Genesis by definition

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A small subdivision of that flourishing discipline, the history of science, is the pursuit of the genesis of scientific disciplines. The central difficulty of that pursuit is to define a discipline, or at least delineate an envelope that can contain the essentials of a discipline.

Whenever I contemplate that recalcitrant requirement, I am reminded of Aaron Katchalsky, who said of biophysics (a modern discipline he had helped to create) that "biophysics is like my wife. I know her, but I cannot define her".

To exemplify the problem of definition, consider what the *Oxford English Dictionary* (*OED*, 1989 edition) says about physics: "The science, or group of sciences, treating of the properties of matter and energy, or of the action of different forms of energy on matter in general (excluding chemistry, which deals specifically with the different forms of matter, and biology, which deals with vital energy)." 'Physics' derives linguistically from *ta fusika*, meaning 'natural things', so it might equally well be a name for biology (which certainly deals with more than vital energy).

In attempting to specify what my own modern discipline, materials science, is about, I increasingly had recourse to what philosophers call ostensive definition — to point at something and say: "That is a specimen of materials science." One intention for the *Journal of Materials Science*, founded in 1965, was that its contents should, in the long run, constitute an ostensive definition of this then-new subject. Those who submitted papers to the journal presumably thought — and think — of themselves as materials scientists. I believe that the journal's contents 35 or so years later demonstrate unequivocally that the progressive ostensive definition has worked.

When one consults the *OED* for a definition of 'discipline', one finds: "A branch of instruction or education; a department of learning or knowledge; a science or art in its educational aspect." The linchpin is that adjective, educational, for indeed, the identification and survival of disciplines is nowadays determined in universities.

Historically, individual disciplines, for example physical chemistry, chemical physics (hard to distinguish these two!) and colloid science, as well as my own, have had to withstand successive stages of ridicule and takeover attempts before becoming established or accepted. Perhaps it is through the harsh trial of academic infighting that disciplines win their spurs. Materials science has made it, colloid science never quite did.

The modern 'social' approach to the history of science produces its own approach to an understanding of 'disciplines' in general. John Ziman, a Bristol University physicist turned commentator on science in general, writes: "An academic discipline is much more than a conglomerate of university departments, learned societies and scientific journals. It is an 'invisible college' whose members share a particular research tradition … A recognized discipline or sub-

Discipline

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discipline provides an academic scientist with a home base, a tribal identity, a social stage on which to perform as a researcher." One might go on to say that this social stage has need of prompters, established authority figures who whisper advice from the wings so that active protagonists do not stray too far from the currently accepted bounds of the discipline in question. But then, the best actors do not need prompters.

To my mind, there are two large families of disciplines which differ in the form of their genesis. Physical chemistry, emerging around 1880 from organic chemistry, was a case of emergence by splitting. In this type of discipline birth, the splitting does not always 'take': thus solid-state physics, held in vociferous contempt by Wolfgang Pauli when it was quite new 70 years ago, is now pursued by many who would not consider it a discipline distinct from 'physics'.

The gradual emergence of geology to amalgamate petrology, stratigraphy, orography, mineralogy and palaeontology, among others, is a case of emergence by integration. So a modern geologist, like a materials scientist, is apt to be quite thinly spread if he or she takes the breadth of his or her science seriously.

A view held by some is that a discipline is only 'real' if a single founding parent can be identified, such as Lavoisier for chemistry, Mendel for genetics or Seitz for materials science. I am sceptical about this suggestion, influential though such minds were, as a trawl through history shows that several streams merge to found a discipline, and the multiple founders are not coeval.

There are always those who turn down their thumbs at aspirant disciplines. The most celebrated instance is the remark attributed to Ernest Rutherford: "There's physics, and there's stamp collecting." The proper response to this piece of hubris is to note that in Britain there's a Royal Philatelic Society but an unroyal Institute of Physics. ■

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FURTHER READING

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