

Physics: No longer a vocation?

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The physicists of a bygone golden age could just as easily have been artists. Physics wasn't yet a profession; doing it in one's spare time, as Albert Einstein did in his years at the patent office, was acceptable in much the same way as it is today for a scientist to also be a novelist. That, of course, meant that only those who felt the call of a vocation would voluntarily submit to its rigors and relish the long hours of abstract thought and argument for no reward but the gratification of a deep soul urge. Money came from more mundane pursuits, and promotions or awards were not expected for what was, after all, pleasure rather than work. A fellowship of such physicists-by-vocation was almost Masonic, one imagines, in its intellectual honor and exclusivity. One envisions that the fiercely proud inhabitants of its rarefied firmament would have fought to establish the correctness of their own ideas and never stoop to copy another's.

The twin explosions of relativity and quantum theory put physics firmly and irrevocably on the job map; more and more people were attracted by the creative promise of a physicist's career, and institutes of physics were created or expanded to accommodate the influx. Physics professionals, for whom physics provided both creative stimulation and livelihood, entered the discipline with high idealism. I remember as a 20-year-old telling my mathematician-turned-social-activist father that I wanted to be a physicist because it was objective enough that only merit counted, that it had no politics. His smile had infuriated me no less than the reply that accompanied it: "You're still young. When you grow up, you'll realize that no towers are made of ivory so pure that politics can't enter them."

Of course, I'd trashed him with debating skills that were to stand me in good stead in physics seminars later in life, and with the unshakable and arrogant conviction of youth. My university years, in Calcutta in the mid-1970s and Oxford in the mid-1980s, reinforced my idealism in full measure: My best professors were people of immense in-

tegrity and brilliant intellect, and I felt that the privilege of knowing them and entering their world was reward enough for the longer hours I had to put in compared with people in "easier" disciplines. Merit was all that counted in this charmed world; I had still not encountered politics. When, after my graduation, I was offered a place in one of India's premier business schools, I turned it down disdainfully, saying that the corruption of the world of business was not for me.

During my undergraduate years at Calcutta's Presidency College, physicists seemed to me to be Renaissance intellectuals central to the culture of the times. That was true even among our peers; some of the best overall students in our elite college were physicists—in addition to being ace debaters, talented musicians, and social activists. That picture didn't change much during my graduate years at Oxford; our tutors were often exceptionally brilliant, sometimes eccentric, but always versatile, well-rounded men of ideas. We had the impression that they were living their dreams, fulfilling their vocations. We always understood that had they wished, they could have excelled in almost any profession of their choice.

Right before our eyes

And yet, subtly and insidiously, the profession was beginning to change in front of our eyes. Physics was getting more specialized as advances in one field became increasingly incomprehensible to those working in neighboring fields. Technology and its applications were invading what had traditionally been a domain for original ideas and rigorous arguments. The big questions were beginning to be seen as either solved or potentially unsolvable. It became clear to us as young postdocs that to most employers big toolkits were seen to be more valuable than original ideas, that it was a smarter career move to solve a narrow problem for a potential employer than to branch out alone in search of new problems. Only a very lucky minority were allowed the postdoctoral researcher's

birthright—the luxury of dreaming—between the travails of graduate school and the demands of faculty positions. As a young researcher in Cambridge who was set free to dream by a supervisor of rare enlightenment, I chose to think about the then unheard-of physics of sand grains; I still look back to those years of living dangerously as the happiest in my research career.

Most of my contemporaries were not so fortunate, having been straitjacketed into premature specialization. The prevalence of such career patterns has had global consequences: For example, few soft-condensed-matter physicists can honestly claim to comprehend a string theory colloquium. Although specialization is an inescapable consequence of the huge advances we've made, it brings with it the incipient danger of intellectual relativism—traditionally associated with humanistic disciplines—in which many competing realities can coexist. Why did I use the word "danger"? Simply because physics is meant to be straightforward, because it is based on the underlying laws of nature, because equivocation in physics is usually due to an incomplete understanding of a phenomenon. An ongoing dialectic, such as that between different religions or political systems, is conceptually out of place in a discussion about the physical constituents of our universe.

