letters

dent confidence in physics and of dealing with underprepared teachers. A major focus of the institute, however, is making physics relevant and fun for the students. The resource agents share innovative demonstrations, learn how to conduct a physics olympics and perform innovative labs, many of which can be done out of the classroom.

The 200 resource agents around the country (100 trained in 1985 and 100 additional teachers trained this summer) have committed themselves to giving workshops and holding outreach programs for teachers in their hometowns, counties or states. The 1985 resource agents were able to reach 8000 high school physics teachers in the first year of the program—four times the original goal of 2000 teachers. They not only put on workshops but acted as mentors to individual teachers, published local newsletters, performed demonstrations at area conventions of science teachers, wrote articles for AAPT professional journals, and more. A quick glance at the "PTRA news and notes" section of the AAPT *Announcer* will illustrate the scope of our activities.

So somebody out there does care. We in the PTRA program are dedicated to improving the teaching of physics on the pre-college level, in the process, we hope, passing our enthusiasm along to others, both students and teachers.

YVETTE A. VAN HISE
Marlboro High School
Marlboro, New Jersey

9/86

More Indian 'tribal leaders'

It is heartening to see an article on scientists from India who contributed immeasurably to the establishment of great and lasting scientific institutions in that country (May 1986, page 36). William Blanpied could have come up with a list of nine "tribal leaders" without doing injustice to the "pioneer scientist" aspect, but doing full justice to the cultural aspect of India because 9 happens to be a very venerated numeral in Indian scriptures. The three scientists I would have liked Blanpied to add to his list of six are S. S. Bhatnagar, P. C. Mahalanobis and K. S. Krishnan.

Bhatnagar was the chief architect of the chain of over 40 laboratories that exist now in India under the banner of the Council of Scientific and Industrial Research. Mahalanobis was responsible for giving statistics and statisticians an independent existence and respectability in India. Krishnan was the first director of the National Physical Labo-

ratory, the first laboratory established under the aegis of the CSIR.

Homi Jehangir Bhabha, Bhatnagar, Mahalanobis and Krishnan were close to Jawaharlal Nehru and each in his characteristic way influenced Nehru in shaping the future scientific institutions of India. Among these four Krishnan was the philosopher and wise man. It can be stated as a fact that Krishnan had a sobering influence on the other three, rather strong-willed personalities. Today a larger number of scientists claim closeness to the Prime Minister of India, but unfortunately none can equal, let alone surpass, the scientific stature and vision of the tribal leaders. All those interested in seeing India contribute mightily to the international scientific effort in a healthy manner should reflect deeply on this deficiency in post-independence India and take remedial measures.

Finally, a comment in respect to Blanpied's conclusions: I do not think the question to be asked is whether or not basic research helps the growth of a developing nation. The real question is, how can one develop in a nation scientific institutions that blend harmoniously with its cultural institutions? It is the brittle nature of the present way of alloying science and culture, be it in a developed country or in a developing country, that is resulting not only in the misuse of science but also in the damage of culture.

S. V. Pappu
Indian Institute of Science
Bangalore, India
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A cure for refereeing's ills?

Authors of scientific articles are familiar with the problems and frustrations caused by the present refereeing system. We all feel that refereeing of articles is highly needed and that sometimes it also fulfills the important and constructive purpose of identifying mistakes in manuscripts or of pointing out additional relevant data. On the other hand almost every one of us has the feeling from time to time that refereeing is being abused or at least that it does not meet its basic requirements.

I would like to propose a significant change in the refereeing system that may help to remedy some of its deficiencies. The first round of refereeing should be exactly the same as it is now: An author (or several authors) submits a manuscript for publication, and it goes through a process of refereeing by one or more referees. The main reform that should take place is in the next round of the process, and only in the case where the author(s) and the referee(s) completely disagree about the merit of the manuscript. A common case nowadays is that referees recommend not publishing the manuscript, and they usually have the upper hand over the wish of the author(s) that it be published. My proposal is that if the author(s) insists on publishing the article, then it should be published, but each referee should have the option to add comments following the paper with his full identity exposed. It should be emphasized that this would only be an option and any referee would have the right to decline it. I believe that this change would improve many of the practices that now exist. First of all, it would encourage referees to raise concrete objections rather than such claims as that the article is "uninteresting" or "unimportant" or "speculative" or you name it. Moreover, referees would probably be a little more cautious not to raise objections based on opinionated or semi-subjective arguments. On the author's side it may also improve matters, since nobody really likes bad comments to follow his article, and he will think it over many times before deciding to go ahead and publish it. And last but not least, the scientific community will also benefit from such author–referee controversies, which will stimulate more reading and discussion of scientific papers.

Gideon Gilat
Technion, Haifa, Israel
6/86

Physics recapitulates geometry

One comment should be made about Leo Kadanoff's Reference Frame column of February 1986 (page 6), especially its last paragraph: Based on a purely geometric intuition, René Just Haüy (in his 1822 *Traité de Cristallographie*) related the external form of crystals to the form of their elementary building blocks. This is shown on page 2 of Charles Kittel's *Introduction to Solid State Physics* (third edition, Wiley, New York, 1966). This shows that in solid-state physics, geometry was prior to physics. Without the geometric concept of lattice periodicity, solid-state physics would have developed much more slowly—or not at all.

Exploration of various fractal geometries could be comparable to the early stages of crystallography. Physics needs nowadays to describe complex objects as a first step toward understanding their physical properties. Conversely, it is useful to remember that there is still no demonstration in physics that crystals should be periodic.

B. Sapoval
Ecole Polytechnique
Palaiseau, France □
5/86