

LETTERS

on communication, knowledge and encouragement.

What has all this to do with the state of science and engineering within Hispanic culture? We've heard much ado about the crisis we are facing in these disciplines. The picture is truly bleak, though not hopeless. Our children are turning away from and not entering these disciplines, which offer the greatest opportunity for growth in the future. It is a crisis. It is a tragedy. It is a shame. Where is the turnoff occurring?

The problem is complex and will likely require a motley of solutions. However, there is one fundamental aspect of the problem that is intimately connected with our very culture and undermines all other efforts at solution: our silence on science. We do not speak of science in our homes. When our children ask about our world, they are misled, ignored or told to be silent. Why so much fear? Is it based on reality, or are we hiding from spirits? Science has got to come out into the open in our homes if our children are to partake of its opportunities for happiness and success. There is little, if any, tradition of science in our culture (not any that has survived, anyway), and so we fear it, perhaps naturally. That is one legacy we do not want to pass on to our children!

Let's be strong and face up to our fears of the unknown. Let's talk. The night is not so forbidden. Any child will tell you that there are things to see in the dark, for children have curiosity and imagination that light their way like the moonbeams of Xarantanga. We can all learn from them. The cover-up must end—else our children will remain like the lamb, quiet and still.

C. J. SALGADO

7/91

Los Alamos, New Mexico

Why Is a Physics PhD Like a Juggler?

I would like to offer some comments on the exchange of letters in the May issue (pages 96 and 99) on the current shortage of jobs for young physicists in the US.

When I received my PhD in physics in 1966 from a state university, I made ten job applications, which resulted in nine offers—perhaps a normal percentage in those “golden days.” The first offer was a postdoctoral position with Carl Sagan, then at Harvard; his letter neglected to mention what the salary was or the duration of the appointment, so I

went to Bell Labs (Murray Hill) instead. Despite our good fortune in graduating at the right time, neither I nor my graduate school colleagues ever assumed that we would be employed as research scientists or professors. We often discussed explicitly the fact that a PhD in physics no more guaranteed a career as a physicist than a PhD in philosophy guaranteed a career as a philosopher! But it seemed so intensely interesting an academic path that we could not reject it and its risk.

In the intervening 25 years I have lived for more than 5 years out of the US, including several years in countries (such as the USSR) where a PhD or the equivalent legally *does* guarantee a career in physics. I do not find such a system preferable to that in the US; it simply means the people who will work in physics research are chosen at age 18 or 22 instead of 27 or 30. These decisions, based as they are on less information, are not likely to be wiser.

It is not clear to me what the problem is that Kevin Aylesworth addresses in his letter. If it is that there are too few research jobs in physics for the number of PhDs we produce, we could improve the ratio in several specific ways: We could greatly restrict the immigration of foreign students and scientists, or we could flunk the lower half of each year's graduating crop of PhDs (every group must have, by definition, a lower half). The general public does not seem interested in doing the former, and our physics departments seem unwilling to do the latter.

Alternatively, we must hope that PhD students in our physics departments become more realistic about the country's economy. A fair comparison to the physics PhD is the juggler. Juggling takes considerable natural ability and years of training. Unfortunately for jugglers, vaudeville is dead; no one will pay to watch people juggle—or to diagonalize Hamiltonians! I know several jugglers and many more PhDs in English literature who would love to receive the \$22 000 salary Aylesworth reports one physicist's rejecting, just for doing what they were trained to do. Why should physicists be treated better than jugglers?

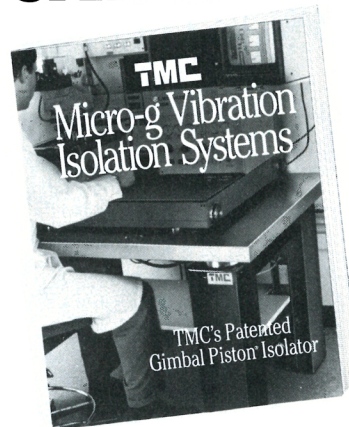
JAMES SCOTT

5/91

University of Colorado, Boulder

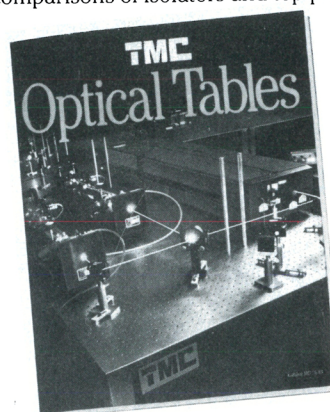
AYLESWORTH REPLIES: I agree with James Scott that a PhD in physics should not be a job guarantee, and that physics students should understand that the job market in physics is tight. The problem I have been con-

