

August 30, 2005

## Scientific Savvy? In U.S., Not Much

By [CORNELIA DEAN](#)

CHICAGO - When Jon D. Miller looks out across America, which he can almost do from his 18th-floor office at Northwestern University Medical School in Chicago, he sees a landscape of haves and have-nots - in terms not of money, but of knowledge.

Dr. Miller, 63, a political scientist who directs the Center for Biomedical Communications at the medical school, studies how much Americans know about science and what they think about it. His findings are not encouraging.

While scientific literacy has doubled over the past two decades, only 20 to 25 percent of Americans are "scientifically savvy and alert," he said in an interview. Most of the rest "don't have a clue." At a time when science permeates debates on everything from global warming to stem cell research, he said, people's inability to understand basic scientific concepts undermines their ability to take part in the democratic process.

Over the last three decades, Dr. Miller has regularly surveyed his fellow citizens for clients as diverse as the National Science Foundation, European government agencies and the Lance Armstrong Foundation. People who track Americans' attitudes toward science routinely cite his deep knowledge and long track record.

"I think we should pay attention to him," said Eugenie Scott, director of the National Center for Science Education, who cites Dr. Miller's work in her efforts to advance the cause of evolution in the classroom. "We ignore public understanding of science at our peril."

Rolf F. Lehming, who directs the science foundation's surveys on understanding of science, calls him "absolutely authoritative."

Dr. Miller's data reveal some yawning gaps in basic knowledge. American adults in general do not understand what molecules are (other than that they are really small). Fewer than a third can identify DNA as a key to heredity. Only about 10 percent know what radiation is. One adult American in five thinks the Sun revolves around the Earth, an idea science had abandoned by the 17th century.

At one time, this kind of ignorance may not have meant much for the nation's public life. Dr. Miller, who has delved into 18th-century records of New England town meetings,

said that back then, it was enough "if you knew where the bridge should be built, if you knew where the fence should be built."

"Even if you could not read and write, and most New England residents could not read or write," he went on, "you could still be a pretty effective citizen."

No more. "Acid rain, nuclear power, infectious diseases - the world is a little different," he said.

It was the nuclear power issue that first got him interested in public knowledge of science, when he was a graduate student in the 1960's. "The issue then was nuclear power," he said. "I used to play tennis with some engineers who were very pro-nuclear, and I was dating a person who was very anti-nuclear. I started doing some reading and discovered that if you don't know a little science it was hard to follow these debates. A lot of journalism would not make sense to you."

Devising good tests to measure scientific knowledge is not simple. Questions about values and attitudes can be asked again and again over the years because they will be understood the same way by everyone who hears them; for example, Dr. Miller's surveys regularly ask people whether they agree that science and technology make life change too fast (for years, about half of Americans have answered yes) or whether Americans depend too much on science and not enough on faith (ditto).

But assessing actual knowledge, over time, "is something of an art," he said. He varies his questions, as topics come and go in the news, but devises the surveys so overall results can be compared from survey to survey, just as SAT scores can be compared even though questions on the test change.

For example, he said, in the era of nuclear tests he asked people whether they knew about strontium 90, a component of fallout. Today, he asks about topics like the workings of DNA in the cell because "if you don't know what a cell is, you can't make sense of stem cell research."

Dr. Miller, who was raised in Portsmouth, Ohio, when it was a dying steel town, attributes much of the nation's collective scientific ignorance to poor education, particularly in high schools. Many colleges require every student to take some science, but most Americans do not graduate from college. And science education in high school can be spotty, he said.

"Our best university graduates are world-class by any definition," he said. "But the second half of our high school population - it's an embarrassment. We have left behind a lot of people."

He had firsthand experience with local school issues in the 1980's, when he was a young father living in DeKalb, Ill., and teaching at Northern Illinois University. The local school board was considering closing his children's school, and he attended some board

meetings to get an idea of members' reasoning. It turned out they were spending far more time on issues like the cost of football tickets than they were on the budget and other classroom matters. "It was shocking," he said.

So he and some like-minded people ran successfully for the board and, once in office, tried to raise taxes to provide more money for the classroom. They initiated three referendums; all failed. Eventually, he gave up, and his family moved away.

"This country cannot finance good school systems on property taxes," he said. "We don't get the best people for teaching because we pay so little. For people in the sciences particularly, if you have some skill, the job market is so good that teaching is not competitive."

Dr. Miller was recruited to Northwestern Medical School in 1999 by administrators who knew of his work and wanted him to study attitudes and knowledge of science in light of the huge changes expected from the genomic revolution.

He also has financing - and wears a yellow plastic bracelet - from the Lance Armstrong Foundation, for a project to research people's knowledge of clinical trials. Many research organizations want to know what encourages people to participate in a trial and what discourages them. But Dr. Miller said, "It's more interesting to ask if they know what a clinical trial is, do they know what a placebo is."

The National Science Foundation is recasting its survey operations, so Dr. Miller is continuing surveys for other clients. One involves following people over time, tracing their knowledge and beliefs about science from childhood to adulthood, to track the way advantages and disadvantages in education are compounded over time and to test his theory that people don't wait until they are adults to start forming opinions about the world.

Lately, people who advocate the teaching of evolution have been citing Dr. Miller's ideas on what factors are correlated with adherence to creationism and rejection of Darwinian theories. In general, he says, these fundamentalist views are most common among people who are not well educated and who "work in jobs that are evaporating fast with competition around the world."

But not everyone is happy when he says things like that. Every time he goes on the radio to talk about his findings, he said, "I get people sending me cards saying they will pray for me a lot."