

# Historian predicts the end of 'science superpowers'

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Is the sun beginning to set on America's scientific dominance? Much like the scientific superpowers of France, Germany and Britain in centuries' past, the United States has a diminishing lead over other nations in financial investment and scholarly research output in science and engineering, say a group of historians and sociologists led by University of Wisconsin-Madison emeritus history professor J. Rogers Hollingsworth.

Massive investments in recent decades by the European Union, China, Japan, Russia and India have leveled the international playing field in the sciences, according to the essay published in the July 24 issue of the journal *Nature*. The trend will likely put an end to the age of the "unrivaled scientific behemoth," a status the U.S. has enjoyed since the end of World War II.

"What we are seeing is a diffusion of good science centers all over the world, a trend which ultimately may be good for science," says Hollingsworth. "But it also means that the U.S. relative to the rest of the world no longer dominates."

The authors cite China as the most pronounced example. In 1995, China ranked 15th among nations in the production of science and engineering papers, according to the research analysis firm Thomson Reuters ISI. By 2007, the country ranked second, an increase driven in large part by the country's economic growth.

China also made dramatic gains in scientific talent. From 1985 to 2005, the number of natural sciences and engineering doctorates in China increased seven-fold and elevated the country to third in the world.

Similar major strides in the number of doctorates and the volume of scientific publishing have taken place in India, Japan, Russia and Europe. Hollingsworth argues that this shift closely parallels the emergence of a global economy and the newfound ability of many nations to compete.

"The decline of the U.S. economy relative to the rest of the world is facilitating the strengthening of science elsewhere," the authors argue.

Hollingsworth and his co-authors - UW-Madison senior scientist Ellen Jane Hollingsworth and Karl H. Muller, director of the Vienna Institute for Social Science Documentation and Methodology - assert that U.S. science is still strong and performs at a high level. For example, U.S. researchers still account for more than half of the top 1 percent of most-cited papers in the world.

But the global proliferation of science will present new challenges to the United States. Hollingsworth says that the biggest threat to U.S. science competitiveness may be the massive size of major research universities, which produce a high volume of published work but not a corresponding increase in "major breakthroughs." For example, Hollingsworth says that almost 50 percent of papers published by U.S. scientists are not cited by other scientists, which raises the question of whether the high volume of publishing "is really enhancing our stock of knowledge."

"I think we have become too obsessed with quantitative measures of science - the volume of papers published, where they're published and the number of grants attained," he says.

"To thrive in this transition from a science hegemony to a global competitive landscape, the biggest need will be to become more flexible and more adaptive," he adds. "And if you're not adaptive, you can see what happens with the examples of the auto industry and steel industry in America."

Hollingsworth recommends a major investment in a new type of nimble and interdisciplinary science in the United States by the National Institutes of Health and the National Science Foundation. He says the creation of more than two-dozen smaller-scale research institutes that would be autonomous from, but adjacent to, current universities could have great results. These would operate with little bureaucracy and without the constraints of conventional academic departments, and be more likely to fuel creative thinking, he says.

These institutes would mirror the successes of smaller-scale campuses such as Rockefeller University in New York, the Salk Institute in California and the Santa Fe Institute in New Mexico. Each of these campuses, Hollingsworth says, produces a high percentage of breakthrough research advances despite their small size, and their successes stem from an organizational culture and structure that is nimble, collaborative and cross-disciplinary.

For the past 15 years, Hollingsworth has been studying research organizations worldwide and looking at whether there are different approaches and structures around the world that are more conducive to promoting innovation. This essay put his ongoing work in an historical perspective.

Provided by University of Wisconsin-Madison

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