have, alas, passed the age at which I can be considered a child prodigy, or even a promising young man. Two years ago, in the middle of a University budget crisis, a special committee was elected to represent the interests of the entire University faculty. By a coin toss following a tie vote, I became its chairman. It seems clear that my colleagues consider me an elder statesman. I still don't think of myself that way." □

ChE book reviews

SCIENCE, ENGINEERING, AND ETHICS: State of the Art and Future Directions

Report on a AAAS Workshop and Symposium, (February 1988)
Mark S. Frankel, Editor
American Association for the Advancement of Science, Washington, DC (1988)

Reviewed by
Mark E. Orazem
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There is a growing awareness in our profession of the need to expose students to the types of ethical or moral decisions that they may face as professional engineers. Our approach to introducing ethics at the University of Florida has been to make use of a series of case studies published in *Chemical Engineering.** We are always on the lookout for new material, and for this reason I agreed to review this report on an AAAS workshop on ethics.

This book provides a report of a workshop, supported by the National Science Foundation, held on the

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*•Philip M. Kohn and Roy V. Hughson, "Perplexing Problems in Engineering Ethics," *Chemical Engineering,* May 5, 1980; 97
•Roy V. Hughson and Philip M. Kohn, "Ethics," *Chemical Engineering,* September 22, 1980; 132
•Jay Matley and Richard Greene, "Ethics of Health, Safety, and Environment: What's 'Right'?" *Chemical Engineering,* March 2, 1987; 40
•Jay Matley, Richard Greene, and Celeste McCauley, "Health, Safety, and Environment: CE Readers Say What's 'Right'," *Chemical Engineering,* September 28, 1987; 108

seminate resource material to the faculty, and to monitor progress.

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SCIENCE AND ETHICS

Continued from page 67.

state of the art and future directions of ethics in engineering and sciences. There is very little of substance in this report that could be useful in teaching. One author reports a brief personal code of ethics attributed to John Last of the *Canadian Journal of Public Health*:

> **Be honest.**
> **Be truthful.**
> **Be fair to collaborators.**
> **Uphold the honor, dignity, and credibility of your field.**
> **Act and write in the public interest.**
> **Save trees.**

This quote might provide an interesting springboard for classroom discussions of the meaning and utility of engineering codes of ethics. Some vague suggestions were made on changes needed in corporate or public policy, but, in general, these comments were limited to identification of the problems; specifics on what the changes should be and how such changes could be implemented were not addressed.

The majority of the material was written by participants in this field, for participants in this field, and in the jargon of this field. The symposium papers submitted deal primarily with problems of defining the structure of this area, and therefore provide little of use to technical personnel. It is interesting to note that the major challenges in this field were identified to be: 1) the introduction of EVS (Ethics and Values Studies) into technical education; 2) the need to have EVS evolve from a passive role to an active role (*i.e.*, transition from conducting impact studies to influencing public policy); and 3) the need to obtain more funding for research. One of the laudable goals identified for education by one contributor is the collection of educational materials that would emphasize development of critical thinking and that could be used easily in grades K-12 as well as in universities.

This is a profoundly disturbing collection of papers and working group reports because it reveals an entire field devoted to ethics in science and engineering, funded by NSF, but dominated by a group of people who exhibit no knowledge of engineering and science or of how technical people work within the corporate structure. I found it disturbing that none of the participants addressed the extent to which decisions on application of technology are made by people who do not have technical training, a critical omission when studying the ethics of technology in a society so dominated by profit as "the bottom line." The comments of some of the contributors reflect a surprising bias against the technical fields they are studying. The following excerpt from a section discussing the need for new teaching methodology provides an example (emphasis is mine):

> **There needs to be more creative approaches to the dissemination of EVS/STS (Ethics and Values Studies/studies in Science, Technology, and Society). One of the most troublesome aspects of EVS/STS dissemination has to do with college teaching. In many cases, philosophy departments send their youngest and least experienced faculty to tell students in science and engineering how to be good people. Often those faculty have no idea what the real problems of the field are; worse, they proceed to brand the particular scientific or engineering field as a social evil. They are unprepared to address the real ethical issues in the field or to help students with ethical problem solving. *It does no good to tell people that their field is bad without showing them practical ways to improve practice in their field.***

Of course, no field, including those in the sciences and engineering, is inherently bad. Comments like these, made by a professor in a psychology department, reflect a profound lack of understanding of the nature of engineering and science. Such comments also underscore the need for a greater activity by our professional societies (*e.g.*, AIChE) in the area of public policy. The development of the field of ethics and value studies in science and engineering in departments of philosophy, psychology, and/or social sciences is, in part, a response to the vacuum caused by the reluctance of technical people to get involved in ethical issues. It is vital that leadership in this area be provided by engineers and scientists who can be knowledgeable in *both* the technical and the managerial aspects of the problem. ❐