

understanding and love, then this love will manifest itself in actions done for the good of all. When a "critical mass of people" become committed enough to love in its purest form (the unconditional love of God), then our society will become transformed.

Physicists have an important contribution to make to the transformation of society. Fritjof Capra, physicist and author, had made this plain in his recent book, *The Turning Point* (Simon and Schuster, 1982). It is a synthesizing work which begins with the paradigms of modern physics and connects them with the best that is being accomplished in biology, medicine, psychology and economics. The result is a vision of our Western society being transformed by the energy of love—in practical ways, by practical people.

If we acknowledge that our main purpose here on Earth is to love ourselves and each other and each moment and if we recognize that love encompasses and includes understanding, then our task becomes clear: to choose love rather than fear in every thought, every endeavor, every moment. Think about it, and apply it—now, before it's too late!

JANE JACKSON

South Dakota State University
Brookings, South Dakota

1/83

Restrictions on religion

I read with great interest the letter by Mujaddid Ijaz on the subject of physics in Saudi Arabia in May (page 9), and I was pleased with the progress that is being made towards bringing a quality physics program to that country. However, I must relate a tale to you that might put some of the peripheral problems of that society into perspective.

A former student of mine, Khaja Subhani, has been assistant professor of electrical engineering at the University of Petroleum and Minerals (UPM) in Dhahran since 1977. We met at a conference in Berlin during the summer of 1981, where he informally invited me to visit UPM some time during the past academic year to present three lectures on selected topics in solid-state electronics. We corresponded further on this, and during the winter I received a formal invitation by telex from the chairman of his department. My plans were to visit in May 1982, and the UPM office in Houston sent me visa forms. I was advised both on separate sheet and by two of my Arab colleagues that, although I maintain no formal religious affiliation, I must complete the part asking for my religion in an acceptable manner. Not knowing what was "acceptable," I

phoned the Houston office and told them that both my parents were Jewish. The Houston office apparently viewed this as a dilemma and wired UPM asking for advice. Within a week I received a telex from Subhani stating simply "my contract has been terminated." He wrote me a letter, which arrived the following week, stating that the "rules of the Kingdom are strict."

It may be that my invitation to speak in Saudi Arabia and the sudden termination of Subhani's contract are disconnected events, in which case my wait to receive a re-invitation from UPM should be rather short. However, the close proximity in time of the two events surely casts some doubt on the rosy picture of burgeoning scholarly activities presented by Ijaz.

MELVIN P. SHAW

Wayne State University
Detroit, Michigan

1/83

THE AUTHOR COMMENTS: The tale narrated in Melvin Shaw's letter does not surprise me. There have been restrictions on the entry of Jewish visitors to the kingdom for many years. People with other religious faiths have been given appointments in the kingdom and most of them have been made aware of the rules and regulations of the kingdom at the time of signing job contracts. Saudi Arabian jobs are by no means governed by equal opportunity laws.

MUJADDID A. IJAZ

Virginia Polytechnic Institute and State University
Blacksburg, Virginia

2/83

Require renewal of PhDs

For many years it has been tacitly understood that in physics the PhD is a research degree. What I propose here is a mechanism by which this understanding is made formal.

The PhD would be reviewed and renewed at five-year intervals by the graduate department that granted it. The degree recipient would be required to submit reprints of at least three research papers published in the preceding five-year period. (The requirement would be prorated for those receiving degrees between evaluations.) Failure of a PhD recipient to submit the required number of reprints would result in the graduate department replacing the PhD with a Doctor of Arts—a non-research degree. To regain the PhD, the graduate would have to meet the requirements at the next evaluation.

In this way graduate departments would be required to maintain responsibility for their graduates, and the PhD will be recognized for what it really is.

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I hope that this proposal will be fully discussed by the physics community, and that it will be adopted in time for the first evaluation to take place in 1985.

BYRON C. HALL JR
Cincinnati, Ohio

1/83

Energy risk standards

In the PHYSICS TODAY debate on radioactive-waste disposal (December, page 37) R. O. Pohl observed that "the criterion for proper waste disposal must be a protection of future generations equal to that required for themselves by those who produce it." This seemingly reasonable criterion is unfortunately difficult to apply because of the disingenuousness of current attitudes toward protecting the public from ionizing radiation from different sources such as energy generation and energy conservation. It has become national policy to ignore the incremental public exposure to ionizing radiation attributable to energy conservation, while viewing the smaller plausible individual exposures from nuclear power plants, nuclear wastes, and even severe nuclear meltdowns, with great alarm.

