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The secrets of my prizewinning research

Serge Haroche, *co-winner of the 2012 Nobel Prize in Physics, warns against the growing trend towards short-termism in science funding.*

Since last Tuesday's phone call from Stockholm and the media frenzy that followed, I have had no time for deep reflection. But the past weekend, which began with a rainy day in Paris, allowed me to collect my thoughts on questions asked over and over again during the past few days. What has made this Nobel prize possible? What is your research useful for? What would you say to decision-makers at a time when they are ready to listen?

The research recognized last week is the fruit of a long quest, initiated 35 years ago, when my present colleague and co-worker Jean-Michel Raimond was my PhD student. With Michel Brune, who joined us ten years later, and the research group we built, we learned to juggle with atoms and photons — to prepare and to manipulate those strange entangled states that are the essence of the quantum world. We had exhilarating moments, when an expected phenomenon revealed itself. Equally, we had to deal with catastrophic equipment failures, correct the consequences of wrong decisions, and overcome seemingly insoluble technological difficulties.

Luck played a part of course, because there was no guarantee that we would be able to achieve the quasi-perfect mirrors that make up the photon box for our experiments. One speck of dust could have ruined everything. But, more than luck, our success has relied on the unique intellectual and material environment of the Kastler Brossel Laboratory at the Ecole Normale Supérieure (ENS) in Paris. There, I was able to gather a permanent research group of exceptional quality, transmitting expertise and knowledge accumulated over time to successive generations of bright students. The courses I gave at the ENS at graduate level and those I have been giving during the past ten years at the Collège de France in Paris have also been part of this adventure. To prepare a new set of lectures each year, I had to focus on different aspects of light–matter interaction.

Our experiments could only have succeeded with the reliable financial support provided by the institutions that govern our laboratory, supplemented by international agencies inside and outside Europe. European mobility programmes also opened our laboratory to foreign visitors, bringing expertise and scientific culture to complement our own. During this long adventure in the micro-world, my colleagues and I have retained the freedom to choose our path without having to justify it with the promise of possible applications.

Unfortunately, the environment from which I benefited is less likely to be found by young scientists embarking on research now, whether in France or elsewhere in Europe. Scarcity of resources due to the economic crisis, combined with the requirement to find scientific solutions to practical problems of health, energy and the environment, tend to favour short-term, goal-oriented projects over long-term basic research. Scientists have to describe in advance all their research steps, to detail milestones and to account for all changes in direction. This approach, if extended too far, is not only detrimental to curiosity-driven research. It is also counterproductive for applied research, as most practical devices come from breakthroughs in basic research and would never have been developed out of the blue.

Some might find my vision too pessimistic. Funding programmes open to curiosity-driven research (managed, for instance, by the French national research agency (ANR) and the European Research Council (ERC)) do exist. Grants are, however, limited to three or five years, far too short a time for an ambitious long-term project. The emergence of the ANR and ERC grants has been concomitant, at least in France, with a decrease in recurrent state funding for laboratories, so that opportunities for long-term blue-sky research by young scientists have shrunk. It is, of course, naive to believe that such funding will substantially increase in the foreseeable future. A solution to this problem might be to create junior ERC grants that extend over ten years, with an evaluation at mid-term.

France also has additional problems. Starting salaries in French research agencies are much lower than those paid to postdocs by ERC grants. They become acceptable higher up the ladder, but young scientists, even when successful, are stuck at the bottom for too long. If more money could be put into the system, it should go there.

Some improvements could be achieved at no cost. French academic institutions form an entangled ensemble of universities, research councils, schools and government agencies, through which even the French cannot easily navigate. Every reform has added a new layer, so that most labs depend for funding and evaluation upon a plethora of institutions. That means bureaucratic hassle for scientists, who spend a great deal of time filling in forms and writing reports instead of doing research. The system cries out for simplification.

I should be delighted if bright young students were attracted to basic science by the description of the experiments recognized by this year's Nobel prize. I can only hope that they will be granted similar opportunities to those that my co-prizewinner David Wineland (at the US National Institute of Standards and Technology) and I have been fortunate enough to experience: being free to choose their research goals and to manage their own efforts over the long term, and able to afford the pursuit of hazardous paths before seeing the light. ■

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