Real Science

What it is, and what it means

Scientists and 'anti-scientists' alike need a more realistic image of science. The traditional mode of research, *academic* science, is not just a 'method': it is a distinctive culture, whose members win esteem and employment by making public their findings. Fierce competition for credibility is strictly regulated by established practices such as peer review. Highly specialized international communities of independent experts form spontaneously and generate the type of knowledge we call 'scientific' – systematic, theoretical, empirically tested, quantitative, and so on. Ziman shows that these familiar, 'philosophical' features of scientific knowledge are inseparable from the ordinary cognitive capabilities and peculiar social relationships of its producers. This wide-angled close-up of the natural and human sciences recognizes their unique value, whilst revealing the limits of their rationality, reliability, and universal applicability. It also shows how, for better or worse, the new 'post-academic' research culture of teamwork, accountability, etc. is changing these supposedly eternal philosophical characteristics.

JOHN ZIMAN is well known internationally for his many scholarly and popular books on condensed-matter physics and on science, technology and society. He was born in 1925, and was brought up in New Zealand. He took his DPhil at Oxford and lectured at Cambridge before becoming Professor of Theoretical Physics at Bristol in 1964. His research on the electrical properties of metals earned his election to the Royal Society in 1967. After voluntary early retirement from Bristol in 1982 he devoted himself to the systematic analysis and public exposition of various aspects of the social relations of science and technology, on which he is a recognized world authority. He was for many years chairman of the Council for Science and Society, and between 1986 and 1991 he headed the Science Policy Support Group. He is currently Convenor of the Epistemology Group.

To Joan: IN HEART, MIND AND SPIRIT.

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Contents

Preface

The seeds of this book were sown forty years ago. I was always infatuated with science and beguiled by philosophy. They seemed made for each other – and for me. But the better I came to know science, the more I realized that the philosophers were not telling it like it is. Then, sometime around 1959, I was asked to review Michael Polanyi's *Personal Knowledge*[1] and Karl Popper's *The Logic of Scientific Discovery*[2]. Each of these great books says important things about science; but in both I noticed a whole pack of dogs that didn't bark. What about the web of lectures, examinations, seminars, conferences, papers, citations, referee reports, books, personal references, job interviews, appointments, prizes, etc. in which my scientific life was entangled? Surely these must have some influence on the work I was doing. So in radio talks and articles I began to say strange things, such as 'Science is *social*' and 'Research is a *profession*'[3].

Those were rash words for a young and aspiring physicist without official credentials in philosophy or sociology. Nevertheless, the heterodoxy was overlooked and my academic career prospered. The books in which I developed this theme – *Public Knowledge*[4], *Reliable Knowledge*[5] and *An Introduction to Science Studies*[6] – were also very well received, and are still read and cited. Indeed, many of the notions that germinated in these books have since been planted out more formally by other scholars. And just as I foresaw, sociology has superseded philosophy at the theoretical core of 'science studies'.

This metascientific revolution has certainly opened science to much more searching enquiry. But the spirit in which this enquiry has been conducted has actually widened the gulf between those who do science and those who observe their doings. What is more, as I pointed out in detail in *Prometheus Bound*[7] and *Of One Mind* [8], science itself is changing

rapidly, as a profession and as an institution. What is happening? Where are we going? Now, more than ever, scientists, science users and science watchers need a clear vision of how it really, really works and what it can really, really do. But just when they ought to be getting sympathetic, well-informed advice from their metascientific colleagues, they are being offered little but deconstruction and doubt.

It seems to me, nevertheless, that a much more substantial model of science can be discerned within the booming buzzing confusion of contemporary science studies. So, what can I now do to bring this model out into the open, to help science understand itself? In the end, it comes down to the same basic question: is science to be *believed* – and if so, in what sense? This is a much more subtle question than it used to seem. For all their labours, the philosophers have failed to come up with any simple, generally agreed principle on which belief in science might be safely grounded. But sociological critiques are vacuous without reference to the specific contexts in which beliefs are held or made. When I said that science is *social*, I meant that this context includes the whole network of social and epistemic practices where scientific beliefs actually emerge and are sustained.

