

## SCIENCE &amp; TECHNOLOGY

utility in controlling science. "Mission-oriented research" such as the \$11.5 billion spent since 1977 in the "war on cancer" has meant more federal money for research grants but less scientific autonomy for grantees. The rising proportion of research ordered and funded by the Pentagon has resulted in the "secret" classification of growing numbers of scientific papers, breaking with the scientific tradition of free access to ideas.

All this, says Shils, has resulted in a "new collective self-consciousness" among scientists. Belief in the scientific method is being replaced by a belief in a vaguely defined "responsibility of science"; researchers worry about the consequences of experiments (such as recombinant DNA research) instead of the validity of the experiments themselves. Those who argue against performing experiments whose results might be put to harmful purposes use flawed logic. They assume that the results of an experiment can be known before the experiment itself is carried out, and place themselves above legislators and supervisors in determining what research *should* be performed by their peers, creating a "scientific theocracy . . . repugnant to the traditions of scientists."

Scientists should try to be accurate within the laws of their field, but, they should not assume that their political views devolve from scientific principles. There is no equivalent of the traditional scientific method to guide scientists in the political world. While codes of ethics created by scientific associations may be useful, Shils concludes, the best guide for a scientist's conduct is "reflective self-examination."

*Deadly Winds*

"Mastering the Microburst" by Richard Monastersky, in *Science News* (Mar. 21, 1987), 1719 N St. N.W., Washington, D.C. 20036.

Airplanes fly through many kinds of hazardous weather—hail, snow, thunderstorms. Yet the most dangerous weather is that which creates a "microburst."

Since microbursts were discovered in 1974, says Monastersky, assistant to the editor of *Science News*, they have been found to be the cause of three accidents in which 398 people have died. Meteorologist John McCarthy says that microbursts "are the largest source of air carrier death in the United States."

A microburst begins as a stream of air (or "downflow") descending from a cloud. When the downflow hits the ground, the wind blows outward from the center of the burst in a pattern similar to that made by water from a faucet when it hits the sink, which causes "wind shear."

An airplane flying through a wind shear initially confronts a headwind, which increases the speed of the air over the wings, "lifting" the plane. From the center of the microburst, the airplane then flies into the spreading winds; the headwind quickly becomes a tailwind, decreasing "lift."

Microburst accidents happen when an airline pilot fails to adjust to these sudden shifts. (Wind velocity shifts in microbursts average 60 mph, but they can be as high as 172 mph.) Microbursts are particularly deadly to airplanes during landings, when engine power is reduced.

Most microbursts are not detectable by conventional radar or by cloud

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observation. Doppler radar systems, now under development by the National Center for Atmospheric Research in Colorado, bounce microwaves off objects that move with the wind (such as raindrops or ice particles) to gauge wind speed, and are thus more accurate at searching for microburst warning signs than conventional radar.

The Federal Aviation Administration plans to deploy Doppler radar at O'Hare, Kennedy, and 14 other major airports by 1989, and to require all airline pilots to undergo training to detect microbursts. The goal, McCarthy says, is to make wind shear accidents "a 20- to 30-year phenomenon instead of a one- to two-year phenomenon."

*Sweet Memories*

"Sweet Memories" by Paul E. Gold, in *American Scientist* (Mar.-Apr. 1987), Sigma Xi, 345 Whitney Ave., New Haven, Conn. 06511.

Doctors and dentists warn of the health hazards of too much sugar. But one sugar, glucose, and one hormone, adrenaline, may be key substances in forming memory.

Twenty five years ago, writes Gold, a professor of psychology and a member of the Neuroscience Program at the University of Virginia, scientists had no proof that "brains were biologically altered by experience." They knew only that important events were remembered better than other events. But Gold has now pinpointed "a physiological system that appears to determine which memories will be stored best."

While studying amnesia and memory enhancement, Gold found that test rats' level of arousal—specifically, associated levels of certain hormones in the blood—"appear[ed] to be the major contributor of additional information telling the brain to make new memories." The stronger the arousal, the better the memory of the event causing it.

Adrenaline, a hormone produced in response to environmental stresses, figures prominently in this process. Even when anesthetized, Gold's rats learned to be wary of a musical tone accompanied by an electric shock if they also received adrenaline injections; when the tone was later played without the shock, the rats still showed fear.

One consequence of high adrenaline levels in the blood is hyperglycemia (an increase in glucose levels). So Gold examined the effect of glucose on memory in rats, and found that injecting it had an effect similar to adrenaline's on memory performance. But unlike adrenaline, glucose has no harmful effects on the cardiovascular system, and can be used safely to study human memory. When healthy 70-year-old men and women were given glasses of lemonade, some prepared with glucose, some with saccharine, those who drank the glucose-sweetened beverage performed better on subsequent memory tests than their saccharine-only counterparts. And, Gold notes, older people who suffer from poor memory generally have poor regulation of blood glucose levels as well.

Gold cautions that scientists do not yet know *how* glucose affects the physiology of memory. But, he adds, research on adrenaline and glucose offers sweet promise of eventually "ameliorating memory impairments with pharmacological agents."