enough physicists to fill vacant positions, I would point out that the signs are that that is not going to happen anytime soon, and if it *does* happen it might not be a bad thing either, because we would then be in a better bargaining position to improve our working conditions. In a capitalist system like ours, adjustment by supply and demand sounds logical and rather trivial.

So why can't our physics leaders see it? Their views appear to be rather puzzling at first. Note, however, that all the roundtable participants are senior members of the profession who are either tenured professors or have good, secure positions. Encouraging more students to go into physics increases the supply of cheap labor that would enable their own groups to obtain more research funding and increases membership in their community, with all its trimmings (for them). It is therefore unrealistic to expect them to look after the interests of the junior members. Until the situation improves I am afraid younger physicists will have to get together themselves to ensure the continuity and future prosperity of the physics profession.

V. K. YEE
3/93 *Arcadia, California*

I have read about and partaken in many discussions regarding the current increased difficulty in obtaining funding and its effect on the job satisfaction of academic scientists. There is general agreement about this increased difficulty, yet funding in constant dollars has, if anything, risen. Little attention has been paid in Leon Lederman's article "Science: The End of the Frontier?" (published in January 1991 as a supplement to *Science*), the roundtable discussions in PHYSICS TODAY or my own conversations to explaining this apparent paradox.

One possibility lies with the demand—more scientists are competing for the same piece of the pie. A trend of increasing levels of research has occurred in the last ten years at many colleges and small universities. Faculty at more liberal arts colleges are now expected to establish rigorous research programs, where once they put all their energy into educating students. As the supply-to-demand ratio for science faculty has increased, small universities have been able and have chosen to hire faculty with stronger research programs than those faculty being replaced; research provides both prestige and financial support for these universities. This process, however, increases the net demand for funding resources.

I believe in the current economic climate we should neither ask for nor receive increased funding levels to satisfy a growing demand for research resources. Perhaps we ought to address how to best balance our own demand with the given supply.

BENJAMIN R. COWEN
University of Pennsylvania
3/93 *Philadelphia, Pennsylvania*

As a young physics postdoc in academia, I would like to offer my impression of the roundtable discussion that was featured in the February issue of PHYSICS TODAY:

I am a deck hand on a supertanker. An enormous iceberg has been sighted and we are headed straight for it. The captain and his officers are frantically discussing what to do about it. The crew, however, are looking for the lifeboats, because they know that supertankers cannot be turned on a dime.

GANE KA-SHU WONG
California Institute of Technology
3/93 *Pasadena, California*

"Roundtable: Physics in Transition" missed the important point that it is physicists themselves who are in transition.

They are in transition to poverty.

Advertisements for PhD physicists in the same issue offer about $29 000 per annum. Enough for a man 28 years old with a wife and two kids who has nothing in the bank because he has been investing his time, ability and energy in his future, do you think?

You pay peanuts, you get monkeys, and then where will the next generation of organ grinders come from?

PETER DUNCAN
3/93 *Walnut Creek, California*

Investment Climate Stunts Tech Transfer

Over the last 12 years an attitude has been fostered and championed in this country that the best use of investments is measured solely by the return on investment. This argument has been used to suggest that taxing rich investors, particularly those whose returns were the highest, is bad, because it takes money from people who obviously know the most about doing what's good for the country, as measured by all the money they are making, and gives it to people who are economic failures,

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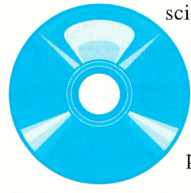

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namely the government.

So, how well have such investors done over the last 12 years? They have made lots of money in programmed trading, where by using statistical modeling, one can pump money from fluctuations by trading on volatility. They've made lots of money in leveraged buyouts. Basically, they've learned that one can get huge returns on investments without having to compete at all; all one has to do is sell off capacity.

How about the issue of investors' actually exercising control over the corporations? Unless one has the leverage to be a raider, most investors don't have much control at all. Large companies consider most investors nuisances. Management appeals regularly to the Securities and Exchange Commission to have stockholders' access limited, complaining that the staff and support required to handle stockholder requests cost millions annually. One impact stockholders do have is to urge companies to increase immediate quarterly returns at the expense of long-term projects. Companies with lots of these projects thus tend to be somewhat undervalued and look like good takeover targets.

