Public Attitude Toward Science Is Yes, but—

Survey results in NSF report show backing is still strong, indicate that the best informed are the most favorably disposed

In odd-numbered years the National Science Board publishes its annual report in the form of a quantitative assessment of the state of U.S. science and technology. This year's version, *Science Indicators 1980*, is the usual useful combination of statistics and cautious adumbration of trends. Because the new *Indicators* uses no data beyond 1980 and bears no hint of the decisions and revisions of the Reagan budget, it may be a source of instant nostalgia to the scientific community.

What may especially interest policymakers, however, is the report's section on public attitudes toward science and technology, which includes responses to questions asking what programs the public thinks the government should spend tax money on. The attitudes section has an added refinement this year, a division of the public into "attentives" and "nonattentives." Members of the former group, estimated at about one in five of the general public, are identified as having greater interest and knowledge in respect to science than the public at large.

According to the opinion survey on which the section is mainly based, the American public's general attitude toward science and technology continues to be decidedly favorable, although not as favorable as in the era of relatively uncritical approval in the late 1950's. The attentives were consistently more proscience in their expressed views than the general public.

Grist for social commentators may be found in responses to questions eliciting value judgments. A majority (58 percent) of nonattentives polled in 1979 thought that "scientific discoveries make our lives change too fast" and 42 percent of the same group thought that "scientific discoveries tend to break down people's ideas of right and wrong." The attentives were less perturbed, but in both groups the percentage of those critical of the effects of science had risen substantially since 1957 (see table). No attempt was made in the survey to relate the change in views to general shifts in political or social opinion.

Responses to questions on limitations on scientific inquiry showed that Americans are generally against such restrictions. A notable exception was the substantial opposition to scientists creating new life forms; 49 percent of attentives and 65 percent of nonattentives were opposed. The report comments that "Almost two thirds of the public believe that studies in this area should not be pursued. Fear of the unknown and of possible misuse of the discoveries by some malevolent dictator are among the reasons that could be given for opposition to such genetic engineering."

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When it came to spending tax money on science and technology, the public declared a strong preference for improving health and for developing energy resources and improving conservation. Health and energy research were ranked highest by both attentives and nonattentives, but in reverse order. The attentives put energy first, the nonattentives, health. Education placed third in a list of 13 areas. "Developing and improving weapons for national defense" was ranked seventh, but has risen dramatically in the priority list since *Indicators* first appeared in 1972. Lowest on the list of areas most meriting tax support were "discovering new knowledge about man and nature" and "exploring outer space" and, last, "predicting and controlling weather."

Noting that the issue of reducing pollution has been dropping in relative importance since 1972, as has concern about the safety of automobiles, the report offers the following rationale for the rankings.

"The consistently low ranks that exploration of space and the search for new knowledge about man and nature have held suggest that the public's interest tends to focus on the practical and immediate rather than on results that are remote from daily life. However, when the public senses that a practical problem is fairly well under control, it quickly relegates it to a lower priority. Thus, finding better birth control methods is now mentioned most often, along with the exploration of space, as an area where tax expenditures are least wanted."

Some evidence for the view that the public favors federal expenditures on problems that most directly stir their hopes and fears can be found in the relatively high priority given to reducing crime—fourth in the list of 13. As the report notes, "The high ranking given in science and technology expenditures for

Attitudes of attentives and nonattentives toward the benefits of science.

	Percent			
	Attentives		Nonattentives	
	1957	1979	1957	1979
On balance, the benefits of scientific research have outweighed the harmful results	96	90	87	66
Scientific discoveries make our lives change too fast	27	43	44	58
Scientific discoveries tend to break down people's ideas of right and wrong	11	27	24	42
Scientific discoveries are making our lives healthier, easier, and more comfortable	100	90	96	83

Source: Jon D. Miller, Kenneth Prewitt, and Robert Pearson, *The Attitudes of the U.S. Public Toward Science and Technology* (National Opinion Research Center, University of Chicago, Chicago, 1980), p. 134.

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reducing crime is surprising in view of the fact that achievements in this area are not considered particularly likely."

To seek closer measures of public reaction to "scientific endeavor and technological advances" the survey's designers singled out for special study three specific issues that have received much publicity. These were space exploration, food additives, and siting of nuclear power plants.

