

letters

had some unpleasant encounters with the Physics and Astronomy Classification Scheme, which is used in indexing some journals published by the American Institute of Physics. Although PHYSICS TODAY doesn't use a PACS index, I'm turning to you in search of a forum to discuss the matter because your magazine goes to all AIP members, and I understand that the PACS indexing reflects AIP policy.

I receive two AIP journals which use PACS indexes—*Applied Physics Letters* and *Physical Review Letters*—and find these indexes essentially worthless. With a PACS index, trying to find papers on a particular subject is a multiply iterative—and very frustrating—process. First, I have to go through the whole list of categories to try to deduce the right one. Then if I find nothing in the index under that category, I have to go back to the list of categories and make another guess. The process continues until I find something or get totally disgusted.

The alphabetical subject listings used to index PHYSICS TODAY and the journals published by other organizations are much easier to use. A good alphabetical listing will include either entries or a cross-reference under major terms describing a particular subject. Even in a poor alphabetical listing that lacks cross-references, it at worst takes a few guesses to pick the term used in indexing. For example, a paper on fiber-optic sensors could end up under optical sensors, optical transducers, fiber optics, sensors or transducers, but there are only a small number of categories to check.

Perhaps PACS makes sense to people who use it daily, but I suspect that's a small minority of the people who would like to be able to use the indexes of AIP journals. To the rest of us, it's just a frustrating and unnecessary guessing game that impedes, rather than facilitates, the flow of information.

I'll concede that the PACS may be useful in computer indexing, but even then it should be used only as an internal code. The computer could readily be programmed to generate an alphabetized listing of index categories rather than one organized by PACS numbers. The result would be an index easy to compile and readily usable by the human readers of AIP journals. As is, I feel as frustrated as I would if confronted by a library organized by the Dewey decimal system but lacking an alphabetized card file.

JEFF HECHT

3/82 *Auburndale, Massachusetts*

REPLY FROM AIP: I suspect one reason Jeff Hecht finds the PHYSICS TODAY subject index easier to use than those in *Applied Physics Letters* and *Physical*

Review Letters is that it is much smaller, with only a fraction of the total number of entries found in the journal indexes. Also, the PHYSICS TODAY subject-index headings are chosen anew each year to suit the articles and news items indexed that year, much as the subject index of a book is made up to suit the entries that appear in it. The Physics and Astronomy Classification Scheme, on the other hand, is designed to suit all AIP journals and most of the member-society publications, and must remain reasonably static from year to year with periodic updates every few years. Thus a search covering several years' worth of indexes, or several journals, can be made on the same set of terms. In addition, consistent indexing brings like articles together in the five- and ten-year cumulative indexes produced for most of the journals but not for PHYSICS TODAY.

If Hecht finds alphabetic listings especially to his taste he should look in the back of the AIP publication *Physics and Astronomy Classification Scheme*, where he will find all the PACS terms laid out in alphabetic order. We will be happy to send him (or anyone else) a copy for \$15.00 prepaid; ask for AIP Publication R 261.2.

JOHN T. SCOTT

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3/82

Physics for architects

Recently, Albert Bartlett commented on the failure of the physics community to reach out more effectively to students of architecture (October, page 9). We heartily agree; physics clearly has a message for the budding artists who would turn their designs into buildings. Since Cal Poly University has the na-

tion's largest school of architecture (1500 students), and since California is located in the heart of "earthquake country," we have been teaching resonance (the damped, driven, coupled oscillator) to our students for the past decade. In fact, the accompanying photo shows some of our students shaking some building models with our "earthquake spectrometer" that has been modeled after Mössbauer spectrometers. The amplitude and phase of the structure are monitored by comparing the driving and pick-up signals with a Lissajous figure on an oscilloscope. The students also perform various practical experiments on electricity and solar energy; they also make visits to neighboring homes as "house doctors" to determine infiltration leaks with a blower door, to determine heat losses through walls and windows with heat-flow meters, and to determine energy usage by appliances with kWh meters. Since the heating and cooling of buildings consumes about 25% of the nation's annual energy budget, the physics community has an opportunity to reduce the waste of energy in buildings. The text used in this required course, *Physics for Modern Architecture*, builds on the required two quarters of Halliday and Resnick. We found that the third quarter of the normal engineering-physics sequence that dealt with esoteric E&M (Gauss's law, Ampere's law, and so on) was of little relevance to the architects, and now they (and we) are much happier talking about the classical physics topics of resonance and energy loss.

