


Advice to a  
Young  
Scientist



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ever thinks of himself as old.

I am properly conscious, too, of joining the company of Polonius, Lord Chesterfield, and William Cobbett,<sup>1</sup> all well known for having advised the young. Although none of their advice was addressed to young scientists, some of it applies. The advice of Polonius was mainly prudential in character and though one can sense Laertes's haste to be away ("Most humbly do I take my leave, my Lord"), it is excellent advice.

Chesterfield's advice had mainly to do with manners, especially the arts of ingratiating. It has little relevance to the circles in which scientists move, which is perhaps just as well because it received a stunning blow from the tail of the great Leviathan of English letters. Chesterfield, Dr. Johnson declared, taught the manners of a dancing master and the morals of a whore.

Cobbett's advice was in a wide sense moral, though it had to do with manners too. Although Cobbett had not Dr. John-

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1. William Shakespeare (1603), *Hamlet*, act 1, scene 3; Philip Dormer Stanhope, IV, Earl of Chesterfield (1694-1773), *Letters to His Son* (1774); William Cobbett (1763-1835), *Advice to Young Men and (incidentally) to Young Women* (1828).

delights and vexations of being a scientist, or about the motives, as  
moods and mores of members of the profession.

Any passage in this book that a reader may think especially apt and illuminating is that which was written for him or her; that which is well understood already will not be thought interesting and will pass by unnoticed.

I have been embarrassed throughout by the lack in English of an epicene personal pronoun or possessive adjective, so for the most part "he" will have to do for "she," and "his" for "hers." Chapter 5 will make it clear that everything I say applies to women if it applies to men.

Almost inevitably, this book embodies a personal "philosophy" having to do with the place of science and scientists in the world. It is a very opinionated book, so something more is needed by way of apologia. In wartime Britain, to establish a personal relationship with the public, the radio newsreaders always announced their identity, often in the following words:

People who believe themselves cut out for a scientific life are sometimes dismayed and depressed by, in Sir Francis Bacon's words, "The subtilty of nature, the secret recesses of truth, the obscurity of things, the difficulty of experiment, the implication of causes and the infirmity of man's discerning power, being men no longer excited, either out of desire or hope, to penetrate farther."

There is no certain way of telling in advance if the day-dreams of a life dedicated to the pursuit of truth will carry a novice through the frustration of seeing experiments fail and of making the dismaying discovery that some of one's favorite ideas are groundless.

Twice in my life I have spent two weary and scientifically profitless years seeking evidence to corroborate dearly loved hypotheses that later proved to be groundless; times such as these are hard for scientists—days of leaden gray skies bringing with them a miserable sense of oppression and inadequacy. It is my recollection of these bad times that accounts for the earnestness of my advice to young scientists that they should have more than one string to their bow and should be willing to take no for an answer if the evidence points that way.

It is especially important that no novice should be fooled by old-fashioned misrepresentations about what a scientific life is like. Whatever it may have been alleged to be, it is in reality

that the graduate student need not change his opinions, lodgings, or friends, but conventional wisdom frowns upon it and is greatly opposed to young graduates' continuing in the same department; lips are pursed, the evils of academic inbreeding piously rehearsed, and sentiments hardly more lofty or original than that "travel broadens the mind" are urged upon any graduate with an inclination to stay put.

These abjurations should not be thought compelling. Inbreeding is often the way in which a great school of research is built up. If a graduate understands and is proud of the work going on in his department, he may do best to fall into step with people who know where they are going. A graduate student should by all means attach himself to a department doing work that has aroused his enthusiasm, admiration or respect; no good will come of merely going wherever a job offers, irrespective of the work in progress.

It can be said with complete confidence that any scientist of any age who *wants to make important discoveries must study important problems*. Dull or piffing problems yield dull or piffing answers. It is not enough that a problem should be "interesting"—almost any problem is interesting if it is studied in sufficient depth.

As an example of research work not worth doing, Lord Zuckerman invented the cruelly apt but not ridiculously far-fetched example of a young zoology graduate who has decided to try to find out why 36 percent of sea urchin eggs have a tiny little black spot on them. This is not an important problem; such a graduate student will be lucky if this work commands the attention of his department. Perhaps the poor fellow

to a word. But it is a warning sign, a shot across the bows. The

Isolation is disagreeable and bad for graduate students. The need to avoid it is one of the best arguments for joining some intellectually bustling concern. It might be his own department, but if it is not, the graduate must resist all attempts by his seniors to persuade him to join it as a graduate student—a warning made necessary by the fact that some seniors are not above using a postgraduate stipendiary award within their gift as a bait to recruit students who would not otherwise have thought to come their way. In these days of disposable equipment, it has become too easy to treat a graduate student in the same spirit—as a disposable colleague.

After graduate students have taken their Ph.D.s, they must on *no account* continue with their Ph.D. work for the remainder of their lives, easy and tempting though it is to tie up loose ends and wander down attractive byways. Many successful scientists try their hands at a great many different things before they settle upon a main line of investigation, but this is a privilege that can be enjoyed only in the employment of very understanding seniors and when the graduate student has not been

lege that can be enjoyed only in the employment of very understanding seniors and when the graduate student has not been enlisted to do a particular job. If he has been, it is his duty to do it.

