

Marginalia

Plainly Speaking

Roald Hoffmann

On December 10 of last year, the Nobel Prizes for 1986 were awarded. The Concert Hall in Stockholm was glittering. The diplomatic corps was there, some in national dress; I and a thousand other guests in white ties and tails and evening gowns. Above sat the Stockholm Philharmonic, on the stage the massed members of the Swedish Academies, the laureates, the royal family. The award ceremony was done in style, the style that derives from the mystique of the prize and many years of practiced perfection.

The ceremonies were also transmitted by television, nationally and to most of Europe. Each set of laureates was introduced by a member of the Swedish Academy of Sciences. When the time came to recognize the chemists, Sture Forsén, a distinguished expert on nuclear magnetic resonance, came to the podium, took out a pocket lighter, flicked it on, and began:

A burning flame—a little everyday miracle that has astonished and fascinated most of us. A chemical reaction that produces heat and light and that during historical times has modified the conditions of life for mankind and made developing civilizations possible even on our northerly latitudes. But at the same time also a chemical transformation in which the products formed slowly have modified our atmosphere and most likely will also affect earth's climate.

There followed a five-minute exposition of the prize-winning work of Dudley Herschbach, Yuan Lee, and John Polanyi.

Forsén's talk was lucid and interesting, an able popular account of the brilliant basic research of three modern physical chemists. It was heard and seen by millions. And as I sat and listened to it, I reflected on how rare it is that scientists speak about their own work, or that of their colleagues, to the general public.

Is it important that we do so? Of course it is, in every way one can imagine. The public out there ultimately supports our research (if we are at a university) through its tax dollars. The informed citizen will let the talented expert carry out his or her basic research. He will put the promise of immediate technological benefit in abeyance. Such a citizen will accept a certain measure of vagueness about what is actually being done, and will take the excitement of the scientist as a sign of creative activity. For a while. But at some point, we have to tell people (not the least among them being our parents and spouses) what it is that lures us back to work nights and Sundays, why it's thrilling to open a new issue of the

hint, in language understandable to them, of what is happening at the free, exciting frontiers?

Scientists and engineers must tell the people around them—relatives, young people, fellow citizens—what it is they are doing, and why they are doing it. There are two aspects to this telling—the opportunity to do so must exist, and so must the desire. One can complain about the lack of venues—popular science magazines, after an initial surge a decade ago, are retrenching. No one wants to come to those popular lectures. No one has the time to read or listen. But my perception is that the lack of opportunities to reach out to the general public, or their lack of response, is the lesser part of the problem. Where there is a will, there is a way. I think that the will is not there.

There is no question that it is more difficult to describe our work to an audience unfamiliar with all those conventions, codes, and abbreviations that we use, not to mention the history and the setting of the problem. So when we try to speak of our work, we get flustered, frustrated. It's easy to blame the intended recipient of the message for the failure to communicate. Perhaps he is "scientifically illiterate"! So much more rewarding to use the little time that we have just to talk to those who understand our language. They are the ones whose opinion we value, who might review our next grant, who will perhaps (dare we hope?) invite us to chair a conference.

This is a cop-out. This will not do. The scenario may be a caricature, but perhaps it touches on the psychological imperatives guiding the behavior of scientists. We must talk to the public. I think the option not to do so is just unfeasible. To devise a plan for us, as individuals and as a community, for reaching out more and more effectively, I suggest that we take a look at what motivates scientists and how the reward system in our micro-society operates. Then let's use some psychological insight to help us change.

