The AAAS Board of Directors presents its statement on the Kansas State Board of Education decision. Implications of recent work concerning Neptune's satellite Triton are discussed. National Science Foundation efforts to improve science and mathematics learning are needed, "[h]owever, [such] efforts...will have little impact until the scientific community fully recognizes education as a task worthy of a real scientist's time and focus." And two letters regarding a Report on tuberculosis vaccines discuss, respectively, a possible explanation for the decreased efficacy of the vaccines, and a mathematical model that addresses the question, "How effective does a vaccine have to be to eventually eliminate TB?"

First Indications of Geological Activity on Triton

In his News of the Week article "Neptune's icy cold satellite comes to life" (15 Oct., p. 383), Richard A. Kerr reports on new work that has led to a "startling" realization that Triton "is still showing signs of [geological] life," and he mentions observations hinting that Triton's "geological activity has made itself evident in recent years." The article also has quotes from scientists talking about "real surprises" and that the implication of the new work is that Triton "probably still is active." However, the article does not mention the discovery from the Voyager 2 mission 10 years ago of active smoking vents on Triton, which led the Voyager team to conclude (Reports, 15 Dec. 1989, p. 1417) that sparsely cratered Triton has "a geologically young surface...and at least two geyser-plumes."

What appears to be new in the work Kerr reports about is not the youthful surface or the geologic activity, but interesting constraints on the resurfacing parameters, global spectral changes, and impactor environment of Triton.

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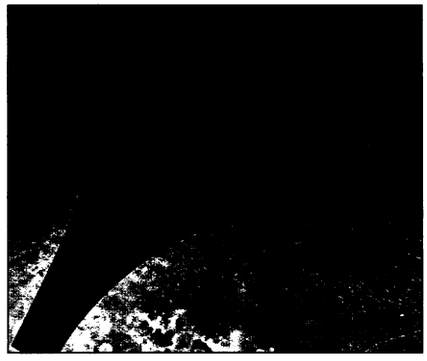
Response

As Hartmann notes, the Voyager team concluded that Triton has "a geologically young surface," but, at the time, geologically young meant that the average age of the surface was perhaps 1 billion years, and even the youngest surfaces could have been half a billion years old (p. 1448 and Table 5 in Reports, 15 Dec. 1989, p. 1422). The recent drop in perceived average surface age to 100 million years and perhaps much lower has let some planetary scientists conclude that geological activity driven by internal heat (not solar-driven geysers) is resurfacing Triton.



Deciphering the age of Triton's surface.

CREDIT: PAUL SCHENK, LPI/NASA

Richard A. Kerr

Valuing Scientists as Educators

In their Editorial "Science learning, science opportunity" (*Science*'s Compass, 8 Oct., p. 237), Rita R. Colwell and Eamon M. Kelly discuss the efforts of the National Science Foundation (NSF) to improve kindergarten through grade 12 (K–12) learning in science

AAAS STATEMENT

on the Kansas State Board of Education Decision on the Education of Students in the Science of Evolution and Cosmology

The American Association for the Advancement of Science deplores the recent decision by the Kansas State Board of Education to remove references to evolution and cosmology from its state education standards and assessments, thereby making central principles for the scientific understanding of the universe and its history optional subjects for science education. This decision by the Board is a serious disservice to students and teachers in the State of Kansas. To become informed and responsible citizens in our increasingly technological world, students need to study and judge for themselves the empirical evidence and concepts central to current scientific understanding. The actions of the State Board of Education may place Kansas students at a competitive disadvantage in their education and work environments. By discouraging teachers from using the best available professional knowledge about the nature and history of the universe, the Board's decision will make it more difficult for Kansas to recruit capable and inspiring science teachers.

Recognizing that the State Board of Education decision is a serious setback for public education in the state of Kansas, the AAAS adopts the following resolution:

Whereas, it has never been more important for American citizens to achieve a basic understanding of contemporary science and technology; and

Whereas, the concepts and evidence inextricably linked to our understanding of the nature and history of the universe are fundamental to the basic education of all Americans; and

Whereas, learning succeeds best when teachers and students can explore, investigate, and criticize the fundamental concepts and ideas in science; and

Whereas, learning and inquiry are severely inhibited if teachers are placed in a position where they may feel pressured to alter their teaching of the fundamental concepts of science in response to demands external to the scientific disciplines,

Therefore be it resolved, that the AAAS urges the citizens of Kansas to restore the topics of evolution and cosmology to the state curriculum. AAAS stands ready to assist all concerned citizens of Kansas in securing the repeal of this damaging ruling by the State Board of Education.

Therefore be it further resolved, that the AAAS and others committed to educational excellence in science work aggressively to oppose measures that could adversely affect the teaching of science, wherever they may occur.

Therefore be it further resolved, that the AAAS encourages its affiliated societies to endorse this resolution and to communicate their support to the citizens and appropriate public officials in Kansas.

Adopted by the AAAS Board of Directors
15 October 1999

and mathematics. Such programs are clearly needed and long overdue as a major focus for the nation's premier agency for the advancement of science. Colwell and Kelly cite four key areas for action: research on learning, coordinated K–16 requirements, improved teacher preparation and professional development, and improved instructional materials. "In each of these areas, active contributions by the scientific community are essential for success," they state. However, efforts in these areas will have little impact until the scientific community fully recognizes education as a task worthy of a scientist's time and focus.

Even at many colleges and universities where the declared core mission is the education of undergraduates, the hiring, promotion, and granting of other honors are based overwhelmingly on research accomplishments, with little consideration for the faculty member's educational achievements and skill. The reality of the scientific culture seems to be that educational work is not valued commensurate with laboratory work.

Colwell and Kelly state that "educational roles are no less important than our other responsiblities as scientists and citizens." How can this forward-looking policy be translated into substantive action?—by publicly respecting, valuing, and recognizing the teaching of science as separate from, but just as necessary and important as, scientific research. When the nation's premier scientific agency leads by example, valuing science education as a primary criteria in its own hiring, appointments to leadership positions and fellowships, and awarding of funds, the rest of the community will follow.

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Colwell and Kelly provide an overview of new efforts to improve science education. To make the story complete, I'd like to relate how the NSF is involving research scientists to help improve K–12 education.

For the past 15 years or so, the NSF has focused on workshop programs for teachers, to bring them up to speed in modern science. But it became clear that such relatively brief workshops did not change the classroom behavior of teachers as much as might be desirable. The NSF, therefore, developed a more intensive program, Research Experiences for Teachers and Students Projects. I direct one of these projects, where 40 biology teachers per year spend 6 weeks designing and carrying out research projects in the labs of university scientists and designing plans to implement components of these projects in their K–12 classes.

This new program appears to be doing wonders for science education. Teachers in the program direct the research projects of students in their classes with scientific know-how that could not be obtained from workshops. The teachers continue working with their research mentors, and the results of both the teachers' and students' research, in many cases, are publishable.

So, when Colwell and Kelly say that new NSF programs are working, from my experience they certainly are.

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Tuberculosis Vaccines

In their Report "Comparative genomics of BCG vaccines by whole-genome DNA microarray" (28 May, p. 1520), M. A. Behr *et al.* used genomic analysis to demonstrate genetic divergence of the Bacille Calmette-Guérin (BCG) vaccine for tuberculosis (TB)