A man for our season

Science is in a parlous state — passing fashions, a star system and the new cult of management have combined to strangle originality. The ethics of V. B. Wigglesworth offer a cure.

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And as our vineyards, fallows, meads and hedges,
Defective in their natures, grow to wildness,
Even so our houses and ourselves and children
Have lost, or do not want to learn for want of time,
The sciences that should become our country.

Henry V, V, ii 54–58

Throughout the world, but especially in Western Europe, North America and Japan, the sciences are threatened by changes in practice and by erosion of principles. An appreciation of the philosophy that guided the research life of Vincent Wigglesworth (1899–1994), the great insect physiologist[1,2], may help to find a cure for this malaise.

Wigglesworth was a shy man, gentle but single-minded, with a sharp enquiring intelligence. His passionate childhood interest in insects led to science, a medical degree and a lifetime of research on all aspects of insect physiology and morphogenesis. He published 264 papers between 1923 and 1991, in all but 19 of which he was the only author. He wrote nine books and updated his superb text *The Principles of Insect Physiology* seven times. Wigglesworth was extraordinary, both for the number and range of his discoveries, and for the way he achieved them. He started his career when technical know-how and expensive equipment were less important than a clear mind. His approach to research can teach us much that is crucial to the practice of science.

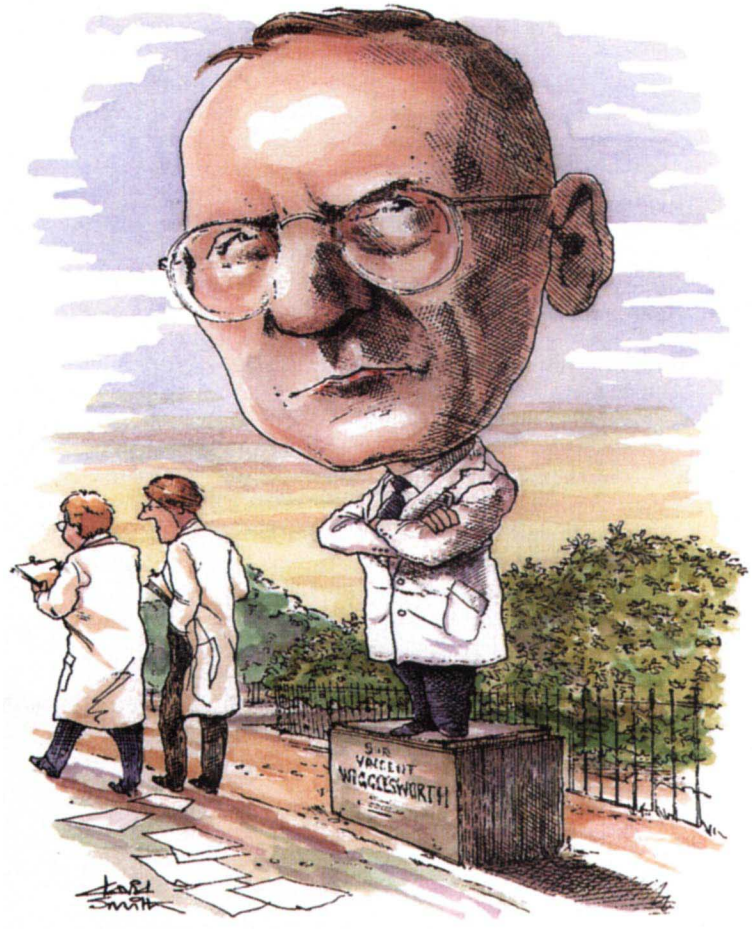
Like Darwin, Wigglesworth believed that the primary purpose of a scientist is to find illuminating solutions to problems: "Except in so far as they contribute to theories and generalisations the scientific mind is not interested in facts"[3]. Many of his discoveries came, not from the narrow preoccupations of fashion, but from keen observation of experimental material, a much more unpredictable and therefore broader source. Nowadays the spotlight cast by fashion, and a star system that highlights the contributions of the few, combine to limit adventures in ideas. Modern science is becoming like the mêlée at a children's party where groups rush hither and thither after any kid who shouts loud enough.

Wigglesworth belonged to a formal and genteel age. He would not talk about his work in progress, nor would he show interest in the unpublished work of others; because he viewed much of what was printed as wrong or misleading, and rightly so, he thought there was little point in paying attention to unpublished material — it was even less likely to be correct. By contrast, modern science thrives on rumour; the stars in each field travel the world, talk at conferences, and publish and republish in the secondary literature. The result is a homogenization of opinion that can stifle originality; a reduction of the tendency of independent schools of scientists, particularly in different countries, to evolve their own approaches to problems.

Journals can also limit originality. Apart from pandering to fashion, editors seem increasingly to be relinquishing what should be their decisions to reviewers[4], and reviewers tend to dislike competitors' hypotheses. Short, clear papers with unifying ideas, such as that of Watson and Crick[5], are out of favour, and detail is becoming confused with profundity. Scientists, who like artists should be trying to build pictures of ideas, are forced into secure but dry descriptions, with any implications hidden by mountains of data. To quote Wigglesworth again: the BBC had returned his script "...asking whether I could let them have something more profound. I replied that I could not promise to write a script that was profound, but if that would be more acceptable, I could easily make it more obscure"[6].

Wigglesworth was very correct: he rarely used a first name, even with colleagues he had worked with for decades. But when he wrote, it was as if he became unshackled from convention and used a simple direct style, free of jargon and acronyms. Nowadays we may be less regimented in dress and manners, but our writing has degenerated into an impersonal coded newspeak that leaves the authors' characters undetectable, their ideas disguised. As Montgomery puts it, "Any point at which there emerges something resembling a truly personal or literary style in a technical article is commonly considered to be a point of failure"[7].