Space exploration seems to be in the curious position, at least since space spectaculars dwindled in magnitude, of having a healthy majority of the public favoring exploration of outer space (60 percent) but at the same time lacking real enthusiasm for spending public funds on the endeavor. Some 61 percent of the attentives see only benefits and no harm in space exploration compared with 42 percent of the total public. The attentives, however, also rank space exploration as an also ran in the preference list for public funding—ninth out of 14 compared to 13th ranking by the total public. Toward chemical food additives both groups have mixed feelings, but a much larger proportion of total public (30 percent) saw harms and no benefits in additives than the attentives (12 percent).

On the siting of nuclear power plants the two groups were quite close in their views. Roughly similar minorities at the extremes saw either only harms or only benefits. Taking the middle ground that there were both harms and benefits involved were 50 percent of the attentives and 46 percent of the total public. The authors suggest that the reactor accident at Three Mile Island which occurred in the year that the survey was done probably hardened public opinion against nuclear power, but cite other studies that show majority opinion remains in favor of developing nuclear power. As for locating nuclear power plants in their own areas, 51 percent of attentives and 64 percent of the total public were opposed.

The NSF-sponsored survey on which the section is based involved a national sample of 1635 people over the age of 18. To make comparisons with 1957 data possible, some questions in the 1979 survey were designed explicitly to conform to questions in the earlier survey. Extra effort was also made at what survey experts call "back analysis" to assure that results were consistent.

NSF officials say that the use of the "attentives variable" was novel in surveys of public attitudes toward science and technology. The distinguishing characteristic of the attentives was education—55 percent of those in the sample

Hayflick Case Settled

An out-of-court settlement was reached in September which brings to a close a bitter 6-year conflict between microbiologist Leonard Hayflick and the National Institutes of Health (NIH) concerning proprietorship of a cell line Hayflick developed almost 20 years ago.

In the 1960's, while working at the Wistar Institute in Philadelphia, Hayflick developed cell lines known as WI-38 and WI-26, the first normal human cells to be established in culture. He subsequently sold some of the cells for profit to hundreds of recipients around the world. NIH has claimed that the cells and proceeds from their sale belong to the government.

The agreement states that the title to both the cells and the proceeds "are in reasonable dispute." NIH is allowed to keep the 19 ampuls of WI-38 cells that have been in its possession since 1975, and Hayflick is allowed to keep the money from cell sales, now totaling $90,000, which has been in escrow since 1975. Hayflick is also allowed to retain the six ampuls of cells that NIH gave him last January for a research project being funded by the National Institute on Aging (NIA).

Hayflick says he regards the agreement as "exoneration" from all the charges contained in two NIH reports released in 1976 which accused him of various irregularities in his stewardship of the cells (*Science*, 9 April 1976, p. 125). "All those allegations were totally false," he told *Science*.

The auditor who produced the reports disagrees. James W. Schriver, former head of the NIH Division of Management Survey and Review (now retired), says "the settlement is no vindication at all. . . . They didn't prove anything erroneous" in the reports.

NIH lawyers will not comment on the case. But according to William Raub, director of extramural research, the government does not regard the agreement as an exoneration of Hayflick; rather, it indicates that the two parties have "agreed to continue to disagree." Raub says there was extensive debate over whether to award the NIA grant but it was finally decided that that was a separate issue from the lawsuit.

Hayflick's case is without precedent. It all began in 1962 when he successfully established two lines of cells from human embryonic lung tissue. They provide the basis for Hayflick's discovery that human fetal cells go through about 50 doublings before dying out. The cells, preserved at various stages by freezing, are widely used in vaccine production as well as research.

In 1968 Hayflick left the Wistar Institute for Stanford University, taking the cells with him. NIH claimed they were its property because they were developed under an NIH contract. The government eventually began an investigation, took possession of remaining cells, and issued two reports that discussed, among other things, Hayflick's commercial dealings with the cells and his handling of a problem of bacterial contamination. Hayflick resigned from Stanford, which was conducting its own investigation of him, and sued NIH.

Hayflick alleged that NIH had violated his rights under the Privacy Act by publicly issuing damaging reports before his rebuttal had become available. He also claimed title to all the remaining cells. NIH countersued, claiming the cells belonged to the government.

Hayflick believes his career was wounded by the affair. Nonetheless in 1979 he was awarded a 3-year grant of $562,000 from the NIH despite Schriver's recommendation that future funding be denied him. Hayflick has been working at Children's Hospital Medical Center in Oakland since he left Stanford, and this month will move to Gainesville to head the University of Florida's Center for Gerontological Studies.