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11/81

"Scientific" creationism

I am glad that PHYSICS TODAY has finally recognized the existence of creationist scientists ("Mainstream scientists respond to Creationists", February, page 53). But I am sorry that the Council of the American Physical Society has chosen to side with the evolutionists. In their statement, the men of the council assume that the theory of evolution is more scientific than creationism. Readers of PHYSICS TODAY should know better—at least because of one article which appeared a decade ago in this magazine, entitled "Thermodynamics of Evolution."¹ The article made the following intriguing statement:

The probability that at ordinary temperatures a macroscopic number of molecules is assembled to give rise to the highly ordered



Architectural models are shaken by Cal Poly students Elizabeth Fisher and Douglas Maze with the "earthquake spectrometer," which uses Lissajous figures to monitor the amplitude and phase of the resonances of the structure. (Photo by Brad Hartwell.)

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structures and to the coordinated functions characterizing living organisms is *vanishingly small*. The idea of spontaneous genesis of life in its present form is therefore *highly improbable*. . . (Part 1, page 23, italics mine).

As I understand English, the authors were saying that evolution is highly unlikely, with a probability near zero. But apparently because they could consider no other explanation for the existence of life, they assumed that evolution is a fact. They went on to say:

... even on the scale of the billions of years during which prebiotic evolution occurred.

The rest of the article went on to grapple with the apparent contradiction between the idea of evolution and the Second Law of Thermodynamics. As far as I could tell, the authors failed to resolve their problem. The best they could say was:

Thus, in principle at least, if we supply a system with a sufficient amount of negative entropy flow, we can maintain the system in an ordered state. (Part 1, page 24).

Maintaining a negative entropy flow is the same as putting *information* into the system. Without a source of information (God, for example) evolution cannot take place. Thus the authors wasted a lot of time trying to resolve the contradiction between the "highly improbable" theory of evolution and the experimentally-verified Second Law. Perhaps if they had known that there is very little evidence in favor of evolution,² they would have pursued a more fruitful line of research.

As a former evolutionist and a present creationist, I have looked at both sides of the issue. As a PhD in physics and a scientist at a national laboratory, I find creation a *scientifically* more satisfying explanation of the universe than evolution. As a member of the American Physical Society, I think that its leaders should quit trying to prop up the theory of evolution. If the facts cannot support it, let it fall.

References

1. I. Prigogine, G. Nicolis, A. Babloyantz, *PHYSICS TODAY* (November, 1972) Part one, pp. 23-28. Part two (December, 1972) pp. 38-44.
2. D. T. Gish, *Evolution—The Fossils Say No!*, Creation-Life Publishers, San Diego (1980) Third Edition.

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3/82

In "Mainstream Scientists Respond to Creationists", page 53, the point was made by David Helfand that "while theories in science are falsifiable, crea-

tionist beliefs are not. When the empirical data don't offer the desired result, God can be understood to be as inventive as any creationist imagination. . . ." The conclusion to be drawn from Helfand's remarks is that any attempt to refute creationism on the basis of physical evidence is an exercise in futility. The only remaining alternative for those who would defend science is to present a logical refutation of the Christian god. Fortunately, this is not difficult.

Although Christians are not in complete agreement as to what god is, there are six characteristics which almost all of them would accept as at least a partial list of his attributes:

- ▶ God is the creator of the universe.
- ▶ God is omniscient.
- ▶ God is omnipotent.
- ▶ God granted man a free will.
- ▶ God performs miracles.
- ▶ God makes science possible by providing the consistent structure inherent in the universe.

Because these characteristics are logically contradictory, the Christian god cannot possibly exist.

The first characteristic is self-contradictory. To show this one may note that if god created the universe then god must be separate from the universe. However, since the universe is everything that exists, to not be a part of the universe is to not exist. So if god created the universe then god does not exist.

As for the next two characteristics, "omniscience" means god knows everything while "omnipotence" means god can do anything. However, if god knows everything then he knows everything he will ever do, which means that at any given instant he can only do what he already knew he was going to do and he cannot do that which he knew he was not going to do. Therefore if he is omniscient he cannot be omnipotent and *vice versa*.

Omniscience also contradicts the idea that man has a free will, for if god knows in advance everything a person will do for his entire life it is ludicrous to claim that that person has any choice in the matter.

The final two characteristics listed are that god performs miracles and god makes science possible by providing the consistent structure inherent in the universe. A miracle is an event that violates and is therefore unexplainable in terms of the structure of the universe. Thus if god performs miracles there can be no consistency to the structure of the universe and science becomes an impossibility. A biologist cannot study the properties of an apple if at any time it may be changed into an orange or a unicorn at the whim of some unknowable supernatural being.

