Letters

Readers Respond to 'God's Rays'

Bryce DeWitt's delightful essay "God's Rays" is a highly personal account of one caring scientist's lifelong struggle to reconcile the beliefs espoused by those he deeply loved with the understandings compelled by the science he also loved (see PHYSICS TODAY, January 2005, page 32). Contributions of this type are what make PHYSICS TODAY a truly outstanding publication.

Dewitt's understanding of cosmology seems to have led him to agree with Steven Weinberg's remark that "the more the universe is comprehensible, the more it also seems pointless."[1] Not satisfied with Weinberg's suggestion that pursuit of understanding through science is one of the few ways to raise human existence above the level of farce, DeWitt offers, through the example of the historical emergence of early Christianity, love as a complement to scientific understanding. However, DeWitt's implied scientistic perspective can also be applied to love itself. Evolutionary biology seeks to explain love and altruism as evolutionary results that confer advantages on groups of organisms that have this trait.[2] Love, then, would be an aleatoric product of the natural world.

Many scientists wonder why the public does not embrace science more fully in matters of human affairs. Perhaps the answer lies in scientists' characterization of the cosmos as hostile, pointless, and farcical and the view that love is an evolutionary accident.

I am no scholar of Christian history, but I suspect that the power of early Christianity to attract a dedicated following did not derive entirely from its generic focus on love. Its predecessor, Judaism, also focuses on love. What Christianity offers is hope.[3] With so much suffering in the world and with the quest to find meaning in existence proving elusive even in a wealthy, materialistic society like ours in the US, it is the glimmer of hope of eternal salvation through faith in a loving God that sustains Christians.

DeWitt argues that we scientists must be absolutely honest. Perhaps—but the use of such language as "hostile, pointless, and farcical" to describe existence not only surpasses the findings of science, it places science in opposition to hope. Technologies developed through advances in science have offered hope for many, but science, by its nature, cannot replace the hope offered by religion for a meaningful existence. Each of us, including DeWitt, is free to come to our own understanding of the world and to express it. However, if this understanding conflicts with sources of hope that address basic human longings, we should not be surprised if the message is not received enthusiastically and if battle lines are drawn between science and religion, as has happened to some extent in the debate about science education (see, for example, PHYSICS TODAY, December 2003, page 36).

References

1. S. Weinberg, *The First Three Minutes: A Modern View of the Origin of the Universe*, Basic Books, New York (1977).
2. S. G. Post et al., eds., *Altruism and Altruistic Love: Science, Philosophy and Religion in Dialogue*, Oxford U. Press, New York (2002).
3. J. Polkinghorne, *The God of Hope and the End of the World*, Yale U. Press, New Haven, CT (2003).

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Thanks so much for making "God's Rays" available online. In my retirement, I tutor senior high-school students, mostly in math, physics, and chemistry, but occasionally in English or biology.

Like Bryce DeWitt, I have wondered how youngsters are supposed to study English literature without knowing any biblical references. And I have seen so many kids suffer because some adults pressure them to choose between evolution and Bible-based faith. I try to assure these kids that exposure to the principles of evolution need not erode their faith.

Reading DeWitt's essay could do a lot of people—pastors, parents, politicians—a lot of good. Too bad only the physicists are likely to see it.

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I write in appreciation of Bryce DeWitt's extraordinary essay "God's Rays." His claim, bolstered and beautifully illustrated by his own life, that theoretical physicists start out (and sometimes even continue!) as amateur theologians is unfortunately a thing of the past. Over my 50 years of teaching courses in materials science and in science, technology, and society, including religion, I have witnessed a new obliteration of familiarity with the roots—the depths—of Western culture. Shakespeare may be taught in high school and college; the Bible, of course, is hardly taught at all; and what is taught is barely retained beyond the final exam. On the basis of my sample of students and young faculty members from the best US universities, I cannot believe that very many who obtain PhDs have a chance to follow in DeWitt's steps.

By my own testing at the Pennsylvania State University, in my classes of 50 graduate students or 400–500 undergraduate general education students, I can certify that no more than 1–5% would recognize DeWitt's remarkable list of key biblical lessons. Such is the theological illiteracy of most of today's scientists, even those involved in the science and religion debate. The failure to read the contemporary literature in religion makes it unlikely that many physicists will understand the depth of DeWitt's last paragraph—about his religion's profound innovation, its

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single-minded focus on love as universal guide to human behavior.

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PHYSICS TODAY's celebration of the World Year of Physics, marking the centenary of Albert Einstein's 1905 papers, got off on the wrong foot with your publication of "God's Rays" by Bryce DeWitt in the January issue. The essay's only mention of Einstein is his "The Lord God is subtle but He is not malicious" quote, but for Einstein, "God" was a poetic metaphor for Nature. Einstein wrote, "I have repeatedly said that in my opinion the idea of a personal God is a childlike one," and "From the viewpoint of a Jesuit priest I am, of course, and have always been an atheist."[1]

DeWitt claims that "it is common knowledge that theoretical physicists often start out as amateur theologians," but it is certainly not common knowledge, and is very likely untrue. His fellow religionists should express themselves in a journal other than PHYSICS TODAY.

Reference

1. M. R. Gilmore, *Skeptic* 5, 62 (1997).

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Thoughts on Starting the Hydrogen Economy

In their article "The Hydrogen Economy" (PHYSICS TODAY, December 2004, page 39), George Crabtree, Mildred Dresselhaus, and Michelle Buchanan say that "basic research must provide breakthroughs . . . to make a hydrogen-based energy system . . . vibrant and competitive." This statement overlooks the near-term feasibility of an ammonia-mediated hydrogen-based system.[1] A research breakthrough might reduce the cost of ammonia production, by emulating its biosynthesis,[2] for example. But we have known how to make NH_3 economically for almost a century. Nowadays, between 1% and 2% of the world's energy is devoted to synthesizing ammonia from air and hydrocarbons, notably natural gas, via the Haber–Bosch process.[3]

Because ammonia forms hydrogen bonds, unlike H_2 or methane, it liquefies at about 8 atmospheres and room temperature, or ambient pressure and –33 °C. Indeed, because of this favorably situated phase transition, anhydrous ammonia was used as a household refrigerant for much of the 20th century.

Pipelines are in place to distribute anhydrous ammonia. To fertilize their fields, farmers routinely pull tank trucks up to ammonia "filling stations." An ammonia-fueled automobile with an internal-combustion engine was reported in the 1970s.[4] Commercial catalytic cells are available to break ammonia into nitrogen and hydrogen and thus produce feedstock for a hydrogen fuel cell. Solid-electrolyte ammonia fuel cells have been demonstrated.[5]

Because Bosch synthesis is performed in large industrial plants, the carbon dioxide byproduct can be captured and sequestered relatively easily—for example, by pumping it back into the wells that supplied the natural-gas feedstock. Any means of producing hydrogen based on a renewable energy source could