The Principles of Humane Experimental Technique

W.M.S. Russell and R.L. Burch

CHAPTER 5

REPLACEMENT

With respect to the "analogical" ... resemblances between organic beings ...

Comparative Substitution

We shall use the term "replacement technique" for any scientific method employing non-sentient material which may in the history of experimentation replace methods which use conscious living vertebrates. Among this non-sentient material, we include higher plants, microorganisms, and the more degenerate metazoan endoparasites, in which nervous and sensory systems are almost atrophied. To shed obsessional tears over the fate of these organisms would bring the whole concept of humanity into contempt by Samuel Butler's famous reductio ad absurdum--the Erewhonian philosopher who inquired whether salt can feel.

A more difficult question arises when we consider the free-living metazoan invertebrates. We have arbitrarily excluded them from consideration as objects of humanitarian concern. It remains to consider them in the light of possible substitutes for vertebrate subjects. Such a procedure may be called comparative substitution.

The responses of insects and mammals to insecticides suggest that these two groups have much in common at the level of fundamental metabolism at which many toxic substances act (Winteringham and Barnes, 1955; cf. also Anon., Nature, 1956a). The fruit fly Drosophila has been employed for titration of the antivenene for the venom of an Australian spider, and its use.

"...enables a larger number of lethal doses of venom to be injected and neutralized than is practicable in the case of mice. A more reliable estimate of the potency of the serum is therefore possible... There is a considerable saving in the amount of venom required for assaying antivenene, and results are available within 24 hr. The method... might prove useful for assaying antisera of medical importance prepared against other venoms and toxins which also happen to be toxic to insects" (Wiener and Drummond, 1956).

In another context, the octopus has been described as a more suitable subject than the albino rat for studies on the mechanism of visual form discrimination (Sutherland, 1957). There are several contexts in which vertebrates might be replaced by invertebrates. Where toxicity is concerned, relatively simple metazoa might meet some requirements.

Such suggestions raise nice issues. Baker (1948) suggests a commonsense divisions between higher and lower invertebrate groups. But many polychaete worms have highly-evolved responses to damaging and startling stimuli (Nicol, 1948). Even sea anemones have mechanisms capable of controlling their behavior over long periods (Pantin, 1952). In spite of this, we may agree with Baker that a line, or a set of lines, could be drawn in principle. Meanwhile, we may regard comparative substitution as a limited gain, while admitting that the argument should be used with caution. In fact, there does not seem to have been much progress in this direction, if we discount the quite irrelevant case of substitution of invertebrate for vertebrate tissues in vitro. The problem is raised only for completeness, and from now on we shall consider only the wholly desirable progress and prospects of replacement proper.