To the above arguments most Chris-

tians would reply that belief in god need not conform to "mere" logic because it is attained through faith. Once Christians have, by means of such a reply, admitted the irrational nature of their beliefs, they will no longer be able to pretend to have any basis for claiming that those beliefs are even remotely scientific.

JOHN C. BORTZ
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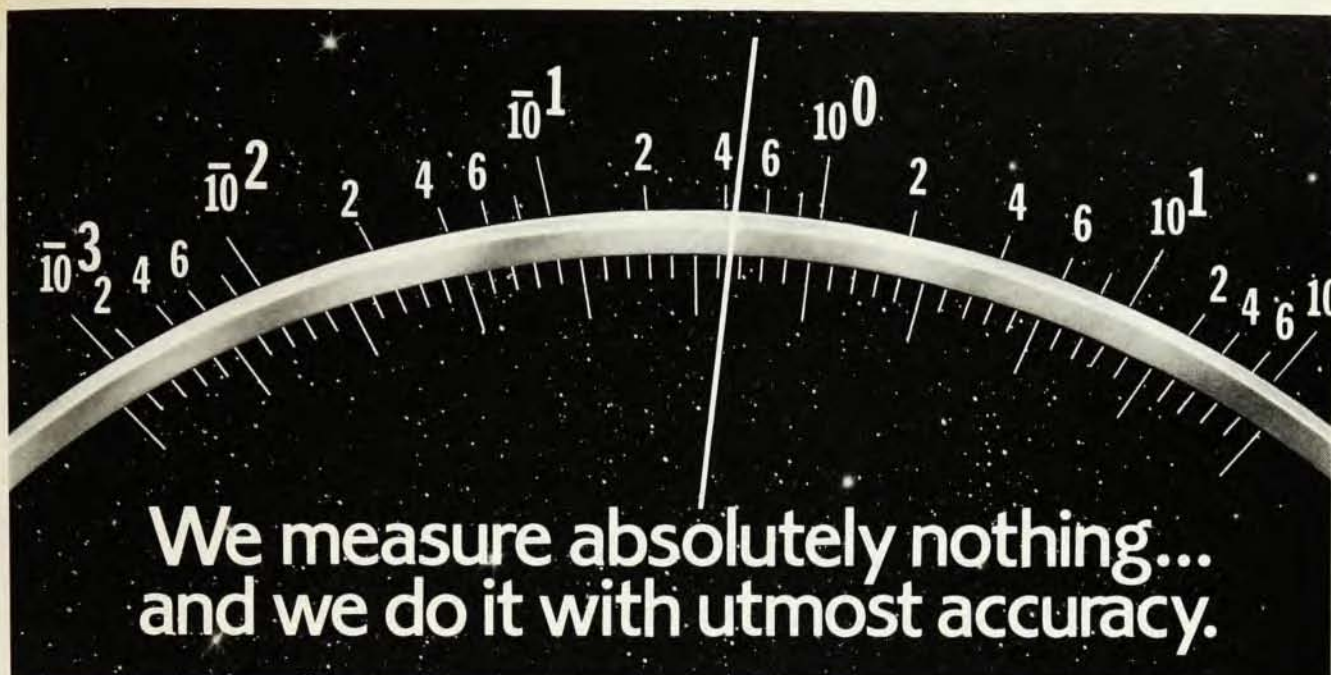
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Harold Davis was correct in his observation ("What is a scientific theory?," editorial, February, page 128) that creationism is not exactly science. The fundamental reason, of course, is that the "experiment" cannot be repeated (although some intelligent beings in genetic engineering apparently expect at least to recreate life). For this same reason, however, evolution is not exactly science either.

While we do not have the usual privilege of repeating the relevant experiment, we do have scientific evidence by which we can decide whether it is reasonable to believe creationism or evolutionary theory. (Actually, all of scientific theory requires belief based on evidence—see Stratton, *Electromagnetic Theory*, 1941, page 1.) In fact, we now have much more scientific information than was possessed by Darwin, including the limits of breeding set by genetics, the laws of thermodynamics, Pasteur's falsification of spontaneous generation, the discovery of many more fossils showing few if any transitional forms, and the discovery of the complexity of living cells and even proteins showing the fantastically low probability of purely random origin.

As mentioned in the same issue in "Mainstream scientists respond to creationists," there is also a debate on the decay of Earth's magnetic field. We now possess measurements of this rather rapid decay over a 150-year period. These measurements are consistent with a theory developed in 1884 by Sir Horace Lamb (Phil. Trans. Royal Soc., London 174, 519-549) for the monotonic decay of a dipole magnetic field caused by electric currents in a spherically symmetric conductor with finite conductivity, and provide evidence for belief in a very young earth.

