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**SCIENCE & TECHNOLOGY**


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*Science 101*

"Tune In, Turn Off, Drop Out" by John S. Rigden and Sheila Tobias, in *The Sciences* (Jan.-Feb. 1991), New York Academy of Sciences, 2 E. 63rd St., New York, N.Y. 10021.

Every year nearly 500,000 students graduate from high school and go on to college with the intention of majoring in science or engineering. But every year only 200,000 college students complete one of those majors. After taking introductory science courses, most of the students initially oriented toward science change their minds. Meanwhile, of the undergraduates who do stay with science and graduate, only about 10,000 go on to earn doctorates—too few, according to some specialists, to sustain the U.S. economy's technological base.

The students who renounce the study of science in college are usually assumed to lack the capacity for it. "Certainly many who abandon science are better off in other disciplines," acknowledge Rigden, of the American Institute of Physics in New York, and Tobias, author of *Overcoming Math Anxiety* (1978). "But what about those who start off with both a taste for science and the necessary aptitude but choose, after a semester or two, not to go on?" College science programs, they argue, should try to keep such able students.

To find out where the introductory science courses go wrong, Tobias had a classics professor and graduate students in literature and philosophy take some basic university physics and chemistry courses. Although most of them did well on the tests, they were put off. Instructors were reluctant to present the intellectual or his-

torical background of the material being taught. The classics professor, who was taking chemistry, wanted to learn "more of the background of Dalton's laws in ancient atomic theory and of the work done on gas laws during the 18th century." Instead, the instructor kept working sample problems "hour after uncomfortable hour."

The instructors were not necessarily unaware of their courses' unappealing aspects. A chemistry professor said that the material "is dull to learn, and it is dull to teach. Unfortunately, it is the basic nuts and bolts stuff that must be mastered before anything useful can be accomplished." The students, another professor said, are assumed to be already decided on scientific careers. The usual grading system, which severely rations top marks, fosters an obsession with grades among science students, and further obscures the intellectual appeal of the sciences.

"Undoubtedly there is a core of committed young people who are unshaken by classroom competition, relentless problem solving and the neglect of intellectual context," Rigden and Tobias write. But to hold the others, something different is needed: Smaller classes with less competition and more discussion. Instructors should consider adding lessons in intellectual history. "Basic science," they conclude, "must become a rigorous adventure instead of a catechism."

*Altered States*

"Computer-Created World of 'Virtual Reality' Opening New Vistas to Scientists" by David L. Wheeler, in *The Chronicle of Higher Education* (Mar. 13, 1991), 1255 23rd St. N.W., Washington, D.C. 20037; "It's Been Real" by Sallie Tisdale, in *Esquire* (Apr. 1991), 1790 Broadway, New York, N.Y. 10019.

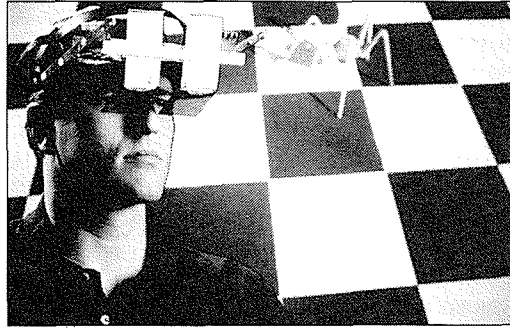
"You can take a stroll on an insect's eye or take a tour of an integrated circuit," boasts Thomas A. Furness, talking about the de-

lights awaiting the visitor to computer-generated worlds of "virtual reality." Furness, director of the University of Washington's

Human Interface Technology Laboratory, and other researchers hope that such travel to imaginary realms will "open up new intellectual vistas in education, entertainment, art, and architecture, as well as in science," reports Wheeler, an assistant editor at the *Chronicle of Higher Education*. But journalist Tisdale suggests there may be a darker side to such "trips."

To journey to a virtual world, as Wheeler describes one simple version of today's technology, a person dons goggles, a helmet, and a glove with fiber-optic cables. Before his eyes appear computer-generated images. "The picture in front of each eye... is slightly different, creating the illusion of three dimensions." An electromagnetic field is generated around him, and wires running from his helmet let the computer know where his head is in the field. "As the user's head moves, the computer adjusts the view being projected in the goggles to what the user would be seeing from the new stance inside the virtual reality." The user can "fly" simply by pointing with his gloved hand.

Variations on virtual-reality technology already have been used to help physicians position beams of radiation for cancer therapy and to aid biochemists seeking to attach drugs to protein molecules. But virtual-reality researchers have more exalted goals in mind. One scientist told Wheeler that the technology's main aim should be to take people to "absolutely unreal" places. He envisions, for instance, people acting as variables in mathematical equations and watching forms, colors, or curves shift around them in response to



Wearing head-mounted apparatus, a researcher at the University of North Carolina enters the computer-generated world of "virtual reality."

changes in the variable's value.

Today's technology is still earthbound, however. "Virtual reality as an experience... is more like going to the movies than going to a new world," Tisdale reports. The phrase *virtual reality*, she says, "is too clever by half for the technology itself. But it reflects the fantasy of its makers: the dream of making worlds, of visiting environments and living inside stories without leaving the living room." And such prospects have aroused some fears.

Jaron Lanier, founder of VPL Research, and others, she writes, "talk of wanting to live outside limitations, to live in a world in which even the laws of physics are designed to one's liking. The connection to [the] drug culture, both as source material and adjunct, is unmistakable.... There is no doubt that the proponents of virtual reality imagine this technology creating a culture just as powerful." That, Tisdale warns, could turn out to be a "bad trip."

## *Tumblin' Pest*

"Tumbleweed" by James A. Young, in *Scientific American* (Mar. 1991), 415 Madison Ave., New York, N.Y. 10017.

Thanks to Hollywood westerns and Zane Grey novels, tumbleweed has come to be an evocative symbol of the Old West in all its romantic glory. But in the real West, writes Young, of the U.S. Agricultural Research Service, the weed did not appear until the late 1870s and then it became "the scourge of the frontier." As the wind

witch (just one of the names settlers had for it) spread uncontrollably across the northern Great Plains, it caused "sudden agricultural havoc."

To farmers, tumbleweed was anything but romantic. Its sharp, spiny leaves penetrated the leather gloves worn by men threshing grain and cut their hands. More