Taxonomy blooded by cladistic wars

Palaeontologists have buried the hatchet of cladism, to the general enlightenment. But the siege mentality at a meeting last month argues for the preservation of comparative anatomy.

AFTER decades of study of long-dead animals, vertebrate palaeontology in Britain itself now faces extinction, and the situation elsewhere in Europe is not much better. It is ironical that the lives of prehistoric animals are avidly followed in the public prints, but that the academic disciplines from which the scripts of these soap operas spring are being starved. Worse still, comparative anatomy, without which vertebrate palaeontologists would be hardly better equipped to trace the history of life than stamp collectors, may be dragged down as well.

Comparative anatomy does not evoke a natural fondness among most working biologists. To many, the smell of formalin means mustiness more generally. Yet to work on a living organism without sound knowledge of what it is, and how it is put together, diminishes the worth of what results emerge. The tale of the embryologist whose observations of a batch of sea urchin embryos were thought anomalous until it was realized that the species used was itself unusual is not apocryphal.

Even so, the plight of comparative anatomy is at least partly self-induced. The emergence in the 1980s of cladistics, in principle an objective method of building phylogenies from structural similarity between forms, provoked arguments between the newcomers and the traditionalists unusual for their savagery. The result was to corrode the climate in a small community of researchers and to invite outsiders to regard these unseemly wrangles as signs of a subject in terminal crisis.

That is why it matters that the Cladistic Wars are now over. So much was plain at the 36th Symposium of Vertebrate Palaeontology and Comparative Anatomy, at Boulogne last month. Within a single decade, attitudes towards cladistic methods have swung from abhorrence to acceptance; serious taxonomy based on old subjective ways is now almost unthinkable. But even cladistic purists now acknowledge the value of fossils in the resolution of three-taxon problems.

Thus Peter Forey (British Museum, Natural History, otherwise BMNH), once a cladistic hawk, used fossils of the primitive lobe-finned fish *Diabolepis* to resolve a coelacanth-lungfish-tetrapod trichotomy. Coelacanths and lungfish are seen as sister groups, with tetrapods a sister group to both. But the proposed sister-group relationship between lungfish and tetrapods is now less certain. There has been much soul-searching among the cladists, but the whole of systematics has a surer foundation as a result.

There is room for numerical taxonomy in the new liberalism, as when Garth Underwood (formerly at the City of London Polytechnic) used compatibility analysis to reveal parallelism in the tooth structure of snakes. The view that venom-injecting fangs are the 'crowning glory' of snake evolution seems to be more revealing of people's fear of snakes than of sound taxonomic judgment.

Changes of perspective have also helped with the ordering of sea snakes (Colin McCarthy, BMNH) and modern rock-dwelling lizards (Nick Arnold, BMNH). Each of the 30 or so independently evolved groups of the latter has a parallel solution for life in a difficult environment. But the solutions are substantially determined by ancestry so that, by contrasting environment and ancestry, rock-dwelling lizards can be a test for the extent of convergent evolution.

By mixing comparative anatomy with palaeontology, Jennifer Clack (Cambridge) produced at Boulogne a new answer to the old question of how the earliest land animals could hear. New specimens of Acanthostega, an early tetrapod from the Devonian of Greenland, show that while the animal had a stapes, that was too big and well-ossified to have fitted into the otic notch at the back of the skull, traditionally regarded as the rim of a tympanic membrane. Neither did the stapes provide support for the braincase. Instead, it may have controlled ventilation through a spiracle, much as the hyomandibular (the stapedial homologue) does in some fishes. An air pocket in the spiracular cavity would have, incidentally, been an excellent resonating chamber. That is another feather in the cap of comparative anatomy.

Comparative anatomy has also been brought to bear on the question of vertebrate origins by Richard Jefferies and Tony Cripps (BMNH), who demonstrated how vertebrates may have evolved from echinoderm-like animals called calcichordates. Their approach differs from Garstang's 'auricularia' theory of the 1920s in that it is based on real fossils.

At Boulogne-sur-mer, French researchers appropriately led in the study of the earliest, fish-like vertebrates. The taxonomy of Alain Blieck (Lille) was the backdrop for the exciting new faunas from Vietnam (Philippe Janvier, Paris) and Bolivia (Pierre Gagnier, Paris). The Ordovician ostracoderm *Sacabambaspis janvieri* may hold the clues to the nostril structure of heterostracan ostracoderms (a long-standing mystery) and also illuminate early vertebrate radiation.

Inevitably, the periodic mass-extinction hypothesis of David Raup and Jack Sepkoski is grist to the mill of the new taxonomy. Colin Patterson and Andrew Smith (BMNH) continue to complain that the taxonomic data on which the hypothesis rests are flawed. They say that in Sepkoski's data, drawn from his own compendium of the stratigraphic ranges of marine fossil families and later genera, the naming of fossil species owes more to the circumstances of collecting than biological reality. For example, 68.8 per cent of all fossil fish species are known from unique localities. The figure for echinoderms is 69.1 per cent. But the ecology of fish and echinoderms are very different, so that the figures are too close to be coincidental, which implies that the formal taxonomy of all marine species is based on locality, not biology. And the same may be true for other groups of marine animals.

Patterson and Smith also say that the 'noise' in Raup and Sepkoski's mass-extinction 'signal' from marine families and genera arises from misapplied taxonomy, as when groups treated as monophyletic turned out to be polyphyletic or paraphyletic. Even at the species level, taxonomy has been misapplied to produce names of little more than administrative significance. If this raking over old coals sounds like the cladistic wars at their height, there is a side-benefit: there is a a much better idea of the phylogeny of fish and echinoderm genera than before Patterson and Smith's analysis.

But while adversity has removed the luxury of internecine strife, a siege mentality has palpably taken over. Palaeontologists know they have a fustian image among other biologists, but the archaic monographs cited in their papers are a doleful reminder that comparative anatomy has too often been abandoned for less well-founded disciplines, palaeoecology for example. Yet it is not much comfort to know that a 1911 lungfish monograph may still be valid while much work from the 1950s and 1960s will prove of historical interest only: for if comparative anatomy goes, the rest of biology will suffer irreparably.

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