

# letters

## Creationism still again

If there is one creationist in the country who merits the label "scientific," it is probably Robert Gentry (October, page 13). I see no reason to doubt the validity of his halo identifications. However, I also see no reason to believe his polonium halos resulted from anything other than *in situ* decay of uranium or thorium:

► Gentry's own publications (adequately referenced in his October letter) contain many references to the variability of halo formation, the need to search thousands of inclusions for good halos, and the possibility of halos being bleached or color-reversed by overexposure. In his article in *Annual Review of Nuclear Science*, Gentry remarked, "Clearly a one-to-one correspondence between halo radius and alpha-energy is not valid."

► The Po isotopes Gentry reports are exclusively those that form from normal  $U^{238}$  or  $Th^{232}$  decay—the isotopes  $Po^{210}$ ,  $Po^{212}$ ,  $Po^{214}$ ,  $Po^{216}$  and  $Po^{218}$ . Where are the other 22 isotopes of polonium? Apart from a possible halo due to  $Bi^{211}$ , Gentry has not even found any halos from the  $U^{235}$  series.

► The inclusions around which the halos are found are minerals such as apatite, zircon, or monazite in which uranium and thorium are common trace constituents substituting for calcium, zirconium or the lanthanides. From a chemical standpoint, there is no reason for a Group VI element such as polonium to be present in these minerals. Where there is a chemical reason for polonium to be present, as in Gentry's coalified wood, there is also ample evidence for its having gotten there by diffusion.

► The very facts that Gentry can identify halos with any certainty at all and that the halo radii correspond fairly well to present alpha-particle energy levels are strong evidence that nuclear-decay properties have not changed appreciably since the rocks formed. No interpretation of the halos that ignores this vital conclusion can be taken seriously. Gentry's evidence (as opposed to his interpretation) confirms radiometric dating rather than casting doubt on it.

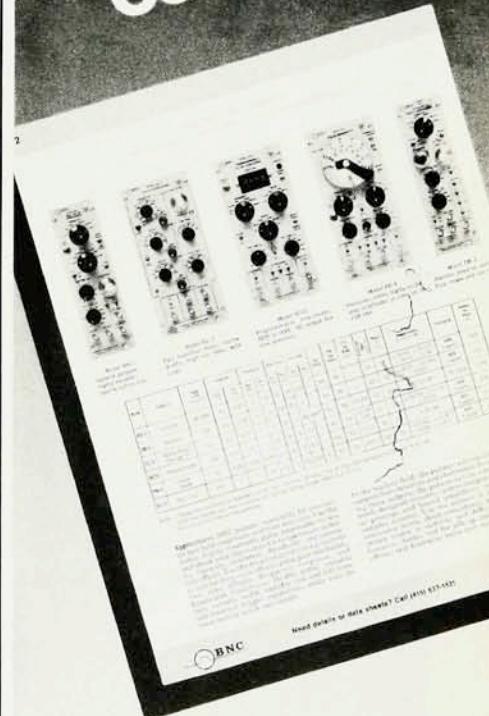
Some of Gentry's other remarks deserve comment. Synthesizing a sample of granite in the lab might show that halos *could* form quickly, but not necessarily that they *did*. More to the point: If the experiment fails and shows the rocks *could not* have formed quickly, will creationists admit it? I think people who can deny that *Archaeopteryx* is an intermediate between reptiles and birds can deny just about any kind of contrary evidence. As for the diffusion calculations, Gentry's article in *Science* (216, 296, 1980) is based on  $Pb^{206}/Pb^{207}$  ratios from zircons in granite samples taken from a deep borehole at various depths and temperatures. His tabulated values show a range of over 10%, with individual measurements accurate to about 3%; the article makes no mention whatever of the enormous range of U and Th concentrations in the samples, presents no analyses of total Pb and makes no attempt to calculate the actual amounts of lead produced and lost. To say "no Pb loss was detected" at the 1% level that Gentry claims sets a limit on the age of his samples is simply absurd. Nevertheless, this "age indicator" seems destined to join a host of other, equally faulty, creationist "age indicators."

Gentry's halo results are an example of what many science writers call the "residue fallacy." The mere fact that items are unexplained does not constitute evidence that a radical revision of science is necessary, and often the "unexplained" facts turn out to have pretty simple explanations on closer examination. If we can argue that polonium halos show the geologic time scale is wrong, we can far more cogently argue that the evidence for the geologic timetable shows that Gentry's interpretation is in error. Actually, Gentry's own evidence shows his interpretation is wrong because it shows that nuclear decay has *not* varied significantly over geologic time.