That, of course, doesn't prevent the increasing occurrence of such dialectics in many branches of physics. Physicists outside a particular subfield are completely ignorant of which, if any, of the warring points of view in a controversy has more merit; that leads, in the realms of phenomenology, to an uneasy truce, to a coalition of opposites in the interests of peace. In many fields, experiments—the old-fashioned way of probing Nature's truths and validating or invalidating theories—either are not feasible or are capable of contradictory interpretations. Computer simulations, which today often replace real experiments, can be even more malleable. Errors of judgment can thus be made despite the sincerest efforts by disinter-

ested arbiters; the many tongues in our Tower of Babel are mutually incomprehensible, spoken only by the insiders concerned.

The spread of technology has only abetted the growing estrangement of subfields within physics. Although technical advances, both experimental and computational, have undoubtedly been useful in addressing previously intractable problems, and although fundamental physics has motivated some of the best technological advances of our time, technique has also occasionally become an end in itself. Unenlightened explorations of ossified subjects can result from an obsession with means rather than end. Even worse, physics tools are being indiscriminately used to make superficial dents in entirely different disciplines, often without due regard for what is known, not known, or of interest in those fields. (Social scientists are among the most sinned against in this regard; fortunately for them, the output from such incursions usually appears in our journals rather than theirs.) Such an assembly-line mindset means that physics papers need no longer be based on original ideas; it suffices that one apply a new set of tools to an existing problem, to solve it to orders of accuracy that seem directly proportional to the problem's intrinsic aridity.

The induction of personnel to man those production lines necessarily emphasizes one-track minds rather than the rounded intellects of yore. Since the latter are rarer, their active de-selection creates a professional climate in which breadth of perspective is increasingly a personal choice rather than a requirement for advancement. Although the same may be true of all academic disciplines, it is particularly unfortunate in physics because the esoteric nature of our concerns makes it difficult for society to understand us, never mind evaluate us. Devoid thus of precise evaluations from within and understanding from without, we've created a netherworld where our much-vaunted meritocracy, our republic of objectivity, has ceased to exist.

A business with small stakes

The effects of these changes are apparent on our profession's anthropology and psychology. Physics is being transformed from an ideas- and imagination-based enterprise to something that sits between dusty academia and monotonous industry; we're replicating, criticizing, and refining rather than dreaming, imagining, and creating. The

best young people are voting with outwardly pointing feet; senior physicists all over the world are exercised by the decline in the numbers of good students choosing to do physics. Of course, the hyperfine structure of the exodus is country-, discipline-, and institution-specific, but a major reason is surely that the best are uncomfortable not only with the material rewards that our profession offers, but also with a perceived decline in its creative stimulus, in the intellectual quality of its practitioners.

Ironically, physics is returning to its vocational status for some—the bylines in publications now occasionally include major financial institutions. Rather than decry such a change, I think physicists should ponder the reasons—surely not only material—for it, and appreciate that despite their migration, some people still love physics enough to spend their spare time doing it.

The exodus of the best leads to the dominance of the rest, with, at times, soul-destroying consequences. Dispiriting anecdotes abound, whose common refrain is the stifling of merit by politics: tales of academics who entertain the editors of journals in the hope of easier acceptance; of professors who award themselves salary increments on the basis of their publications; of impresarios who fly around the globe giving PowerPoint talks whose points are powered by others; of the shady lobbying that often accompanies major awards. And there are more sordid stories whose mention would demean the spirit of this article, but they seem to have become significant enough that national academies in many countries have set up ethics committees; it remains to be seen how many cats will be belled by any of them.

The current circumstances provoke rather depressing reflections on the state of physics and physicists. Dishonesty is never justified, even in the dog-eat-dog world of business, although at least the fat rewards of corporate life can be seen to attract it. But—and this is what is the most puzzling—what is the point of corruption on such small scales as academic physics? Is it the case that when physics turned from being a vocation to a profession, it became a business with very small stakes?

Had my father lived to read this piece, he would, infuriatingly as ever, have let the upturn of his smile convey all that he no longer needed to convince me of—the ubiquity of politics, the fragility of ivory towers, and the decline of nobility in a profession that is no longer a vocation. ■

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