

Nurturing the Next Einsteins

All revolutions begin with a seminal moment. This year, we will celebrate one of the greatest in the history of science: the 100th anniversary of Albert Einstein's 1905 landmark papers that introduced the special theory of relativity and the equivalence of mass and energy. As we explore their impact, we must ask ourselves if we as a nation are doing what it takes to spark new scientific revolutions. Are we nurturing the next Einsteins? Regrettably, the answer is no. The lack of federal investment in basic research and restrictive immigration policies are eroding America's leadership in the sciences. The ripple effects of these two troublesome trends are enormous: Our future economic competitiveness and quality of life depend on our ability to stay ahead of the scientific and technological curve.

The splitting of the atom ushered in an unprecedented era of public investment in basic scientific research after World War II. The National Academy of Sciences (citing the work of Nobel Laureate Robert Solow) estimates that nearly half of our nation's economic growth since that time can be attributed to advances in science and technology.

However, in recent years investment has shifted away from research in the physical sciences and engineering to the life sciences. The irony is that advances in the life and medical sciences will be impossible without their physical and engineering counterparts. I agree with the recommendation of the President's Council of Advisors on Science and Technology that the funding levels for the physical sciences and engineering be brought to parity with that for the life sciences, which has more than doubled over the past decade. Adequate funding alone, however, will not guarantee that science in the United States maintains its strength.

We must continue to serve as a magnet for foreign scholars while also creating an environment to attract more U.S. students to the physical sciences and engineering. History's lesson on this topic is worth heeding. Fleeing Nazi Germany, Einstein immigrated to the United States in 1933 and became a citizen in 1940. Fellow immigrants Richard Courant, Edward Teller, Eugene Wigner, Hans Bethe, and Enrico Fermi fathered stunning scientific achievements, earned Nobel Prizes, and helped build the science and mathematics departments of America's greatest universities.

Unfortunately, after September 11, 2001, delays in processing student visas have discouraged thousands of foreign students from continuing this vital tradition. The very scholars we need to be attracting—those pursuing advanced math, physics, and chemistry—are particularly hard hit, because the technical nature of their study sets off a rigorous and time-consuming screening process that is designed to prevent the transfer of sensitive technologies to other countries. Consequently, applications to U.S. graduate schools declined by 28% last year, with those from China falling by 45% and those from India by 28%. Other nations, including Australia, Great Britain, and Germany, are taking advantage of this window of opportunity by aggressively recruiting more foreign talent and retaining more of their own scholars.

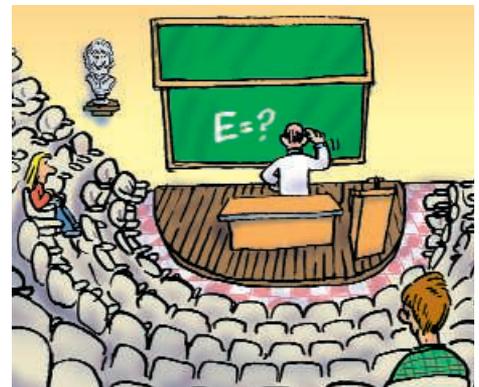
For the physical sciences and engineering, this is a particularly ominous trend, because fewer Americans are pursuing advanced degrees in these areas. Close to one-third of U.S. doctoral degrees in science and engineering are awarded to foreign nationals. Nearly 40% of the current engineering faculty members at U.S. universities are foreign born. Replenishing our intellectual capital will depend on our capacity to create a timely, more transparent, and less burdensome visa process.

The stakes here are high for U.S. industry and for the other nations with whom we trade. The booming decade of the 1990s gave rise to over five million new firms, most of them science-intensive companies that were responsible for over three and a half million jobs. The generation of new patents continued at a strong pace, indicating the potential for strong job growth in the future; after all, these innovations are the rough drafts of new businesses. But continuing the pace of innovation will require a renewed commitment to investment in research and development. The centennial of Einstein's remarkable achievements presents us, his adopted compatriots, with the opportunity to reinvigorate our own passion for discovery. The quest for new frontiers is a hallmark of the American spirit. It is a national imperative we cannot afford to ignore.

Lamar Alexander

Lamar Alexander is a Republican U.S. Senator from Tennessee. He is chair of the Senate Subcommittees on Energy and on Education and Early Childhood Development.

10.1126/science.1110137



Science

Nurturing the Next Einsteins

Lamar Alexander

Science **307** (5712), 1013.
DOI: 10.1126/science.1110137

ARTICLE TOOLS

<http://science.sciencemag.org/content/307/5712/1013>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.