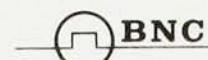
It is distressing to see so much journal correspondence on creationism by scientists who have little idea what creationists really believe. We don't need to resort to philosophical debates on the assumptions of science; indeed

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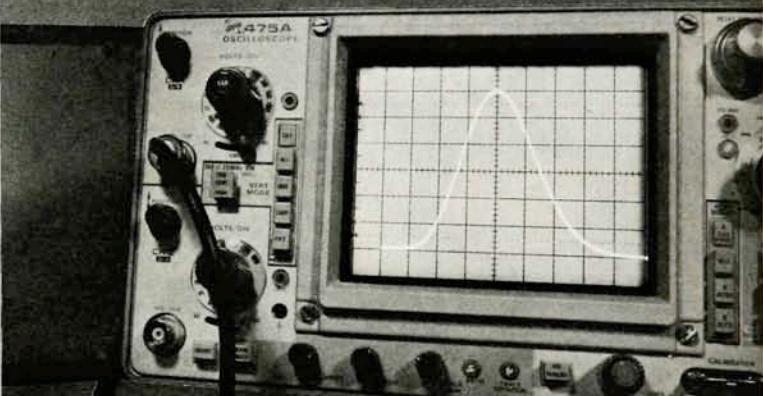
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creationists have a field day with that sort of argument. The only really effective argument against creationism is that it doesn't work; creationist theories rapidly and inevitably lead to logical contradictions or to conclusions that are plainly contrary to fact. It takes little effort to ferret out creationist mistakes, and ultimately the only way creationism will ever be discredited in the eyes of the public is by revealing these errors. Contrary to many current thinkers, creationism is testable—and it always fails.

STEVEN DUTCH

University of Wisconsin

11/82

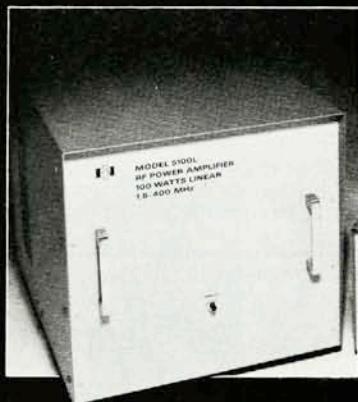
Green Bay, Wisconsin

**THE AUTHOR COMMENTS:** Space limitations imposed by the editor limit my response to my colleague's letter; so readers who wish more details should obtain a copy (I get no honorarium) of the videotape of my invited talk given at the June 1982 AAAS Creation/Evolution Symposium held at the University of California, Santa Barbara,<sup>1</sup> or check my publications,<sup>2</sup> especially the EOS responses. Since Steven Dutch is so overwhelmingly convinced that evolution is true, he needs to face more squarely than he has the fact that the scientific community has not responded to the crucial scientific test that I have proposed. To understand this test, readers must first realize that the Precambrian granites, which are the crystalline basement rocks of the continents, are rocks which evolutionary theory pictures as having formed repeatedly over the vast expanse of Precambrian time (about 3 billion years supposedly) with nothing more than the uniform action of known physical laws to govern their cooling. My challenge to this view hinges on the simple fact that I claim the various types of polonium halos that exist in these Precambrian granites initiated from primordial rather than secondary Po radioactivity, and that these primordial Po halos constitute *prima facie* evidence of a virtually instantaneous creation of these rocks. For over 3½ years I have challenged geologists and others who believe in the evolutionary development of the granites to confirm that hypothesis, first, by synthesizing a hand-size piece of granite, and second, by synthesizing a single Po<sup>218</sup> halo in that same piece of granite.<sup>2</sup> The first requirement would be accepted as falsifying my view that the granites are primordial or created rocks, and the second would falsify my view that the Po halos in granites represent primordial radioactivity. With such a grand opportunity to confirm evolution and falsify my view of creation, I have searched for a reason for the deafening silence which my challenge has met.