To believe on the basis of all available evidence that princes have come from something like frogs, jellyfish, and the primordial "soup" surely takes at least as much faith as belief in special creation by an intelligent Being. This latter belief was held by such intellects as Newton, Kepler, Pascal, Sir Francis Bacon, Faraday, Joule, Maxwell, Linnaeus, Pasteur, Stokes, Lord Kelvin, and Lord Rayleigh. We hope that our children will be able to



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Experimental Meson Spectroscopy

Editors: S. U. Chung and S. J. Lindenbaum, Brookhaven National Laboratory

Proceedings of the Sixth International Conference on Experimental Meson Spectroscopy, Brookhaven National Laboratory, Upton, New York, April 25-26, 1980

The advent of QCD has brought many changes to the field of meson spectroscopy. The twenty-nine papers contained in this compilation address many of the untested yet crucial points surrounding quantum chromodynamics. Contributions from an international array of physicists who are active in the field make this a diversified collection from the sixth annual conference.

Table of Contents: Resonances in $\pi\pi\pi$ and $K\pi\pi$ Systems, R. J. Cashmore; K^-p Interactions at 11 GeV/c: New Results on Strange Meson Systems, Blair N. Ratcliff; New Results on $K\pi$, $K\bar{K}$ and $\bar{\Lambda}p$ Mesonic States, W. E. Cleland et al; Heavy Vector Mesons, B. R. Kumar; New Results on Radiative Meson Decays, B. Collick et al; Dynamics of Light Hadrons—Mostly Glueballs, John F. Donoghue; Review of $\bar{p}p$ Production Experiments at CERN, A. Ferrer; Search for Narrow $\bar{p}p$ States in 10 GeV/c π^+p Interactions, D. R. Green; Search for Narrow $\bar{p}p$ States in the Reaction $\pi^-p \rightarrow p\pi^- \bar{p}p$ at 16 GeV/c, S. U. Chung et al; Review of NN Formation Experiments, Gerald A. Smith; Theories of Baryonium Exotics and Multiquark Systems, Anthony J. G. Hey; Search for the Narrow S-Resonance in a Measurement of $\bar{p}p$ Total Cross Section Using Wire Chambers, H. Aihara et al; Charmed Mesons from e^+e^- Annihilation, Gerson Goldhaber; D. Meson Production by photons and neutrinos, James E. Wiss; Charm Production in Hadronic Interactions, M. S. Witherell; Measurements of Charmed Meson Lifetimes, J. D. Prentice; Radiative Transitions to an n_c (2980) Candidate State and the Observation of Hadronic Decays of This State, Elliot D. Bloom; Radiative Transitions from the ψ (3095) to Ordinary Hadrons, D. L. Scharre; New Results on the Υ -System from DORIS, H. Schröder; Results on the Υ Region from CLEO at CESR, C. J. Bebek; Results on the Υ Region from the Columbia-Stony Brook Experiment at CESR, J. Lee-Fransini; Recent Theoretical Developments for Heavy Quark-Antiquark Systems, E. Eichten; Flavor Mixing and Quark Decay, Ling-Lie Chau Wang; A Search for Narrow States Produced in the Reaction $\pi^-p \rightarrow n + \gamma$'s at 13 GeV/c, I-H. Chiang et al; Recent Results of Mark J, The AACHEN/DESY/MIT/NIKHEF/PEKING Collaboration, presented by M. Chen; Recent Results on $\gamma\gamma$ and e^+e^- Annihilation from the Pluto Experiment, Gerhard Knies; An Overview of QCD in Relation to e^+e^- Annihilation and Brief View of Single Particle Spectra, Harvey L. Lynch; Recent Results from the JADE Collaboration at PETRA on e^+e^- Annihilation to Multihadrons, L. H. O'Neill, Jr; D and E Mesons and Possible KKK Enhancements, C. Bromberg et al.

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letters

learn all the available scientific evidence and decide for themselves whether to agree with these men.

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3/82

Now the creation-evolution debate has entered the physics journals. As a confirmed "creationist" I am also opposed to the proposal of "equal time." Perhaps the public educational system is not the place to discuss origins. The theory of evolution cannot rightly be taught as fact, and many biology teachers probably don't know the biblical account well enough to present it without serious misunderstanding.

Perhaps the public high-school biology course, for example, should only content itself with classification and not origins. The families who feel strongly about the current issues will probably soon teach their children at home or send them to a private or parochial school that teaches what they wish to hear.

