letters

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Vocations vs. avocations

I read with interest the letters regarding employment in November. If I may, I would like to present another view of the employment issue. My comments are not directed at those who entered physics just to become physicists, but at those who study physics because of an insatiable desire to disrobe nature and marvel at her charms on the most fundamental level attainable.

The point I would like to make is best illustrated by an example: my own. I have had experience in both experimental and theoretical physics as evidenced by a few of my publications.[1–4] Of these papers, three were a matter of survival, whereas the fourth[4] was an act of love. I was paid only for the first three; the fourth was based on my dissertation (University of Houston, 1977) and was only indirectly supported by a teaching fellowship. Herein lies the essence of the employment problem.

Many of us would like to work on pet projects of our own choosing. However, society is unwilling and unable to support most of these efforts. Consequently the majority of physicists, especially in my generation, must seek means of financial support in areas very often remotely related to our professional interests. These are the facts of life and they are unlikely to improve in the foreseeable future. Grim, isn't it?

No!

There are many professions open to physicists at all levels (BS, MS, PhD) today because of our broad training in the physical sciences. Furthermore, many of these professions pay far better than post-docs or assistant professorships.

Ah, you say, you're listening to a mercenary. Not so, and here's why.

If you'll browse through the want ads at the back of this magazine you'll see virtually every available position is for only one to two years and is to be filled by an individual to do a particular chore. If this chore is your cup of tea and you get the job, great! Usually, however, the chore is just that: a chore. Can you do better than this?

I think you can. When I entered physics I hoped to develop a theory of nature as I understood it. I'm sure many of my colleagues had a similar motive for embarking on the difficult, albeit gratifying, study of physics. I considered myself fortunate that I was able to develop such a theory for my PhD dissertation; however, this permission was granted only after I demonstrated my competence as a scientist by doing work others wanted done. This is as it should be. Unfortunately there are no funded positions for the work I'm interested in, so I turned to industry for my livelihood. The big advantage I now have by working in industry is that I can generate my own resources to achieve my objectives, including publishing a novel.[5] I have the freedom to select what topics I want to work on as my avocation while my vocation pays for it.

Need I remind you of Albert Einstein's tenure in a patent office? The opportunities available to him then are there for us now, as my case illustrates. Those of you who do not find a job in a government laboratory or academia shouldn't despair. Don't be afraid to go out in industry and make your mark, and while you're at it, do some physics of your own choosing. We may have another Einstein waiting in the wings!

References

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Engineering physics

In the last year there have been a number of articles and statements regarding job opportunities for physicists and about new programs designed to give young physicists an applications orientation. An option not discussed has been in effect at the University of Virginia since the early 1950's. This option requires neither new courses nor additional faculty course loading, but rather an enlightened cooperation between the already existing applications-oriented programs (that is, the engineering programs) and a physics department.

The Engineering Physics program has been producing students in applied physics who have taken roughly half of their courses in engineering and half in physics leading to Masters of Engineering, Masters of Science and PhD degrees. The job opportunities have been excellent, particularly in the classical-physics oriented fields (fluids, mechanics and gas dynamics) as well as in the solid-state

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area. The faculty participants in the program have resisted the temptation to develop separate applied-physics courses, requiring the students to take existing graduate courses in engineering and physics as well as preliminary examinations split between the two schools. In addition, there has been created a graduate co-op program at the Master's level, which further increases the employability of the Masters of Engineering students.

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Stock-market fluctuations

Rolf Landauer's comments (November, page 23) on the influence of noise on "open systems" are well illustrated by recent fluctuations of historic proportions in the stock market. The market may be considered an open system in which an adequate flow of money will effect a transition from disorder (random walk) to order (cooperative or crowd behavior). Near the critical threshold it is highly susceptible to noise (random economic or political news).

In mid-October of this year the Federal Reserve Board announced that the discount rate of interest charged to member banks would be raised to an unprecedented 8.5%. This bad news came at a time when the market was near the transition threshold (undamped). It resulted in the largest single-week decline in history (59.08 points on the Dow Jones Industrial Average) and a staggering two-week loss in the market value of all stocks on the order of 100 billion (10^{11}) dollars!

The concept of the second-order phase transition in equity markets is new. It implies that the market is not always efficient, that is, the impact of random economic and political news is not always discounted (damped) quickly. In particular, a virtual lack of damping near transition implies a highly inefficient market, characterized by large, long-lasting fluctuations.

Noise (chance developments) always has a strong influence on the stock market, and it represents an ever-present element of risk to investors. By understanding that the market is of necessity more susceptible to noise during the undamped transitional period, investors can be aware that even small changes in economic or political fundamentals at these times can have a big impact on the market.

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THE AUTHOR COMMENTS: Tonis Vaga points out that the coupling of the opinions of people leads to situations that share some of the characteristics found when many physical degrees of freedom are coupled to each other. This point has been brought out on a number of occasions.[1]

I would like to supplement Vaga's example with one that may be equally important for the readers of PHYSICS TODAY.

The evaluation of scientific work has become much like the stock market; the influence of the opinions of others provides a coupling leading to positive feedback, and to a strong dominance by fads and fashions. Just as the investor can no longer ask: "Which company will do well?" but must ask, "Which company will *others* think will do well?" the scientist who asks, "What are the important problems?" instead of, "What will *others* think are the important problems?" takes a serious risk with contract-granting agencies and with his chances for invited papers. You need competitors to be grouped into a reasonable APS meeting session.

Some clustering into communities of interest is, of course, essential to the healthy development of science. I believe, however, that we have let the coupling, leading to positive feedback, get out of hand.

Reference

1. W. V. Smith, Science **167**, 957 (1970); E. Callen, D. Shapero, PHYSICS TODAY, July 1974, page 23. For other citations see refs. 1 and 21 of my PHYSICS TODAY paper.

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Too many physicists

I feel that the letters of Robert Yaes (February, page 83), G. Adomian (June, page 48) and others (November, page 15) have put too much emphasis on tenure and missed the important point.

The careers of physicists are far longer than the careers of professional football players. For example, out of the 45 players on the 1972 Washington Redskins team, only seven are still present in 1978. On the other hand, many physics departments hire as many postdoctorals every year as the draft choices of Los Angeles Rams or New York Giants. With or without tenure, there will be few positions for young physicists. Take another example; there is no tenure system in the national laboratories or industrial laboratories, but the turnover rate is not much higher than the universities with the tenure system.

We must recognize that the physics community is now approaching the steady state rather than the expanding state. The number of physicists has grown fifteenfold since 1926, when the dawn of