Certainly geologists have extraordinary reasons for wanting to meet this challenge because, as eminent geochronologist Paul Damon has admitted,<sup>3</sup> the existence of primordial Po halos in granites calls into question the entire science of modern geochronology based on uniform nuclear decay rates. As evidence of a young Earth in the context of *non-uniform* nuclear decay rates, I refer to my most recent results<sup>4</sup> on helium retention in zircons extracted from deep granite cores where temperatures varied from 105° to 313°C. For uniform decay over geological time the He accumulation in the zircons would have been almost negligible because of rapid diffusion at higher temperatures. On the other hand, if the Earth is quite young and if the nuclear decay processes were higher during a special period (such as the Flood) when the Creator intervened, then due to lack of time some of the He should still be encapsulated with the tiny 75-micron zircons. The experimental results showed almost phenomenal retention of He even at 197°C, which I view as strongly supportive of a several-thousand-year age of the Earth. If Dutch feels this interpretation is incorrect, I invite him to provide *demonstrable* evidence showing why this interpretation of the data is wrong and explain in detail just how these results are *predicted* by the current evolutionary model of a 4.5-billion-year age of the Earth.

Finally, this response would be incomplete without showing how my creation model encompasses astronomy as well as geology. Since the days of Hubble about 50 years ago, galactic red shifts have been almost universally interpreted as Doppler shifts resulting from high recessional velocities of the distant galaxies and have been thought to provide some of the strongest evidence for the hot Big Bang model of an expanding universe. In contrast, I have recently proposed<sup>5</sup> another explanation based on the idea that the galaxies are revolving in different orbital planes and with different tangential velocities around a universal Center C. The galaxies would remain in orbit by gravitational attraction of the total mass *M* within the sphere of orbital radius *R*. Observers on the innermost galaxies see light from the more distant galaxies red-shifted because of the transverse Doppler and gravitational effects. Unlike the Big Bang model, this new scenario easily accounts for both the red shift  $z \propto R^2$  relation determined by Segal<sup>6</sup> (for low *z*), if the density  $\rho$  is constant, and a Hubble-type  $z \propto R$  relation for higher *z*, if  $\rho \propto R^{-1}$ . Further, the observed 550 km/s of the Milky Way through the microwave background<sup>7</sup> is quite naturally explained as the tangential veloc-

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## letters

ity around  $C$ . For  $\rho = 10^{-27} \text{ g/cm}^3$  then  $C$  is only  $3.7 \times 10^6$  lightyears away (possibly beyond Orion).

### References

1. Videotapes may be obtained from the Learning Resources Television, UCSB, Santa Barbara, CA 93106.
2. R. V. Gentry, EOS 60, 474 (1979); EOS 61, 514 (1980); Science 184, 62 (1974); Ann. Rev. Nuc. Sci. 23, 347 (1973); R. V. Gentry *et al.*, Science 194, 315 (1976); N. Feather, Commun. Roy. Soc. Edinburgh 11, 147 (1978).
3. P. E. Damon, EOS 60, 474 (1979).
4. R. V. Gentry *et al.*, Geophys. Res. Lett. 9, 1129 (1982).
5. R. V. Gentry, Bull. Am. Phys. Soc. 28, 30 (1983).
6. I. E. Segal, *Mathematical Cosmology and Extragalactic Astronomy*, Acad. Press, 1976. See also J. F. Nicoll and I. E. Segal, Proc. Natl. Acad. Sci. 79, 3913 (1982).
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ROBERT V. GENTRY  
Columbia Union College  
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1/83

The controversy between evolutionists and creationists is of a nature that precludes it from being resolved. Each side contends that their theory is the true one. The obstacle that will forever prevent agreement is that the approach to truth is different for the two sides; evolution depends on scientific rationality whereas creationism depends on faith. Such different methods do not even allow the serious examination of one theory within the context of the approach of the other.

Given this irresolvable conflict and the fact that at present neither side apparently is going to fade away, some means of handling the conflict is needed. The freedom of ideas that we cherish so much implies a responsibility that both sides be appropriately presented.

The main problem is that many people try to refute one theory in terms of methods employed by the other, which is easy but inconsistent. Instead, attention should be focused on how to "appropriately present" the two conflicting sides, a problem that does have an answer.

