letters

Making science accessible and scientists human

The Reference Frame "What Is Science?" by Helen Quinn (PHYSICS TODAY, July 2009, page 8) misfires, from opening paragraph to final sentence.

I have instructed elementary and junior-high students in general science, conducted planetarium and backyard astronomy sessions, given workshops for homeschoolers, presented maritime history and whaling technology to museum visitors, assisted a class in celestial navigation for sailors, conducted robotics workshops for middle-school science teachers, and judged middle-school science fairs. This diversity has afforded a wide opportunity to hear and ask what people think of science.

Most people do not see science and scientists as Quinn believes: "an authority that provides some information . . . that they use to help make sense of their world." Most of us do not distinguish between scientist and engineer. We tend to view science and technology as an endless source for nifty new gadgets and medical miracles. Other nonscientists perceive science as the emotionless underlying source of war and environmental destruction that often wastes tax revenue by examining frivolities. Most of us no longer ask Why? or How? The questions now are Why can't I? and How much will it cost?

Quinn's sense is that the public's excitement for science can be ignited by expanding the "usual description of the scientific method" to include the notion that it is an iterative, cyclical process incrementally increasing one's insight into the workings of the universe and by including token examples of missteps to show that scientists are human. That concept would fall flatter than Euclid's plane on nearly everyone I have worked with. Even if her suggestion that revealing scientists' fallibilities were an effective means to titillate a wider interest in science, her dry examples pale against letters and responses in the same issue (page 10).

People pursue science for many of the same reasons they do anything else. Some are drawn to the intellectual stimulation; others hope to better mankind; others want to make a buck, gain power, or advance an agenda. The need for "absolute honesty" and the other admirable characteristics Quinn relates aren't exclusive to scientists.

Science has lost luster not because scientists are fallible, but because much of it is so far removed from daily experience that the gap seems unbridgeable and therefore suspect. Quantum mechanics and string theory, despite their impact on us all, are arcane realms that cannot be discussed at dinner beyond tabloid fabrications, and we seem to lack scientists who can or will bridge that chasm.

Quinn further attempts to justify science's isolation from endeavors such as philosophy and politics by explaining that scientific rational methods, and hence scientists, are necessarily limited to narrow pursuit of one type of knowledge. That explanation may be accurate. However, to the rest of us it sounds like scientists want to experiment unfettered on our dime, unleash hurried results to meet grant deadlines, and then claim immunity because "moral and ethical questions are not amenable to the methods of science." How does abandoning ordinary folks to bear the full weight of difficult ethical decisions advance the stature of science?

Rather than merely noting "the public's feeling that science is always changing its conclusions," scientists need to explain the escalating stream of contradictory studies bewildering most of us. The media portrays such nonsense in terms of this week's miracle diet becoming next week's tragic mistake. Most scientists avoid such frays and leave us nonscientists to draw our own misinterpretations. That does not garner public interest. Part of the price for public support of research is routine explanations of how it's going to those footing the bills.

A disconnected, arid appeal to scientists to reiterate the usual academic line will not get many laypeople excited about science. People get excited about a subject when they actively share others' enthusiasm and passion about it. The participation and enthusiasm must be genuine; even very young children readily sense gimmicky "experiments" and feigned hyper-excitement designed to entice them. Yet the simplest hands-on explorations of basic questions, combined with the challenge that many of those questions still lie unanswered, can foster lifelong interests and understanding that enhances support for science. I have seen the success of such a process.

Bill Gill
(bill.gill1@worldnet.att.net)
Mystic, Connecticut

Much of the essay by Helen Quinn on the teaching of science deals with the field's overall structure and process. She seems to downplay the importance of the human side of science; she mentions it only briefly at the end of her essay and in a negative way that involves jumping to conclusions, making mistakes, faking data, and committing fraud. After 31 years of teaching physics at a community college, I am convinced that it is important to stress that science is a human endeavor. By doing so, we can make science far more interesting and far less intimidating to students.

If we portray science in too perfect an image, how could any student feel capable of pursuing it? And if a scientist is perceived as a cold and logical thinking machine, why would any student want to be one? I think good biographies of scientists should be required reading in introductory science courses so that students see their humanity. It's good, too, for teachers to show their own human sides and tell students

Letters and opinions are encouraged and should be sent by e-mail to ptletters@aip.org (using your surname as "Subject"), or by standard mail to Letters, PHYSICS TODAY, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842. Please include your name, affiliation, mailing address, e-mail address, and daytime phone number on your attachment or letter. You can also contact us online at http://www.physicstoday.org/pt/contactus.jsp. We reserve the right to edit submissions.

about mistakes they've made in their careers. I am not advocating that the approach be too casual, but we should make it clear that mistakes are a part of every human endeavor and that if a student does not do well on a particular quiz or messes up one experiment, it does not mean that the student is a failure. Let us not exaggerate the "perfection" of science and scientists.

William DeBuvitz
(joanbill8@nac.net)
Mendham, New Jersey

Helen Quinn's Reference Frame points in a useful direction, and it certainly improves on the typical middle-school oversimplification of what scientists do and how and why they do it. However, it maintains one idealization: that we lab scientists choose our problems based on a desire for understanding and consistency. In many cases, driven by funding imperatives, we choose our problems based on the needs of nonscientists. In those situations, we cast our choices in such a light that nonscientists will believe we are solving their problems. For example, SLAC might not have been built or maintained were it not perceived by the public that particle physics has practical consequences.

Alexander Scheeline
(scheelin@scs.illinois.edu)
University of Illinois at Urbana-Champaign

A light correction

In Robert Crease's interesting biographical discussion, "Charles Sanders Peirce and the First Absolute Measurement Standard" (PHYSICS TODAY, December 2009, page 39), one small error crept in. As Leon Golub and I explain in our book *The Solar Corona* (2nd ed., Cambridge University Press, 2009), spectroscopy was first used at total solar eclipses in 1868 and 1869, with helium and what was at first called coronium (now known to be a highly ionized state of iron) as the spectral discoveries. Crease has checked his references and confirmed that the argon he mentioned in his article was later reported by Peirce to have been observed not at the 1869 eclipse in Kentucky but in an aurora at about the same time.

Jay M. Pasachoff
(jay.m.pasachoff@williams.edu)
Williams College
Williamstown, Massachusetts

Galileo, Kepler share IYA anniversary

Here's a little postscript to the International Year of Astronomy 2009. Although it celebrated the 400th anniversary of the telescopic discoveries of Galileo, the IYA was the quadricentennial of another monumental event in the history of astronomy and physics—the publication of Johannes Kepler's *Astronomia Nova*. In that work Kepler stated his first two laws of planetary motion: the ellipticity of planetary orbits, which finally broke the circular mindset of his predecessors, and the sweeping of equal areas in equal times (conservation of angular momentum). Surely his text deserves celebration as well, for it led directly to Newton's law of universal gravitation later in that century.

Michael Lieber
(mikelieber1@yahoo.com)
University of Arkansas
Fayetteville