The trouble is that this network is not regulated by any single prince or principle. To appreciate the significance of scientific knowledge, one must understand the nature of science as a complex whole. That is why I decided, about five years ago, to start again from scratch and work systematically through the whole argument. As in all my writings *about* science, I wanted to show that this argument did not require much scientific knowledge as such, but could be presented perfectly clearly in the everyday language of the common reader. The line of reasoning of this book is lengthy, and visits many different academic sites, but it is not at all technical or intellectually convoluted.

But I also wanted to show that this line of reasoning is no longer a personal fancy. The naturalistic account of science that I am presenting in this book is accepted – albeit tacitly – by numerous reputable scholars. This is clear from the the size of the bibliography, even though this does not pretend to cover all the standard metascientific literature. Indeed, this book would never end if I had set out to expound and/or refute all that has been written about the nature of science, most of which is irrelevant or tangential to my main argument.

But that still left me with a practical problem. I wanted to say what I thought in my own words; so how should these be linked to the words

and thoughts of so many other authors? A mosaic of verbatim quotations would have been unreadably ponderous. Even the scholarly practice of citing every author by name in the text – e.g. 'As Tadpole & Taper (1843) have shown (see also Disraeli 1844) . . . .' – would have interfered with the flow of ideas, and repelled the non-academic readers to whom this book is mainly addressed. On the other hand, the lazy custom of mentioning by name just a few of the usual suspects – Karl Popper, Thomas Kuhn, Robert Merton, Donald Campbell, and so on – does less than justice to many less eminent scholars whose ideas were no less perceptive and original in their time. Or, to put it another way, what really matters is the idea itself, not whether it is conventionally associated with some famous name.

What I have done, therefore, is to indicate all such linkages in the main text by inconspicuous superscripts referring to endnotes on each chapter. To avoid loading these notes down with formal bibliographic information, which tends to be very repetitive and difficult to scan, I have compacted this into a comprehensive alphabetical list of references, accessible directly from the notes by the author's name and date. Moreover, since each entry on this list bears a coded reference back to the various notes where it is cited, the bibliography also operates as an author index for the book as a whole.

But what else beside such bibliographic pointers should these notes contain? In principle I am permissive in such matters, and have always enjoyed reading (and even composing) the addenda, qualificanda, divertenda, detractenda, joculanda, etc. with which a gristly book can be made more palatable. In practice, however, notes easily get out of hand. As footnotes they clutter the printed page, and as endnotes they are out of context. A more austere academic tradition would restrict notes to their ostensible function of relating the contents of the cited work specifically to the place in the text where they are cited. Thus, in addition to recording intellectual priorities, they should give the reader an indication of the attitude of the cited author to the point being made, whether of enthusiastic agreement, qualified acceptance or downright opposition.

But as I have observed ruefully when my own work has been cited by others, that can seldom be done accurately or equitably in a few words. Suppose, for example, that I want to cite Kuhn (1963) on 'paradigms'. Yes, he should certainly get abundant credit for first formulating this invaluable concept – but did he mean exactly the same by it as I am now proposing? Shouldn't I at least hint at differences through verbatim quotes?

What about his later responses to the critical literature that it provoked? How have other scholars interpreted this concept – and so on? Before you know where you are, your note has become a small essay. Practise the same scrupulosity for hundreds of other equally worthy authors, and your whole book has again drowned in its own notes.

Presenting references satisfactorily is a hard problem in a non-academic book. So I have cut the Gordian knot, and included nothing in the notes beyond the formal bibliographic citation. This could refer to anything from a favourable treatise to a scornful aside. But at least it indicates a linkage, a certain congruence of interest, a wave of recognition to a fellow pilgrim on the path through the forest, an invitation to further discourse on a theme of mutual intellectual concern. Academic reviewers will never, of course, forgive this breach of ponderous current practice; but those for whom this book is really written may well be grateful for all those unwritten pages that they don't have to buy or pretend to read.

Finally, I ought to acknowledge the help of all those kind people who have contributed to the creation of this book. Ah, but they are too numerous to list individually. As I said, I began thinking and talking about these matters years ago, and have discussed them personally, pro and con, back and forth, with a great many other scholars with similar interests. In fact, this list would include about half the authors I have cited in the bibliography – although I guess that some of these would not wish to have it thought that they had actually *helped* to bring *these* ideas to birth! Let me just say 'Thank you all!', for the courtesy, conviviality, collegiality and straightforward friendship that has graced these innumerable conversations and communications.

John Ziman
Oakley, August 1998