Evolution employs methods of attaining the truth which are consistent with the tenets of science as currently accepted. Evolution, therefore, has a right to be taught as a scientific theory. Creationism, upon complete examination, does not follow the tenets of science. Logic is certainly employed at various points in creationist arguments, but in the final analysis the

most crucial parts of creationist scenarios depend upon faith as the determiner of truth. Whether it is correct or incorrect, reliance ultimately on faith for deciding truth cannot be taught as science within present-day ideas of what science is. This is not to say that creationism should not be mentioned at all in classrooms. It has a right to be taught as any other philosophical idea that relies on faith is covered. My personal feeling is that Judeo-Christian creationism should be taught with creation ideas of other civilizations—Egyptian, Norse, Indian and so on. This is certainly not the only place that creationism can be taught; it would fit in suitably in any field of intellect that depends on faith as its basic method of ascertaining truth.

Thus creationism does have a right to be expressed. However, since creationism does not follow the principles of science as these principles are generally accepted at present, creationism should not be taught as a scientific theory. If creationists would like their theory to be taught as science, their job is not to persuade us that their ideas are of a scientific nature, for at present they are not. Instead, the only possibility for creationism to be accepted as a scientific theory is for creationists to show that the present-day principles of science require major changes.

BERNARD S. GERSTMAN  
University of Virginia  
1/83  
Charlottesville, Virginia

It is almost amusing to see the proponents of Big Bang cosmology, who have themselves been accused of fostering a religious intolerance toward those who question whether the foundations of the Big Bang hypothesis are scientifically justifiable,<sup>1-3</sup> now getting a dose of their own medicine from biblical creationists.

It is, of course, not amusing to see state courts or local boards requiring educators to give "creation science" equal time whenever evolution, earth science, and astronomy are taught in public classrooms (February, page 53; June, page 52).

The aggressive resurgence and success of creationism now threatening to transform science education in this country is due, in part, to the Big Bang creationism that has been increasingly recognized as a "wounded rabbit" because of its already excessive need for *ad hoc* assumptions in predicting (or rather postdicting) observational data.<sup>4-6</sup> In this regard, it has been suggested that not much will be left of the Big Bang hypothesis ten years from now (November 1981, page 257).

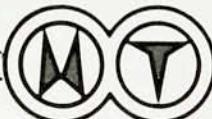
What, then, can replace creationism, either Gamov's version or the version

continued on page 82

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in *Genesis*? One possibility is the Klein universe model, more familiar to plasma physicists than astronomers, that has always given a far more credible zero-state description of the universe (February 1971, page 28). Additionally, the Klein universe leads to precise evolutionary models that can be directly confronted with astronomical observations, something that the creationist theories appear to be having a great deal of difficulty with.

**References**

1. H. Alfven, *Cosmic Plasma*, (D. Reidel, Holland (1981), page 125.
2. G. Reber, *PHYSICS TODAY*, November 1982, page 108.
3. P. Goldreich, *Focus on the Stars*, H. Messel, S. T. Butler, eds., Shakespeare Head (in US: Crane-Russak, New York) (1976), page 127.
4. H. Arp, *Problems of Physics and Evolution of the Universe*, L. V. Mirzoyan, ed., Armenian Academy of Science (1978).
5. C. G. Falthammar, S. I. Akasofu, H. Alfven, *Nature* **275**, 185 (1978).
6. H. Alfven, Observations and Hypothesis in Cosmology, Royal Institute of Technology, Department of Plasma Physics report TRITA-EPP-78-11, May 1978, Stockholm, Sweden.

ANTHONY L. PERATT  
12/83  
Los Alamos, New Mexico

Hurrah for the letter from J. Willits Lane in October (page 15). It is so decent and so fair, in contrast to many letters.

I wish to comment on the letter from Burton Voorhees (page 108). It should not be necessary to go back over one thousand years to make a point, but when he does it is totally irrelevant. That was not true Christianity that he was talking about. After Constantine, "Christianity" became a state religion. For true Christianity he should go to before Constantine when Caesar worship was the state religion. Then Christians used the method of peaceful civil disobedience and thousands of them paid the legal penalty, martyrdom.

Also, he should recognize that it was the *state church*, or churches, that were "the major causes of" the Dark Ages. It was after the Reformation, a breaking away from state churches, that the modern scientific age was able to begin.