Many scientists have been upset over the Hayflick affair, which has been perceived as a case where the government marched unhindered into a private laboratory and publicized what it pleased with no peer review or outside verification. Bernard Strehler, biologist at the University of Southern California, has prepared a letter in Hayflick's support (p. 240), bearing the signatures of 85 scientists.—CONSTANCE HOLDEN

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with graduate degrees were in the attentive group compared with only 12 percent of those whose education ended with high school. Other "significant predictors of attentiveness" were political activism, maleness, and youth (being in the 18 to 34 age group).

The question of the extent to which public opinion influences science and technology policy decisions remains an enigma. Identification of the attentives group may be a step toward unraveling it. A next step could be the survey NSF is supporting to examine the linkages between the attentive public and what are termed "opinion leaders," that is, the 2000 or 3000 people who, because of personal prestige or positions held, are called on to give testimony before Congress or provide other formal or informal advice on science and technology issues. After that, if opinion polling is up to the task, it will be time to consider who it is among the public that the lawmakers and bureaucrats really listen to.

Meanwhile, the status report on public attitudes toward science and technology reflects solid support. Those who ponder long term implications, however, may be given pause by the decline in the percentage of nonattentives who say the benefits of scientific research outweigh the harmful results. Between 1957 and 1979 the favorable majority declined from 87 percent to 66 percent, an erosion averaging about 1 percent a year. Should that continue, science and technology would before too long face a deficit in public opinion.—JOHN WALSH

Science Magazines: The Second Wave Rolls In

Six new publications are about to hit the street, though changes in the tax laws may make this wave the last

The splash made by the first wave of new science publications has lured several entrepreneurs into this newly discovered consumer market. Six new magazines, with startups running between $3 and $7 million, are on the drawing boards or the newsstands. In general, the magazines inhabit editorial niches more specialized than the first wave.

"Basically," says John D. Klingel, a consultant who has helped launch both the first and second wave, "the publishing world never saw how broad the field of science was. Today, that's changing. There are literally thousands of business magazines, and the same thing is happening in the world of science publishing."

The first wave, which started building around 1980, featured general interest publications such as *Science 80* (now *Science 82*), *Discover*, an expanded *Science Digest*, *Omni*, and the addition to the *New York Times* of its science section. Though success for the second wave seems likely, according to industry observers, there are a few clouds on the horizon. The cost of putting out a magazine is rising as such things as postage get more expensive. Further, the second wave may well be the last. The new tax law that goes into effect in 1982 will lessen the incentive for investors to sink millions into magazines. For the moment, however, the presses are running, with a vengeance:

• *Technology*. The premiere issue is dated November/December 1981. It is a glossy, no-nonsense, 100-page publication aimed at managers and businessmen who want to put technology to work, and will expand from 6 to 12 issues a year. Each issue has a major article that explores a given technology in depth. The first was industrial ceramics, "the future beyond plastics." In line with its utilitarian approach, the magazine offers information kits (two versions, $45 and $195) for readers who want an exhaustive bibliography or a complete set of reprints. Also offered are experiment kits. Pegged to the first issue was a ceramic injection molding kit (at $50 or $115) so readers could try ceramic injection for themselves. Editor and publisher of *Technology*, based in New York, is Robert B. Shnayerson, formerly the editor of *Quest*. The money behind the venture has been put up by Binx Selby, a 38-year-old biologist from Colorado whose experiments with microprocessor-based computers led to the founding in 1973 of NBI, now ranked among the top three U.S. firms in the sale of word processors. In 1976, Selby set up PureCycle, a firm that produces microprocessor based water recycling units.

• *High Technology*. Aimed at the engineer and technologist, the premiere issue of 116 pages is dated September/October 1981. It will expand to monthly publication. Editors say articles are written at the intellectual level of *Scientific American*. The third issue has a comprehensive and well-illustrated review entitled "Fusion energy: Still an elusive target." The money behind *High Technology* comes from Bernard A. Goldhirsh, 41, an MIT-trained engineer who roamed the world after graduation as a boat bum and then proceeded to found *Sail* magazine in Boston. Goldhirsh further shook the New York publishing world by starting up his very successful magazine aimed at small business, *Inc.* After selling *Sail* for $17 million, Goldhirsh sunk much of the money into *High Technology* and its sister publication:

• *Technology Illustrated*. This is a popular, 100-page magazine with articles in its premier issue (October/November

"We raised $5 million," says Lipstein of *American Health*, "in part because we sold the idea in 1981. It would be harder to sell this year."

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