Because the newly graduated Ph.D. is still very much a beginner, a new migratory movement has grown up in modern science that is spreading as rapidly as the at one time newfangled habit (deplored in the Oxford of my days) of taking Ph.D.s at all. This new movement is the migration of "postdocs." Graduate research and attendance at conferences usually gives graduate students powers of judgment that they often wish they had had before they embarked on their graduate work. Later on they will know a great deal more than they did at first about the places where really exciting and important work is going on, preferably in congenial company. To one or other such group the most energetic postdocs will try to attach themselves. Senior scientists welcome them because as they have chosen to come they are likely to make good colleagues; for their part, the

meanor upon scientists generally, but for the sake of the profession they should take pains not to bring it into disrepute; it is no longer taken for granted that science and civilization stand shoulder to shoulder in a common endeavor to work for the betterment of mankind. Scientists will certainly encounter and must work out some suitable means for rebutting the notion that, so far from trying to better the lot of mankind, the outcome of their work is to devalue much of what ordinary folk hold dear. Through science, you may hear, art has been replaced by artifice: portraiture by photography, live music by Muzak, good food by processed substitutes, and the old-fashioned crusty loaf by a chemically bleached or otherwise "improved," devitaminized, revitaminized, steam-baked, presliced parallelepiped in a polyethylene shroud.

This is an old story, though, which has more to do with avarice, the convenience of manufacturers and dishonest deal-



## *Is Science Undervalued?*

Scientists sometimes feel a little aggrieved that most ordinary folk are so little interested and impressed by their calling.

The explanation of this real or seeming indifference was agreed upon by Voltaire and Samuel Johnson—a conjunction of opinion so unlikely that there must surely be something in it. The explanation is true, so scientists had best come to terms with it, resent it though they may. Science does not have a major bearing on human relationships: on the relationship of governors to the governed; on *les passions de l'âme*; nor on the causes of exaltation or misery and the character and intensity of aesthetic pleasures.

In his *Dictionnaire philosophique*, Voltaire said that natural science "is so little essential for the conduct of life that philosophers didn't need it; it required centuries to learn a part of the

public as the world's problems that confront them do not have a unique solution; that two poets should hit upon the same wording or two composers the same score for

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3. R. K. Merton, "Behavior Patterns of Scientists," *American Scientist* 57 (1969): 1-23. See also R. K. Merton, "Priorities in Scientific Discovery," *American Sociological Review* 22 (December 1957): 635-59; "Singletons and Multiples in Scientific Discovery," *Proceedings of the American Philosophical Society* 105 (October 1961): 470-86; "The Ambivalence of Scientists," *Bulletin of the Johns Hopkins Hospital* 112 (1963): 77-97; "Resistance to the Systematic Study of Multiple Discoveries in Science," *European Journal of Sociology* 4 (1963): 237-82; *On the Shoulders of Giants* (New York: The Free Press, 1965; Harcourt, Brace and World, 1967); "The Matthew Effect in Science," *Science* 159 (January 5, 1968): 56-63.

of the society. True, he gave a paper at the last meeting, but things have moved on since then, and a whole lot of people will be anxious to hear about these later developments.

The old-fashioned remedy for hubris was a smart blow on the head with an inflated pig's bladder—and this is in the spirit of the rebuke that may have to be administered before the young scientist injures himself in the opinions of those who would otherwise like him and wish him well.

*Brilliant Young Scientist.* While he *is* young and if he is genuinely brilliant, his colleagues will exercise forbearance and may even feel affectionate pride at the manifestations of the razor-sharp intellect, the lightning comprehension, and the uncanny facility with which he recollects facts or notions recorded only in the *Proceedings of the National Academy of Sciences* of a banana republic or in a long-out-of-date issue of *The Grocer and Fishmonger*.

quote (in a contemporary translation) was published after his death at their hands.

Scientists as a class are rationalists, at least in the limited sense of believing without qualification in the *necessity* of reason. They would be surprised and offended if any withdrawal from such a view were imputed to them. Rationalism carries with it a professional obligation to combat the modern taste for irrationalism—not just spoon-bending (a fashionable form of psychokinesis) or its philosophic equivalents, but the inclination to substitute “rhapsodic” intellection for the humdrum ratiocination that has satisfied all the world’s great thinkers hitherto. Among the principal antiscientific movements are the cult of the wisdom of the East and of mystical theology—a prose offering to the Almighty, said George Campbell, which, where a living sacrifice would have been deprived of life, had been deprived, instead, of—sense.

Young scientists must however never be tempted into mistaking the necessity of reason for the sufficiency of reason. Rationalism falls short of answering the many simple and childlike questions people like to ask: questions about origins and purposes such as are often contemptuously dismissed as nonquestions or pseudoquestions, although people understand them clearly enough and long to have the answers. These are intellectual pains that rationalists—like bad physicians confronted by ailments they cannot diagnose or cure—are apt to dismiss as “imagination.” It is not to rationalism that we look for answers to these simple questions because rationalism chides the endeavor to look at all.