Many of our early colonists were people seeking to escape from the tyranny of state churches. It was not for nothing that the first amendment was added to our Constitution very early. Its first purpose was that there be no established, national church. Its second purpose was that the govern-

ment should not impede or interfere with the free practice of religion. The actions of teachers Lane describes is a definite infringement of the Constitutional rights of students. Surely we must agree that for many decades now such students have been taking this abuse pretty passively and peacefully. Such tactics of schools and teachers is in effect establishing the religion of humanism, in violation of that first amendment. Note that I wrote *humanism*, not a kindly attitude toward fellow humans, which is a virtue that Lane wonderfully exemplifies. Also I wish that Voorhees would take notice that creationists are trying to use peaceful, legal processes, not "imposing their dogma by the systematic extermination of all opposition." Where does he get that? And where does he find "efforts to eliminate the teaching of evolution"? As Lane notes, it seems that the opposite is what we are finding. I know of some legal efforts to get some sort of balanced treatment, but even that does not seem to have much chance. He went back over a thousand years to find his "straw man" (see Lane's letter) to knock down, and some of these other pronouncements look like the "Chicken Little attitude" category.

WAYNE E. NEWQUIST  
11/82  
Kearny, Nebraska

THE AUTHOR COMMENTS: Wayne Newquist attempts to make two points. In the first he tells us that we must not condemn attempts by a certain vocal minority of Christians to influence the scientific process by appeal to external *state* authority since they are only seeking their civil rights. We are assured that no repression of other views is intended and that past examples of such repression are not relevant since they occurred during periods of history in which Christianity was a *state* religion.

The second point is that we have, in our constitutional separation of church and state, accepted a *de facto* state religion of humanism and it is this new religion which is oppressing fundamentalist Christians by not giving creationist theories equal time in our schools.

Really, Newquist! Show me a humanist temple. Show me a humanist bible, or a congregation of humanists meeting to worship together. What is the humanist dogma? I can only take this second of Newquist's points as an example of the psychological tendency of individuals and groups to project their own mental structures onto the world. In this case, certain groups of Christian fundamentalists think in terms of churches, religious groups and their mission. They feel oppressed and can only blame this oppression on the machinations of some other religious group. In the face of such a psychologi-

cal barrier, it may be futile to point out that science is not a religion, official or otherwise; that science has no legal or moral obligation to teach all viewpoints on any topic; and that the way creationists could legitimately seek to establish their theories as scientific is through standard channels of research and publication. In going outside of the scientific community they are simply admitting the scientific bankruptcy of creationism.

As far as Newquist's first point is concerned, I can only offer the old saying: Those who do not learn from history are doomed to repeat it. The real point I was attempting to make in my letter is that a small but vocal percentage of Christians are attempting to railroad their personal beliefs into the public educational system; that the psychological reasons behind this seem to be such that these people cannot tolerate divergent opinions or beliefs; and, based on historical example, such fanaticism is dangerous. I am not criticizing Christians, I am pointing out that there are those within the fold of Christianity who use an historical interpretation of the Christian Bible to cover deep personal fears and, as a result, strike out in terror at anything they perceive as a threat to their belief. Such people are not true Christians, they are merely obsessed.

BURTON H. VOORHEES  
Athabasca University  
12/82  
Edmonton, Alberta

Since I have been addressed directly and indirectly in October (page 110), I wish to respond. To save some of everyone's time I shall only elaborate on the last point of my previous letter (July, page 15) since it contains for me the essence of the subject.

Consider this: "In defense of their beliefs, creationists . . . want students to get a fair hearing of both sides of scientific controversies so they can make decisions for themselves" (February, page 53). Let us assume that creationism is indeed a competing scientific theory to planetary evolution, including the possibility of life. Since when is it considered a contribution to a scientific issue to give school children a lesson on competing theories to *let them decide for themselves*? Does the issue of quark confinement, the structure of Saturn's rings, the best pulse shape in laser fusion or any other scientific question benefit anything by this approach, or, for that matter, do the students benefit in any way? The answer to all our scientific questions is fixed since the beginning of the laws of physics. Only by rigorous scientific inquiry shall these answers ever become a part of human knowledge.