It is reassuring to remember that our country's freedoms allow us to differ in opinion and even criticize the current scientific paradigm without fearing house arrest, imprisonment, or exile to some less than desirable portion of the country. Keep your journal as open, objective, and as impartial as possible.

KENNETH ALBERTSEN

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3/82

Your news article on the response of scientists to creationists presents, I think, encouraging evidence that positive steps are beginning to be taken to resolve the creation-evolution controversy. I have been following the creation issue for several years and have found that in many cases the creationists come across to the average citizen as fair and open-minded, while the evolutionist appears closed-minded and doctrinaire. It is time that scientists offer clear, honest and objective answers to the points raised by creationists. A combination of ridicule of the creationist position and appeal to scientific authority is not sufficient to stem the rising tide of creationism.

H. R. BROOKER

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3/82

Your editorial urged physicists to battle the current rash of clerics-against-evolution. That contest ought not re-

quire still another round. Instead, we ought to agree on the following:

► There is no evidence to support the notion that living things are the result of known processes affecting inert substances, and no acceptable theory of such a process has been developed.

► While the bare historicity of evolution is undeniable, no known process or acceptable genetic theory connects earlier and simpler species to the later and more complex, that is, primate to man.

If we accept the above as we should, then in turn the clerics should be able to agree that

► No proper exegesis of *Genesis* 1 requires a young earth; its writer can be thought of as describing a sequence without being also burdened with a chronology—ancient Hebrew was short on vocabulary: yom (Hebrew "day") was as good a choice as any other for the idea, "epoch."

If we can agree on these three propositions, this unhappy controversy should disappear.

JOHN I. MAHLER

Vienna, Virginia

4/82

In his editorial "What is a scientific theory?", Harold Davis calls for action by physicists in building stronger school science programs, in response to the current interest in creationism and the laws requiring it to be taught. Something is clearly wrong when scientists will not obey a law enacted by the majority of the people, and go to court to try to escape from having to. The underlying problem has been aggravated by a failure of some educators to recognize, as the APS does in its statement on creationism (February, page 54), that religious beliefs are an element of the human experience. A scientific theory can indeed predict observational data. But it cannot answer a student's questions like "Who created me?" and "What is the purpose of my life?" Unfortunately, the science class (consciously or unconsciously) may try to answer: "You are the product of random interactions of molecules governed by physical laws." "Your life is without meaning or purpose." Such atheism has no place in the science classroom. When the science courses are properly neutral on religious matters, then people of religious faith will have no further reason to call for curricula to be modified by biblical teaching.

Where information about the scientific method is not coupled with respect for experience or authority, a young person without a sense of purpose may well feel encouraged to experiment with sexual perversion or drug abuse. All parents with a high regard for traditional values will press for change if this is a result of their children's education.

There are deficiencies in the scientific enterprise that must be rectified. Physicists need to be scrupulously honest. Alienation from science after working in a laboratory where conclusions were drawn from insufficient evidence or where data were falsified, followed by a religious conversion, has led some people to disbelieve valid scientific results and to embrace creationism.

Students may never perceive the elegance and beauty of true science. Complex detail about concepts like relativity, molecules or evolution, which are not intuitively evident from experience in the real world, fills their courses. The creationist alternative then becomes appealing: It is simple, being based on the obvious stability of biological species; it has a circumscribed finality, as an interpretation of an inerrant holy book.

Physicists should interact more with theologians, frequently isolated from the larger academic world in small religious colleges. They might then understand the anguish or lostness that pastors discern in many young people, who may be their own students in a large impersonal physics class. In turn, the theologians, who educate the pastors of tomorrow, need to be better informed about science. Our pastor can call forth hundreds of letters to legislators from a committed congregation; when science is better appreciated, these will urge more sensible action than anti-scientific teaching.

More attention should be paid to religious writers who respect science. In Darwin's time Charles Kingsley, Asa Gray and George Frederick Wright sought to resolve the apparent conflict between evolution and the doctrine of creation. Today many others continue this work. Affirming the truth of the scriptures, given for spiritual edification, these writers generally see in evolution an account of how God creates in the actual imperfect world, the very good world of *Genesis* 1 and Eden now being inaccessible because of human sin.

Whether or not they openly acknowledge the Author of the laws of nature, all physicists should cooperate to remedy the weaknesses that have allowed scientific creationism to spread like a virulent disease. Otherwise God will no longer entrust us with greater knowledge of his creation. He will permit victory to go to the creationists, thereby degrading our educational system and withholding from our generation the privilege of sharing in the ministry of Christ—feeding the hungry, healing the sick, and teaching the ignorant.

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4/82