unlearn—their home-, school-, and street-derived intellectual baggage. But, with due allowance for special circumstances, do not relieve them, especially those in higher education, of responsibility for their own education.

I have no definitive answer for whether the points I raise here relate to the dearth of female bachelor-level physicists. Whatever the causes of the gender gap among undergraduate physics majors may be, I wish the physics community well in narrowing it.

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■ **Trefil and Swartz reply:** We thank our colleagues for contributing to this important debate. Diane Grayson added an international perspective, and Manuel Bass deepened our insights into the role of problem sets in science education.

Mark Lesmeister argues that the underrepresentation of women in physics may begin before college. Regardless of whether that is true, the data in figure 2 of our article clearly show a rapid decline in female participation during the undergraduate years. That is the problem we chose to address.

Sarah Gilbert and coauthors point out that there is ample room for more research in this area, and we agree. We think, however, that studies cited in our article amply support the modest conclusions we draw. We hope that the article will help to stimulate the type of research Gilbert and coauthors think is needed.

Jeffery Winkler presents a variation on the old argument that women just don't like physics. If that were true, we would have trouble understanding the success of fields like mathematics and chemistry in attracting women. Nevertheless, it is worthwhile to consider whether there may be unnecessary deterrents to students' staying in physics, particularly if the deterrents could be easily fixed.

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On the value of particle physics

The naive letter by John Waymouth (PHYSICS TODAY, September 2011, page 10) claims that particle physics has never "produced permanent jobs for anyone except high-energy physicists and their acolytes and assistants."

My group at Vanderbilt University designed and built high-field magnets to measure the Σ hyperon's magnetic moment in experiments at Caltech and at Brookhaven National Laboratory. Using those magnets and teaming up with Oak Ridge National Laboratory, we were able to demonstrate the superconductivity of niobium–tin at fields of up to 14 T, which was 6 T higher than had been previously observed.

Several of my students made careers in applied superconductivity. For example, A. D. McInturff has designed superconducting magnets at Brookhaven, Fermilab, and CERN; his PhD thesis included the first measurement of the Σ hyperon's magnetic moment. A magnet-stabilization technique that he first suggested has transformed medical practice.

Rapid communication between experimental groups was very expensive when I worked at CERN. A group led by Tim Berners-Lee in the computer division developed the Hypertext Transfer Protocol, which is used to modify networks to provide inexpensive, rapid internet communication.

The recent detection of the Ξ_b^- decays[1] may be of limited public interest, but the ability to data-mine 500 trillion collisions and find the 25 candidates is important in many areas. There is no shortage of jobs for anyone with the ability to select the significant information from the vast flood of raw data available today.

My retirement project uses computer and sensor technologies developed for particle physics to make industrial sorting machines. These machines identify and sort post-consumer PET (polyethylene terephthalate) beverage bottles in Asia, Australia, Europe, and North and South America. Recycled PET is made into new bottles or polyester fiber used in clothing and carpets.

Particle physics is a major source of innovation and economic growth in areas as diverse as medicine, recycling, data management, and the internet. I do not know if the Higgs particle exists, but I am confident that future jobs and technologies will result from the efforts to find it.

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Notes on Anderson localization

Ad Lagendijk, Bart van Tiggelen, and Diederik Wiersma, in their article "Fifty years of Anderson localization" (PHYSICS TODAY, August 2009, page 24), discuss the experimental studies in semiconductors such as weakly compensated phosphorus-doped silicon. However, the authors don't accurately depict the situation, and they ignore important work.

Lagendijk and coauthors note that in 1982 a Bell Labs group[1] found that for charge-carrier densities n above a critical value n_c in weakly compensated Si:P, the conductivity, extrapolated to zero temperature, scaled with reduced density with an exponent s of approximately 0.5; for compensated semiconductors (also amorphous alloys), experiments yielded s of approximately 1, which agrees with the scaling theory. As the authors describe, that finding led to the "exponent puzzle." But the zero-compensation case includes only off-diagonal order in contrast to the 1958 paper by Philip Anderson. The different disorder cases are characterized by different scaling exponents.

Considerable controversy ensued in 1993–99. H. Stupp at Karlsruhe University and coauthors[2] claimed an exponent of 1.3 for Si:P, but with n_c 6% lower than the Bell group. I showed that for n between 3.52×10^{18} cm^{-3} and 3.69×10^{18} cm^{-3}, the data were a better fit to Mott variable-range hopping; the finding suggests that these samples were insulating as $T \to 0$. A 6% decrease in n_c increased s from 0.5 to 1.3, which demonstrates the very strong coupling between s and n_c. Lagendijk and coauthors state, without giving references, "In 1999, researchers argued that an exponent of 1 is recovered in the experiments on silicon if the conductivity is correctly extrapolated to zero temperature." That statement is misleading. In 1999 two groups[3] reported measurements of σ as a function of uniaxial stress on Si:B and Si:P. Both groups observed a substantial increase in s from near 0.5 to between 1.2 and 1.5 close to n_c. However, compressive uniaxial stress introduces inhomogeneity from sample bending, which increases s.[4] The features of the 1999 data were similar to the Bell Si:P data, but the Bell group didn't analyze the tail portion of its data very close to n_c where the stress inhomogeneity became dominant and σ is small.

Are features like weak localization or carrier interactions relevant or essential to explain the scaling component of approximately 0.5 for the weakly compensated case? Although there may still be disagreement, some researchers believe the answer is no. Two different calculations, both featuring the two-component model, yield $\sigma \propto k_F$, the Fermi wavevector, and $k_F \propto (E_F - E_c)^{1/2}$ for noninteracting carriers. That explanation is consistent with a Boltzmann–Drude conductivity.[5] Since $k_F = 2\pi/\lambda_{dB}$, with λ_{dB} the de Broglie wavelength, the calculations demonstrate a second scaling length besides the ubiquitous correlation length $\xi(n)$. Those explanations were ignored by Lagendijk and coauthors.

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■ **Lagendijk, van Tiggelen, and Wiersma reply:** In his response to our story on the history of Anderson localization, Theodore Castner classifies our statements regarding both the scaling of the conductivity with temperature and the exponent puzzle as "misleading." He also says we "ignored" important contributions, in particular his own proposition to explain a critical exponent 0.5 in weakly compensated semiconductors by the so-called ion-impurity scattering mechanism.[1] That mechanism would lead to a Drude electronic conductivity proportional to the Fermi wavenumber.

It is true that the controversy over critical exponents around the mobility edge and the ongoing debate about the Mott minimum conductivity at the mobility edge marked the history of Anderson localization. They should be mentioned—as we did—by any review on the subject. Given length constraints, it was impossible for us to go into more detail and to discuss recent speculations, including claims on the Mott minimum conductivity.[2] We