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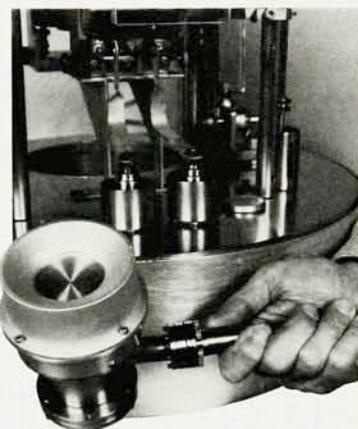
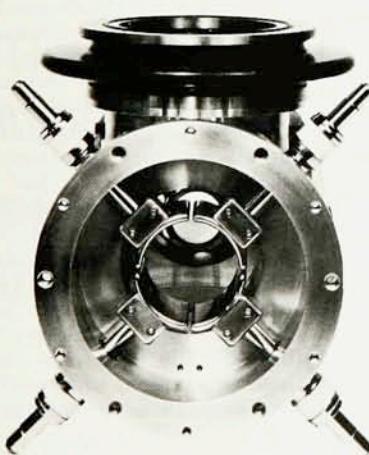


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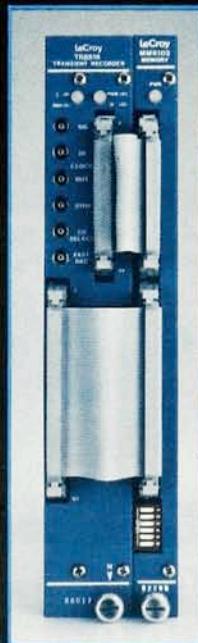
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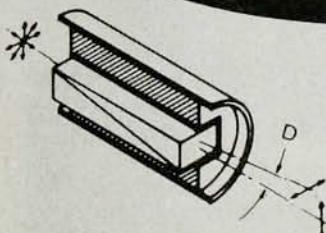
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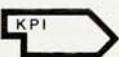
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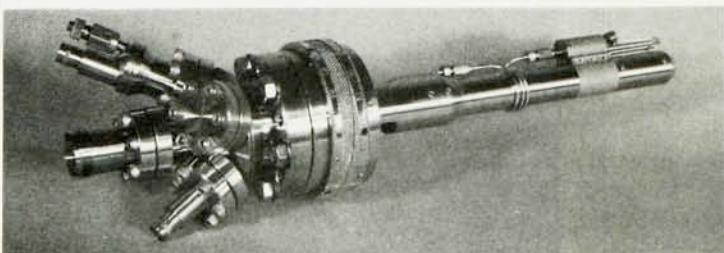


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## letters

schools" obviously furthers nothing of scientific concern, why is the creationists' effort arrived at just through schools? I very much doubt it is to give children a "fair hearing," to "let them make their own decisions." If an independent decision is so close to their hearts, why baptize children? Why not let them grow up, give them a "fair hearing" on everything from ancient Chinese and Egyptian religious beliefs to atheism and *then* let them "decide for themselves." Instead, one is, for example, a Roman Catholic before one knows it, literally.

I rather suspect this current effort again aims at the very young, whose ideas are as yet easily influenced, particularly by social pressures (which seem to work almost as well on their parents) if only they can be created. They lack the training to put up much of a discussion or provide much of a critical assessment and, finally, can be conditioned early enough, hence sufficiently, to pass these views on to their own children. Thus the survival of the system is insured, much in accordance with Darwinistic principles. Why this, with its eventual effect on the science community, could become reason for grave concern has been discussed to some extent in February and October. Unfortunately, most scientists respond to creationism by resorting to science. Creationism, via the demand for equal time in public schools, however, is not a scientific issue. By treating it as such we will indeed lose. Instead it is, at present, a social issue that might soon become a political one and must be addressed as such. For these reasons, I recommended in my last letter to oppose the adversaries with their own methods.

Creationism in the form of claims for a 10 000-year-old Earth or photons "created en route" is a completely different subject. And were it only for that, I would quite enjoy reading all those productions until we finally get tired enough of it to turn to other issues.

GEORGE F. ALBRECHT  
University of Rochester  
Rochester, New York

12/82

The letters from Harry Ellis and J. Willits Lane in October (page 13 and 15) strike some of the sanest notes I have yet read, in any journal, in the whole sorry controversy about creationism and evolutionism. I almost wish I had written the letters myself.