R. L. Fleischer detailed the lack of attention to incremental public radiological exposures from energy conservation in his August guest comment (page 9). Since that time, both the magnitude of the problem and the determination of society to take no meaningful mitigative action have been further confirmed.¹ Pohl spoke of the radon decay product lung dose of 30 rem per year in a hypothetical future home embedded in an abandoned uranium tailing pile, but did not mention the 2- to 120-rem-per-year lung dose resulting from actually measured indoor radon levels reported at the 1982 APS Fall Meeting.² (It has now been repeatedly demonstrated that, while indoor radon levels depend on the highly variable radon source term, they can be further increased by energy-conserving home characteristics such as tightened construction and improperly designed heat reservoirs.) The bottom line is that incremental public exposures attributable to routine energy conservation measures in normal homes can far exceed standards for nuclear facilities such as waste repositories, and when the radon source term is high or when extensive reductions in air infiltration are made, the incremental doses can reach or exceed the levels associated with the Utah fallout litigation, or even from an uncontained nuclear meltdown.³

There is some possibility that utili-

ties, fearing future litigation, will revise their present practice of encouraging and subsidizing potentially hazardous energy-conservation measures without warning the public and determining the existing radon levels. But it seems unlikely, and perhaps not even desirable, that indoor radon standards will every be based on an imputed incremental lifetime risk of less than about 1000 premature deaths per million people exposed. This, in my opinion, is far more meaningful indicator of the level of protection that the present generation is willing to provide for itself than the rhetoric of activist groups that demand levels of protection far beyond the capacity and willingness of society to provide on any uniform basis.

I hope that we will someday acknowledge the necessity of establishing tenable and consistent criteria for the protection of public health. Such criteria would remove the artificial barriers to providing the resources needed by this generation without doing injustice to generations of the future.

References

1. The Final Environmental Impact Statement of the New York State Energy Master Plan II (9 February 1982).
2. C. T. Hess "Radon concentration in Maine houses due to use of radon rich water," Bull. APS, October 1982, Abstract EC 3, page 877.
3. H. L. Beck, P. W. Krey "External radiation exposure of the population of Utah from Nevada Weapons Tests" Report of the APS study group on lightwater reactor safety, Rev. Mod. Phys. 47, Suppl. 1, 1975, page S108.

HENRY HURWITZ JR

Schenectady, New York

12/82
THE AUTHOR REPLIES: While I, together with many scientists¹, share the concern expressed by Henry Hurwitz about the lack of a public policy on indoor air pollution, I disagree with his belief that once such a policy has been formulated for indoor radon concentration, disposal criteria for uranium mill tailings will be relaxed. If, as has been found by C. T. Hess², houses built on normal ground (that is, not on an uranium ore body) and with normal building material can experience high radon concentrations, how much higher must these radon concentrations be if these houses were built on highly porous mill-tailings sand containing the very high radon concentrations characteristic for uranium ore? (Note that the radiation dose I had quoted in my article, 30 rem/year, which Hurwitz repeats in his letter, was a theoretical estimate.) Hess was presented evidence that the high radon concentrations in the houses he studied resulted from ground water transport. As I had pointed out in my article (December, page 43), no estimates appear to

exist for the role ground water plays in carrying radioactivity from mill tailings into houses. Hess' work clearly demonstrates the urgent need that this question be studied.

References

1. See, for example, J. D. Spengler, Bull. Am. Phys. Soc. Ser. II, 27, No. 8 (I), (1982) page 876.
2. Reference 4 in letter by Hurwitz.

ROBERT O. POHL

Cornell University

Ithaca, New York

1/83

Critical review criticized

In his review of *The Cosmic Code* by H. R. Pagels (December, page 60), David Layzer strongly criticizes the book because of its "inaccuracies" and "lack of proper historical content." His criticism of the book consists totally in proving these two points. He fails to say anything positive about the book. In all fairness to the readers of PHYSICS TODAY, I believe an alternate viewpoint is needed.

David Layzer obviously understands the physics, philosophy and mathematics the book sets out to explain, but I wonder how well he understands the reader for whom the book is written. Trained physicists tend to forget the many struggles great scientists had in formulating their theories. Similar struggles are encountered by the intelligent man in grasping their ideas.

Some general notions initially must be developed in learning new theories. At that stage, everything is not clear; everything has not been spelled out. And, if too much time is spent on details (sometimes on mathematical precision), the ideas become obscured. The depicting of general ideas is the goal of my primary scientific explanation and this is what Heinz Pagels has sought to do in his book. He does it successfully.

But let us examine the "inaccuracies" that wrought the strong criticism of the book. They are underlined below, followed by David Layzer's comment and then by some refuting remarks.

► *Einstein's general theory of relativity is needed to resolve the twin paradox.* David Layzer states the general theory isn't needed. If the general theory isn't needed to resolve the twin paradox, then what theory is used during the accelerating and decelerating period of the twin? Einstein formulated the general theory to deal with accelerating systems. Is there a new way of dealing with this problem?

► *That gravity is the curvature of space and that the round-trip time for a light beam grazing the Sun is increased because "the beam has to bend slight-*