

lesion. Anti-haemorrhagic agents under test are incubated with the MHD of venom for 30 min at 37°C and the mixture injected i.d. Mice are killed 24 hr later and the extent of skin haemorrhage is recorded. Our alternative assay uses fertile hens' eggs, which have a highly vascularised yolk sac membrane at a very early developmental stage. Although the embryonic heart is beating, the blood vessel system develops prior to the appearance of intact reflex arcs and the onset of pain sensitivity. Eggs are cracked out of the shell into cling film 'hammocks' on Day 5 (after laying) and incubated at 35°C. On Day 7, filter paper discs impregnated with venom or anti-venom or a mixture of both, are placed on the yolk sac membrane. Two hours later, the degree of haemorrhage is assessed and the results are photographed. A measurable corona of haemorrhage surrounding the disc is induced by as little as 0.5 µg venom (*Echis leucogaster*) and remains stable, together with a heart beating embryo, for 24 hr. Systemic toxicity may also be assessed by the viability of the embryo. So far, the eggs have provided clear cut results, which parallel the mouse skin assay, using equine antivenom, mouse mAb ascites and plant extracts and are very cost-effective (11 p/egg compared with £2.00/mouse).

*Systematics, venom variation and toxinology: bridging gaps between evolutionary biology and biomedical science.* Wolfgang Wüster (School of Biological Sciences, University of Wales, Bangor, Gwynedd LL57 2UW, Wales, U.K.)

Venom variation at low taxonomic levels (between closely related species or within species) can seriously complicate both toxinological research and snakebite treatment. This is of particular importance because many of the world's most medically important snakes belong to complex groups in which species definitions and identification are either poorly understood or in a state of flux. In some recently revised groups (e.g. Asiatic *Naja*, *Echis* spp.), venom variation appears to be at least partly related to species affinities. This emphasises the importance of a sound taxonomic framework for toxinological studies. In other species, geographic variation in venom composition appears unrelated to taxonomic affinities (e.g. *Daboia russelli*), and in such cases, details of locality of origin of specimens or venoms are of crucial importance. Finally, the status of some species groups (e.g. *Bothrops atrox* species group) remain unresolved or in a state of flux, and this presents particular problems. There is a need for toxinologists to obtain, and for venom producers to supply, a maximum of information on identification and locality of origin of specimens, and for close collaboration between snake systematists and biomedical researchers in general.

*The clinical problems caused by saw-scaled or carpet vipers (genus Echis) in Africa and Asia.* David A. Warrell (Centre for Tropical Medicine, University of Oxford, Oxford, U.K.)

Snakes of the *Echis* complex are distributed throughout northern Africa from Senegal to Kenya, through the Middle East and western Asia and the Indian subcontinent including Sri Lanka. A recent controversial taxonomic revision suggested 12 species in three subgenera (Cherlin, V.A., U.S.S.R. Academy of Science, Tropical Zoology Institute Leningrad 207, pp. 193–223, 1990).

The *Echis* complex is responsible for much snake bite morbidity and mortality, especially in West Africa (*E. ocellatus*), East Africa (*E. pyramidum*) and the Indian subcontinent (*E. sochureki* and *E. carinatus*). In parts of West Africa, the incidence and mortality of bites is as high as 120 and 8, respectively, per 100,000 population per year (Warrell, D.A. and Arnett, C. (1976) *Acta Tropica (Basel)* 33, 307–341). More than 90% of bitten patients