

Citizen-scientist: an oxymoron?

...Rustum Roy



At a recent American Association for the Advancement of Science annual meeting, in a session on "Science and Democracy" many of the speakers agreed that in practice the term was an oxymoron, at least for the vast majority of scientists in academia.

Can materials researchers behave like citizens first? That means thinking about the whole of society and our science's place in it, in that order. Scientists are forever complaining about the 'scientific illiteracy' of the public, without considering either their own citizenship knowledge, or the consequences of a citizenry genuinely knowledgeable about science, but financially and professionally disinterested in it. There are large numbers of such. In the US, they work in the Congressional committees or as members' staffers. They work in science agencies. They work in the dozens of public interest groups. Unlike the media, where many science reporters have become mere cheerleaders for science, such citizens – although knowledgeable about and appreciative of science – are critical of many of its aspects. Daniel S. Greenberg's most recent book [*Science, Money, and Politics: Political Triumph and Ethical Erosion* (2001) University of Chicago Press, Chicago] adds to the corpus of recent informed but critical views of how science works, also to be found in the books by John Horgan [*The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age* (1997) Broadway Books, New York], Daniel Sarewitz [*Frontiers of Illusion: Science, Technology, and the Politics of Progress* (1996) Temple University Press, Philadelphia], and Jean Gimpel [*The End of the Future: The Waning of the High-Tech World* (1995) Praeger Publishers, New York]. What do scientifically literate citizens think about science? Try those books to calibrate your literacy.

I am saddened by a situation in which so few scientists appear active in social and political causes. But even closer to their work, few scientists appear concerned about why their particular work should be funded at all, and also whether the present system of funding is effective and efficient. At the most basic level, the tragedy in academia is the situation that de-focuses scientists from the realm of ideas and experiments to the constant attention to raising money.

In the past, professors in the sciences and engineering had the luxury of being able to give their full attention to their ideas and their science. Success was

assembling some gear, getting new data, and explaining them with new theories. Success was a radically new experimental result or a new theory.

What a change! Today, the major success of a faculty member is the award of a contract. At least one-third of an active faculty researcher's time goes into the 'proposal system', and much emotional stress and anguish. Yet few complain. Leo Szilard, the great citizen-scientist, got it exactly right in his book *The Voice of the Dolphins: and Other Stories* [(1992) Stanford University Press, Stanford]. His 'Agency' would have simply consumed *all* the time of scientists in writing and reviewing proposals, but always giving them the money – leaving no time for research.

The operative question for citizen-scientists is *not* how much money we get, but what we produce with it. Take this example. Three major discoveries in materials research occurred within a year: high T_c superconductors, chemical vapor deposition (CVD) of diamond films, and the Lanxide composite-making process. As a rough estimate, superconductor research, with a huge (and continuing) publicity push, has absorbed about \$10 billion of the world's R&D effort; CVD diamond, also with much PR, possibly \$1 billion; and Lanxide, with zero PR, less than \$50 million. Seventeen years later, what have the citizens got for their bets? Not much yet. The annual product value appears inversely proportional to the R&D effort, and it is very small potatoes (\$100 million in Lanxide, \$50 million in CVD diamond films, and a smaller amount in superconductors).

The point of our story is: was the PR-driven route the best way to do materials R&D, to capitalize on these new discoveries? My opinion is a firm 'no'. The alternative, adopted by a few countries and now by most industries, is to fund only a few of the most talented and relevant groups and wait. If there appears to be real advances in finding potential applications, *then* ramp up the effort.

The positive side of this story is that materials research is certainly one of the most easily justified parts of science today. Our products are tangible, making a difference in ordinary peoples' lives. And competition drives prices down. There is an excellent case for materials research, but as citizen-scientists, let us set new standards of probity and accurate justification for our needs and opportunities, and let us champion the cause of less costly-in-time processes for funding, and less focusing of research by hype.