It is a matter for great regret that this controversy ever got into the courts. Our legal system may serve very well the purpose for which it was designed, but deciding the truth in

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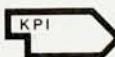
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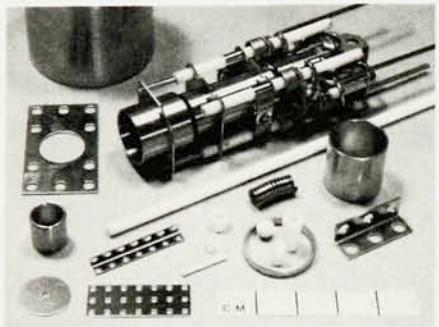
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## letters

matters of intellect is not part of that job. Moreover, once a legal decision has been made, whichever side is victorious, some teachers are likely to find themselves in the unpleasant position of being legally obliged to teach what they believe to be false. I do not think, however, that the dogmatic attitudes that led to this controversy becoming a cause for legal action are all on the side of the religious fundamentalists. Some widely read popularizers of evolutionary biology make no secret of their materialism and, indeed, use their popular writing as a means of propaganda for their world view. Even if, in their own minds, their belief in evolution is related to their unbelief in God, the one does not logically entail the other. It is hardly surprising, however regrettable, that some adherents of Christianity have retaliated by trying to cast doubt on the scientific theory that has been used as an instrument of propaganda outside its sphere of applicability.

I personally see no conflict between the theory of evolution and religious belief—unless one is wedded either to the concept that natural selection rules out the possibility of some purpose working through evolution or to the notion that the early chapters of *Genesis* must be taken literally. I agree with Ellis that the latter notion is ridiculous, but I am not entirely without sympathy for those who hold it. At least they stand for a belief in what Aristotle would have called a final cause. Modern science has concentrated on studying only efficient causes and has deliberately eschewed the search for a final cause. This attitude has proved a very successful way of increasing our understanding of some aspects of the universe, and its very success, coupled with the failure of scientific research to uncover evidence for a final cause, has led many to conclude that there is no such thing. This, however, is an egregious logical blunder that few, if any, of the founders of modern science made. We have found no evidence for a final cause because we have deliberately avoided looking for it and have defined the whole question of its existence to be outside science. Our theories tell us nothing on this topic, except insofar as we add to them our own subjective interpretations. If the creationists have reminded us of this, they may yet have performed a service.

While the existence of a final cause is not a question to be solved by the methods of science, few can doubt that scientific discoveries have made totally implausible the traditional imagery used to talk about such a cause. The misfortune of creationists is that they cling to this imagery and seem to have made it more important than the rea-

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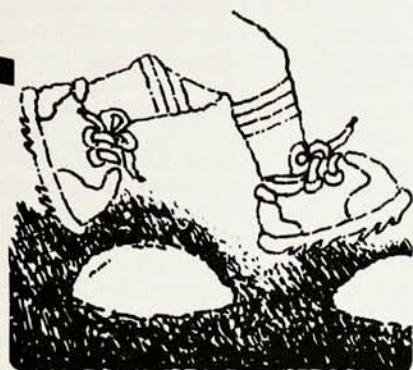
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## letters

lity it was trying to express. The rest of us, whether believers or not, have abandoned the old imagery without being able to find a convincing new one. Thus, not surprisingly, we have no words with which to talk about the ineffable. Yet surely the wonder at, and curiosity about, the universe that led most of us to take up scientific careers is not so very different from the attitude behind the first chapter of *Genesis*; and if the writer of that was more interested in the final cause than we are, can we say that our different ideas about efficient causes prove him wrong on what to him was the greater concern?

ALAN H. BATTEN

National Research Council  
Victoria, British Columbia

11/82

•

I cannot help feeling that the whole debate as published in your columns, interesting as it is, misses a major point that is a central issue in the relation of science to theology.

The correspondence focuses on the issue of the nature of the creation of the world and the Universe. However, if one accepts the idea of creation through the agency of some God, the mode of that creation ("Big Bang," "Steady State," or any other proposal) is really irrelevant to the theological discussion. Why any particular mode of creation should be considered more "Christian" than others is something of a mystery; as your correspondents have noted, the Bible offers several contradictory creation options, all of which a mature view will interpret as symbolic rather than factual. Major scientific figures (such as Lemaitre, Eddington and Jeans) have had no difficulty in reconciling versions of the usual scientific view with a Christian understanding.