A desire for knowledge and understanding drives us. But precious few are strong enough to subsist on the satisfaction of achieving that understanding alone. We depend on others to reward us, to praise us for the knowledge that we have discovered or created. The rewards are all intertwined; there is no way to sort them out. But if I were to make a list, I would say that most important is the opinion of other scientists in the international community, expressed by the content of their papers, citations, invitations to lecture, being asked for opinions on hirings and firings, memberships on committees, etc. Second is the opinion of the funding agencies, expressed so exquisitely and summarily in their granting or denial of funds. Third ranks the voice of colleagues in our departments (this is a university perspective); even lower, the attitudes of faculty and administrators outside our intellectual enclave, not to speak of

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the community where we live. It's clear that the opinions and recognition of all three constituencies are interwoven—the funding agencies rely on evaluations by peers; local promotions and salary increments do so as well. Still I will stick to the claim that there is an order, and thereby a priority list, for a program that might seek to change attitudes toward speaking plainly, but clearly, to the public.

The psychological tactic I would recommend is not very sophisticated, but based on personal observation. I seem to be driven as much by a sense of duty and obligation as by just plain *wanting* to do something. I don't necessarily like myself for that, but I think I can use "the system"—this poorly motivated stuff that I am, and the society around me—to do more than I want to do, more than I think I can do. I often create, of my own free will, obligations, deadlines, and then I respond to them by doing what has to be done. And more.

A caricature again, but I think many people function, indeed achieve, this way. The strategy, then, for enhancing our ability to talk and write about science is to create obligations that are coupled to rewards, to make us do what we think we can't (but once we do, it turns out to be easier than we thought, and the next time still easier . . .). Here is an idiosyncratic set of suggestions, based on this line of thought.

1. Swedish Ph.D. theses are usually written in English these days. I was looking through one given to me by Margareta Blomberg, a theoretical chemist at Stockholm University. I noticed a six-page section in Swedish, which begins with a story. While she was writing her thesis, having finished her work, Blomberg went back to her hometown, and in the street met an old acquaintance. This person, curious and well educated, but not a scientist, asked Blomberg what she was working on for her Ph.D. Blomberg had difficulty in replying. So she promised herself to write a common-language summary of her thesis in Swedish, addressed to someone like that friend. And she did.

How about institutionalizing this process? Let us include as a thesis requirement not only weird rules for margins and figure captions, but also a requirement for a plain English summary, *not* a technical abstract, of the work. The parents of our Ph.D.s will be grateful.

2. Speaking of summaries, such common-language ones are standardly required as part of federal grant proposals. I suspect that they're not taken very seriously by either the people who write the proposals or the granting agencies. Indeed, one would not want to base a funding decision on the quality of an abstract. But recall, it is on the basis of just such abstracts, or even less—a title—that Senator Proxmire makes his Golden Fleece anti-awards.

I would suggest that the authors of successful grant proposals be required, not as part of the initial application, but in the continuation proposal (i.e. between the first and second years of the grant, when there's less to write), to compose a three-page account of their work, addressed to a lay audience.

To encourage people to take this seriously, Congress might put aside a small pot of money (say 0.1% of the agency's budget), divide it into small but not insignificant parcels (say \$5,000), and award it to already supported programs as a bonus. The competition for

these awards would be based on these popular abstracts alone, and the judges would not be scientists. The award-winning summaries would be prominently published. The scheme is far-out, but my intent is clear.

3. Any general lectures I've put together were not spontaneous creations, but in response to obligations. For instance, invitations to present the Walker-Ames Lectures at the University of Washington and the Silliman Lectures at Yale carried with them much honor, good honoraria, and said, politely, that I had to give two or three public lectures, nontechnical. I didn't have three such, only one. Being a good boy, I put together two more.

Most professional lectures are frantic one-day stands, informing the local specialists of the lecturer's recent advances. But every university, every department has some endowed lecture series that are longer—from three days to several weeks. It would be most appropri-

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ate if every invitation to present one of these prestigious series carried with it the obligation of a general lecture. People will rise to the occasion. And the lecturers in such named series are role models—their performance in an expository mode will be noted by younger colleagues.

4. Indeed, the mind-set of the scientific community is affected by role models, by what leading scientists do. I think the style in which young people do their research, and in that I include how they apportion their time, is influenced more than what they actually do. There is a premium on finding something different, so young researchers choose new subjects for study. But they model their approaches and working habits, often unconsciously, on the scientific and personal style of people they admire. Or people who they see succeed.