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cerned about is that the very best new PhDs have been having significant difficulties finding permanent employment at the same time that many people, including physicists of Scott's generation, have been led to believe that a shortage of scientists—defined as a surplus of permanent jobs—exists. At the time I wrote my letters (October 1990, page 13; May, page 99) very few older physicists were convinced that there was any problem with the job market. My letters were designed to educate young and old physicists about the employment problems facing my generation.

The general public still believes that there is a scientist shortage; just ask your closest nonscientist friend. Better yet, ask your representatives in Congress who passed the Immigration Reform Act of 1989 based, in part, on a belief in that shortage. Although I don't think that particular law is bad, I do think that Congress should make decisions based on accurate information.

Scott's comparisons of physics PhDs to philosophy and English literature PhDs and jugglers leave a lot to be desired. First, the government spends a great deal of money on each physics PhD produced. Second, I doubt very much if the public and Congress would pay much attention to a projected shortage of PhDs in philosophy and English literature, or of jugglers. Finally, according to a philosophy professor I know, philosophy departments send all applicants for graduate school a letter that explains the poor employment prospects for PhDs in philosophy. It would be nice if physics departments would do the same.

KEVIN AYLESWORTH
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7/91

Scanning Tunnel Vision

I recently attended a meeting that included presentations on scanning tunneling microscopy. Almost every talk used a different method of presenting the STM images, and many of them used more than one form within a single talk. Moreover the majority of these methods of presentation seemed to obscure rather than communicate the information in the image.

I write this letter to appeal for uniformity in presentation and to offer my strongly prejudiced opinion as to which method should be chosen.

STM micrographs are presented with the value of the measured pa-

rameter at each pixel represented by vertical displacement ("y modulation"), by color, by intensity (gray scale) or by any combination of the above. In addition, micrographs are presented at normal incidence, in isometric projection or in perspective view; they can have shading as if obliquely illuminated or not.

The reasons for some of this confusion are clearly historical. Early images from scanning tunneling microscopes were recorded using repeated traces on a pen recorder. In this case there is no choice but to use vertical displacement to represent the signal. Very soon, however, computer graphics presentation took over and that has led to the present mess. Two things seem clear to me. First, y modulation has been retained for no good reason—except that the pen-recorder plots established the habit. Second, many of the other tricks have been introduced because the computer permits them, not because they aid scientific communication.

The data consist, after all, of a two-dimensional array of scalars. The natural way to present such a data set, and the method that would be used in any other field, is a monochrome image in which the intensity at each pixel represents the value of the scalar. Replacing the gray scale by color contouring (as in geographic maps) is useful when the dynamic range of the data is too great for reproduction or visual perception in monochrome. Any additional tricks seem to me to be counterproductive.

Now I concede that for presentations to managers or to funding officers, it may be appropriate to use an image that is visually spectacular, but for scientific purposes, can we please agree that communication of information and consistency are more important?

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4/91

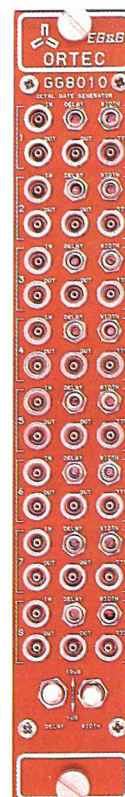
Central Bureaucracy Stifles Good Research

John J. Gilman's generally perceptive article on research management (March, page 42) ignores basic changes in the structure and *de facto* purpose of research organizations that have taken place over the last 20 years. The structural change has been the rise of a permanent central administrative bureaucracy, funded by overhead. These days researchers, projects and even sponsors may come and go, but the central bureaucracy remains. The *de facto*

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