Wigglesworth worked alone — he taught by example and was unwilling to do experiments by proxy. He wrote papers from his own results and was never faced with the dilemma of principal investigators who sometimes have to decide between their own prejudices and the findings of a junior colleague. Not knowing exactly how information is acquired makes it easier to publish



careless or even fraudulent data. Nowadays, heads of laboratories include their own names on papers, claiming ownership of the work done by students or postdoctoral fellows. At its best, the addition of principal investigators' names gives authority, for they are presumed to have checked the results and to vouch for the conclusions. In practice, their function is increasingly managerial, manipulating multiauthorship and name order as part of the politics of science.

Author sequence may be permuted to allow each young scientist in a large group to be first author, so that the sequence no longer signals responsibility. Others with tenuous claims to authorship, and little or no knowledge of the work, may clamber on board (A did the biopsy, B donated an antibody, C checked the statistics, D's technician collected the samples). Papers tend to be written when people leave or need a job, or when a grant renewal becomes due, rather than when the results are ready for publication. The consequence is that many papers have become competitive tokens for insertion into grant-dispensing gambling machines rather than bricks in the edifice of science.

Wigglesworth worked with the introvert intensity characteristic of many creative people. We might now stigmatize him as a loner. Selection committees would judge him lacking in the forceful leadership, managerial skills and salesmanship they suppose to be required in our tough world of entrepreneurial science. There is a place for aggressive scientific publicists, teachers and laboratory directors, but history has shown that original and creative minds are rare, and should be looked for also among the reserved and introspective. We should recognize that the scientific establishment needs many kinds of talent and modify selection procedures appropriately.

Wigglesworth's attitude to students was motivated by his belief that a fresh mind was an asset that should not be squandered, as well as by his wish to be free to do his own research. He recognized that students need to learn how to be independent, so he gave them independence. He did not author their papers. They learned to write early, to take responsibility for the correctness of their results, and to defend their interpretations. Learning how to report results should not be separated from learning how to get results; both are integral parts of becoming a scientist. These days the principal investigator often supervises students and postdoctoral workers very closely. If we liken the search for knowledge to the search for gold, many are trained to be miners rather than prospectors. They leave their mentor and become 'independent', but continue on the same line with groups of their own. Some may go through their entire careers without really choosing their own field of research.

Group science carries the threat of inertia, but Wigglesworth was never troubled by such a problem. For example, although he grew up in a period when geneticists and embryologists rarely talked to one another, and at first had little interest in genetics, he came to understand how relevant it is to his favourite subjects, pattern formation and morphogenesis. He became an ardent advocate for the genetic approach to development[8]. No one can progress far in science without changing ideas and research direction. Yet, in large groups, commitments to grant objectives can make big jumps and opportunistic research too risky. Moreover, careers depend on publications which come more securely from overlapping doctoral theses than from innovation.

> The rise in the dictatorship of the manageriate is lowering the status of scientists, demoralizing them and shredding their sense of purpose

Changes in funding practices are at the root of much of the malaise afflicting science. Take Britain — in Wigglesworth's day, the research councils recognized the excellence of the individual's record as a sufficient basis for scientific support; his productivity, and the diversity and originality of his papers, show the effectiveness of the research council system under which he worked. Things are different now. Grants are awarded on the basis of frequent short-term assessments, a method that discourages adventure. Ed Lewis, for example, would have had difficulty getting support for his Nobel prize-winning work in developmental genetics had he been subject to present-day criteria[9] — his key papers were produced about once a decade.

Wigglesworth had a healthy view of science administration: he thought administrators should see their prime purpose to be the facilitation and encouragement of research and that "Anyone who has tried both, knows that administration is so immeasurably easier than research that it becomes the line of least resistance and that is why research needs encouragement"[10]. Now, numbers of papers, 'quantitation' and audit are emphasized, bedevilling creative activity in the arts as well as in science. The root cause lies in the new cult of management which puts administrators at the top of a hierarchy, confusing management with leadership.

As a result of this trend, an organization with a mission in medical research had its scientific posts evaluated by consultants who devised a questionnaire that rated administrative skills as the most important; and salary disclosures at a group of universities showed that some minor deans earned more than many distinguished scientists. The solution to this problem lies in resisting the tendency of bureaucrats to increase their status and income and in making sure that administration does not compromise the scientific mission. This may not be easy, but democracies have solved the problem in an analogous situation. Police need authority: a police officer may arrest a prime minister, but this does not result in the pay of a police officer being greater than that of those over whom he has authority. Remuneration for administrators and research coordinators needs to be viewed in the same way; it should be of a lower order than that of productive researchers, who by their discoveries can bring major benefits to society.

In both Western Europe and North America, good students are being diverted from science to careers that are more lucrative. Other countries, notably in Eastern Europe and Asia, where higher education is still a way to the top and which recognize the social value of scholarship, now supply the graduate students. The rise in the dictatorship of the manageriate is lowering the status of scientists and scholars, demoralizing them and shredding their sense of purpose.

Clocks cannot be turned back. But pendulums can swing, and we hope that they will start to swing soon in the matters we raise here. Could grant reviewers attach more value to independence in the training of the next generation, favouring projects where students are likely to publish on their own? Could editors invoke Darwin's dictum that "all observation must be for or against some view if it is to be of any service"[11], and insist that publication in science involves the art of telling a story? Can politicians be educated to know what science is and to value it for its long-term benefits, rather than putting their trust in the new cult of short-term management? We should all reflect on the conditions that allowed some people, Wigglesworth among them, to make great scientific contributions. □

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