It is, then, very important for scientists of stature to show a serious interest in speaking of science in a way that everyone can understand. Mind you, those successful scientists (a) should not be too old, or (b) too successful at their popularizing. Not too old ("old" here probably means ≤ 49), because popularization, like too much interest in the history or philosophy of science, is taken as a sign of softening, the kind of thing a macho scientist in his prime just wouldn't think of doing. Not too popular, or petty jealousy will creep up. If he is so good at talking about science—and we know that takes time, so much time—the presumption is that there must be something inadequate in his science. I suspect that there is some illogical reaction along these lines in the astronomy community to Carl Sagan, a remarkable expositor who has done more for science around the world than any other person I know.

We should encourage outstanding young and middle-aged scientists to lecture to the public, to write, to make films. Editors of scientific and popular journals should pick up these attempts to reach out, and quote them.

5. Attitudes form early. The problem is to get our

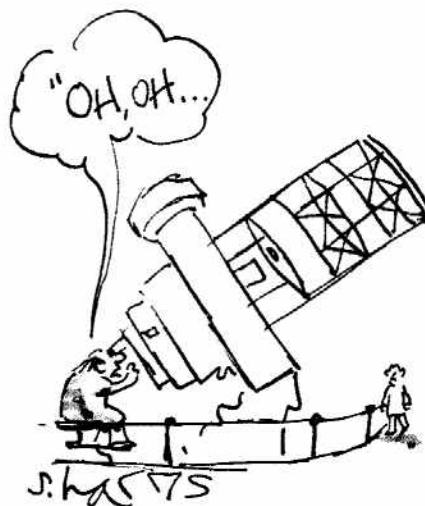
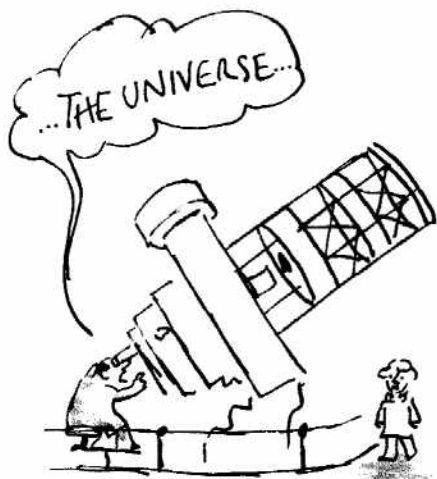
younger industrial people, our assistant and associate professors, to value the popular description of their work. Speaking of industry, I must say that I really appreciate those glossy two-page spreads of advertising, describing simply some exciting research at Company X, accompanied by some snappy photographs of the carefully groomed scientists at work.

How about reviving in the United States what is common in Europe, the inaugural lecture by a new professor? Since achieving tenure is a clear marker, and occasions some revelry, why not turn it into a real celebration? Invite the family of the successful associate professor, his or her legendary long-suffering spouse. Invite him to speak to the family. I think the ritual and happy setting will elicit a superb general lecture.

These ideas may be thought small, but since we are dealing with established perceptions and value judgments, no major legislation will effect instant change. I

think a strategy of many small incentives will work in time. Anyway, the reader will think of other ways. What energies or emotions can we harness to make popularization popular?

The obstacles to speaking plainly are great. The questions we are trying to answer in our research are framed in a complex hierarchy of concepts that took lifetimes to build. To simplify may be to trivialize, like being asked to give a one-paragraph English abstract of Rilke's *Duino Elegies*. But think of the alternative to *not* trying to explain what we are doing, not just the technological end or the medical benefit, but the hard (and sometimes soft), beautiful logic that fascinates us. The alternative, not really far down the road, is a cutting off from the society that supports us, and from those close to us; a sinking into still more jargon; the alienation of just those young people whom we want to join us.



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