In my view, the area where physical science impinges much more directly on theological issues is via the vexed question of free will. Presumably the brain is controlled by the laws of physics. The usual physical view must surely be that it is completely controlled by these laws—there are no biological factors not determined by physical laws. Classically, this prevents the existence of free will—the ability to make responsible choices. Given an initial state of the brain, the final state is determined by the laws of physics, and any apparent choice is an illusion. Quantum mechanics worsens the situation—probability replaces determinacy, and the illusion of free will is the reflection of chance events. Either view challenges the notion of responsibility, and hence the basis of ethics. I know of no satisfactory resolu-

tion of this question (which poses a major problem for humanism just as it does for theology).

This relates back to the issue of creation in the following way: the concept of creation inevitably has an element of continuation, because one of the fundamental questions (posed, for example, by John Wheeler) is why one particular set of laws of physics controls and continues to determine events in the universe. What dictates that they should become and remain the controlling feature? For it is these laws that enable the body and the brain to function as they do, and therefore gives us either free will or at least the illusion of free choice. Thus, as significant as the question of how the Universe came into being is the question of why it maintains its functional basis in a particular set of physical laws. This question relates, of course, to the "Anthropic" principle that has been the basis of much fascinating speculation in recent times.<sup>1</sup>

### Reference

1. R. Breuer, *Das Anthropische Prinzip*, Meyster (1981); P. C. W. Davies, *The Accidental Universe*, Cambridge University Press (1982); J. D. Barrow and F. J. Tipler, *The Anthropic Principle*, Oxford U. P. (1982).

GEORGE F. R. ELLIS

University of Cape Town  
Rondebosch, South Africa

2/83

•

Science deserves every whack it gets from the so-called creationists, for a charge of puritanical posture belongs as much to one side as to the other.

Ultimately, those who presume to engage in intellectual rather than emotional debate must first inform themselves of their subject—both sides, that is. And to any scientist who takes the trouble to expand his mental horizon beyond the strict confines of his profession, inquiring with free and properly open mind into the nature and reaches of the religious experiences marking both current and historic humanity, prolongation of the 19th century contest between science and religion into the 20th would only be viewed as ridiculous were it not so serious. For if those engaged with the various pursuits of the intellectual life, and in sufficient number rather than the typical individual oddity, had only prepared themselves properly for the subject they now find thrown back at them, this foolish contest over what to teach our children in public schools could never have arisen. The fact that it has arisen therefore stands as a direct and censoring measure of both a closed and an insufficiently informed attitude among scientists themselves.

For all one needs in rebuttal of the

fundamentalist proposition is to ask this simple question: Which religious teaching? Which "creationism"?

Purely through circumstance, this loud cry for teaching a particular religious tradition along with the scientific paradigm has been allowed to arise from a mere minority within a minority, which happens at a particular time and place to be a local majority. For not only is the Judeo-Christian stream a minority among world religions, but fundamentalism is a minority in turn within it. Of some four billion inhabitants currently occupying this interesting planet, far less than half belong to the Judeo-Christian persuasion. And of these, the fundamentalist represents a fraction of very trivial proportions, were it to be measured arithmetically rather than acoustically. Has any one heard the great Roman or Greek Orthodox churches, or indeed the majority of the larger Protestant branches of Christianity, either issue a proclamation or take a public stand against the basic tenets of science since they made that now-admitted massive mistake of the Inquisition?

To repeat: Which "creationism" should be taught in our schools to balance the alleged and possibly real materialistic threat of science? The Hindu's? The Buddhist's? Shamanism? Taoism? Jainism? Shinto? The fascinating Nana Bozho constructions of the Ojibwe Indians? . . .

CARL A. ZAPFFE

Baltimore, Maryland

## Liquid crystal priorities

It was with keen anticipation that I was reading the special issue of PHYSICS TODAY on liquid crystals (May 1982). In this field, as in most fields of science, the work done by a number of scientists and laboratories all over the world contributes to the progress. However, if there are scientists whose original work can unambiguously be shown to have initiated the development of a new technology such as the LCD technology with which we are familiar today, I believe we should give proper credit to these persons. It was therefore with considerable astonishment and disappointment that I read in David Litster's article (page 26) that the twisted nematic display (TN-LCD) was invented in the US. An equal surprise was his statement that liquid crystal materials that made TN-LCDs practicable were developed in Great Britain.

It is well known and generally accepted by the scientific community (see, for instance, reference 1) that the twisted nematic effect was discovered by Martin Schadt and Wolfgang Helfrich<sup>2</sup> at the Hoffmann-La Roche Re-