

Coming to terms

Caloric, cathode, curium and quark — coinage from the mint of science.

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Among the obstacles to the steady advance of science are the words invented to denote its conquests. Francis Bacon rated poor terminology as the most menacing of the four sets of idols he defined in his *Novum organum* of 1620 as befuddlers of the human mind. Badly coined words, the “Idols of the Market Place”, thoughtless phrases minted for the moment, “wonderfully obstruct the understanding”. The incautious wordsmith of science can “throw all into confusion, and lead men into numberless empty controversies”.

The history of scientific terminology opens a royal road to the history of scientific culture. The eighteenth century, which spent much of its intellectual energy classifying and summarizing its burgeoning knowledge, devised terminology that transformed botany and chemistry. The binomial designation of natural species introduced by Linnaeus and the systematic names of chemical compounds invented by Lavoisier and his collaborators remain in use, although they are not free from damaging idolatry. Linnaeus embedded his binomials in a system of arithmetically defined taxa that sometimes put species in the wrong families. The French chemists admitted the substance caloric, which does not exist, among their elements, and coined ‘oxygen’ on the mistaken idea that the gas so designated gave acids their acidity. But the terminology, erected on the enlightened principles of rationality, order and universality, proved flexible enough to drop erroneous reifications (like caloric) and ignore misnomers (like oxygen).

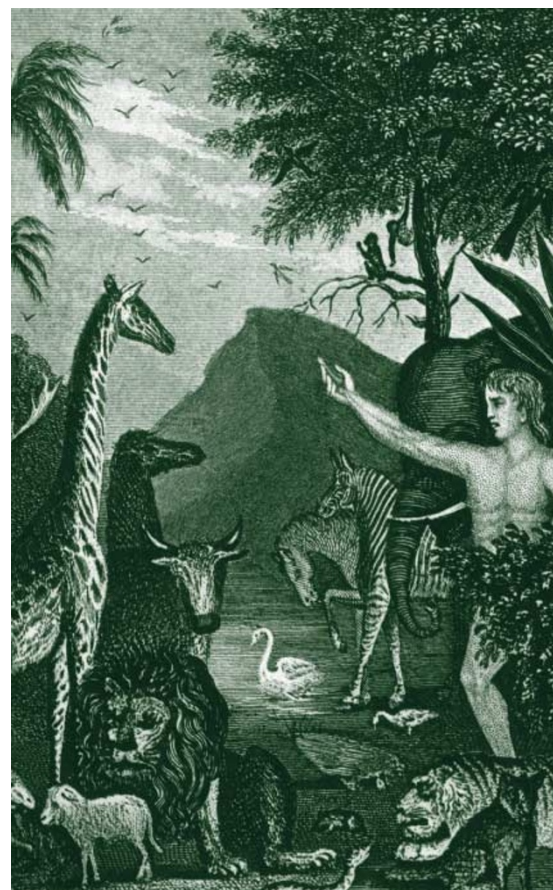
In the nineteenth century, geology, palaeontology and physics enlarged their vocabularies with the help of William Whewell, a veritable mint of new coinages. He did not try for grand systems, however, but for small groups of linked words that would convey concepts without fixing theories. In response to Michael Faraday’s

request for terms to describe his experiments in electrolysis, Whewell supplied anode, cathode, electrode and ion from non-committal Greek roots. He gave names to experimenters too, ‘scientist’ and ‘physicist’ for example; however, they had too much of the market-place about them (they came too close to ‘dentist’) for the ‘men of science’ they were supposed to designate.

Whewell’s criteria guided the choice of terminology in the established sciences until the First World War. His use of ancient languages and his conviction that the right words would establish correct and durable concepts fit his age perfectly. Most of the people whom he wanted to call scientists knew some Latin and Greek; and they and he built as if their constructions would be in use for ever.

In competition with Whewell’s rules of art, the later nineteenth century began the practice, in keeping with the growing nationalism of the time, of naming chemical elements and electrical standards after a discoverer, the country of the discoverer, or a national hero. In chemistry, the introduction of the new style can be traced to the 1870s and 1880s, when the discoverers of gallium, germanium and scandium named them after their nationalities (French, German, Swedish). During the twentieth century, nationalistic names attained the detail of a postal address (berkeleyum, californium, americium). The names of heroes, invoked to distinguish electrical standards during the late nineteenth century (ohm, amp, volt ...), invaded the periodic table a century later (curium, fermium, mendelevium ...).

After the Second World War, Americans gained by priority of discovery the right to name the elementary particles. Their terminology tended to be facetious and jocular. Thus, quarks in their various flavours and colours; gluons to paste quarks together; quantum chromodynamics, which does not study colour; and GUTs and TOEs, not body parts but Grand Unified Theories and Theories of Everything. Did the jocular indicate the easy confidence of people who felt close to finishing physics? It certainly demonstrated that the sober conservatism of European scientists of the nineteenth and early twentieth centuries had given way to the flippant equality of Americans during their time of world dominance. The playful names coined by high-energy physicists have been criticized as inelegant, non-ancient, capricious and misleading. No doubt it is unlucky that quark means garbage in German, but gluon



The first systematic naming was Adam’s task of finding names for the creatures God had made.

is an inspired put-on: it looks Greek, means nothing in German, puns in English and satisfies Bacon’s requirement that a word express a clear and distinct idea.

The earliest case of systematic naming occurred about 6,000 years ago, when God brought all his newly fashioned creatures to Adam, “to see what he would call them” (Gen. 2:19). That eases the task: one Provider of instances, one namer of names. Genetics and molecular biology have had a great many of both and, consequently, a taxing and awkward terminology. Students of fruitflies favour bouncy names in the style of particle physicists: *armadillo*, *hedgehog*, *lost-in-space*. Mouse geneticists like dull ones, such as *b-catenin*, which happens to be the same gene as *armadillo*. A single gene (*selectin L*) has 15 different aliases, whereas *MT1* refers to at least 11 different genes (see *Nature* 411, 631–632; 2001).

The cure for this genetic disorder is a computer, which identifies a gene not by its name but by systematic descriptors. The new Adam condones local and multiple names for fundamental entities of science and undercuts the principle of univocal universality that has informed scientific terminology since the Enlightenment. A perfect post-modernist solution. ■

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