How about the question of the coupling of stock market performance to actual corporate competitiveness? While there have been some very dramatic stock market failures recently, the market has done very well for a nation plagued by problems with international competition. The Dow Jones industrial average, recently in the 3300 range, up from the 1000 range a decade ago, does not look like an aggregate investment picture reflecting serious structural problems with production and competitiveness.

If stockholders do not have significant influence over how production is managed and actually seem to have benefited in the short term from the reduction in competitive capacity, what do they need physicists for? Most applications of discoveries from basic research seem to have taken around two decades to develop. If investors can make lots of money by not making anything, why pay physicists to work 20 years on the kinds of research that take a basic discovery to the market? Remember, this is the same group of investors who profited by giving up TV to the Japanese and who decided that the costs of developing a consumer electronics version of the VCR just could not be justified.

Yet the same voice that favors such investment policies has found expression in the idea that the physics community should be more responsible to society in bringing critical technologies to market. By the standards described above, this responsibility to society is to be measured solely by returns on investment. With attitudes persisting that research is just too expensive and that competitive development takes too much off the short-term returns on investment, it becomes difficult to see how physics can justify itself.

In a way, the idea that physics should be made more accountable to investment interests and that its recent performance has been "pie in the sky" is somewhat mythical. If we examine the last 20 to 40 years, we see that the notion that physics, and basic research in general, has failed to contribute to our economy and the interests of investors is ludicrous: What would be the delta to our economy without semiconductor electronics, laser technology in communications and consumer electronics, not to mention physics applications in health and medicine, magnetic resonance and other imaging technologies, microwave and satellite communications, and so forth? That physicists have somehow changed in the last 20 years in such a way that we don't have anything more to contribute is just as laughable.

What things is physics doing today that will have practical impact? There's mesoscale physics: When chips get dense enough that the thermodynamics of depletion layers starts to verge on the border of dynamics and stochastic fluctuation, and band structures start to look like discrete transitions, there will be significant impact not only on how traditional design is handled but also on what kinds of new devices might be constructible. There are single-electron devices and large-scale problems such as protein folding and other interdisciplinary studies. Nonlinear physics, chaos and dynamical systems show up in a wide range of problems, including everyday systems such as the weather. Lab techniques such as picosecond spectrometry, scanning tunneling microscopy and nanoscale technology are probing and manipulating matter on scales only dreamed of 15 years ago. It's an exciting time to do physics. The community is exploring such a wide range of problems. Yet there are connections between these areas that are often subtle. Any sizable reduction in the population of active researchers would not just seriously do damage to our pursuit of many interesting questions but also cause the mutual contributions to suffer incalculably.

If physics looks so good right now, what is the real problem with technology transfer? I believe the problem has to do not so much with *doing* technology transfer as with *valuing* it. Right now, our investment and corporate culture has a problem when it comes to evaluating returns on investment. This isn't to say there are not some systemic problems: Technology becomes obsolete at very high rates. The cost required to keep at the competitive cutting edge is high and does not maintain its value for long. It is hard to maintain accustomed profit margins in the face of such demands. Intellectual assets also don't have a long shelf life. Yet the most permanent assets companies can have are self-renewing and can remain productive and competitive for 20 years or more. The problem is that they walk around on two legs and go home at night. Their expense looks to investors and management like competition for profit margin rather than worthwhile investment. It is hard to see researchers as involved participants making an investment of their loyalty and careers in developing products and bringing them to market.

I don't think the problem with technology transfer has been the fault of physics. Nor do I feel that as a community we are unwilling to participate in solutions to the problems we've been facing, as some people have accused. I suspect those people have misinterpreted the indignation that many bright people who, having been trying for a long time to make a technology transfer to reluctant investors, feel when told they haven't been trying hard enough. It's becoming clear that our economic health cannot just be measured by return on investment, but that it has to be measured by technological development, employment rates, competitiveness and taking products to market. That's where physicists do have contributions to make.

DANIEL E. PLATT
3/93 *Yorktown Heights, New York*

Cosmic Background: No Conflict with Relativity

In a letter that appeared with the headline "Reconciling COBE Data with Relativity" (March, page 13) Robert J. Yaes asks why the cosmic microwave background does not constitute a privileged reference frame.