The Principles of Humane Experimental Technique

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CHAPTER 3

THE ECOLOGY OF EXPERIMENTAL ANIMALS

We may infer that our domestic animals were originally chosen... because they were useful...
The rat and mouse... have been transported by man to many parts of the world...

Results of the Analysis

The tables produced in this way (q.v.) contain a wealth of information. They would form an excellent basis for a course in animal biology, to most of whose branches they could serve as introduction and commentary. (Why, for instance, are chickens used for assaying Vitamin D3, or toads for diagnosing human pregnancy?) I shall confine myself here to noting a few salient features.

Table 5 brings out the relative numerical importance of the varied species (cf. also Table 4, from the analysis of Lane-Petter et al). I have already discussed the huge preponderance of mice, which will certainly be the main beneficiaries of more humane technique in the laboratory. The first three species are mammals, but chickens are more numerous than rabbits, and even if cats have been underestimated, they are about equal in number with the humble frogs. If they could learn at all, the more fanatical antivivisectionists would learn much from perusal of these tables; but of course their favoritism of the cuddlier species has nothing to do with factual priorities, and for them one dog in Sputnik is worth millions of mice on the bench (cf. Russell, 1956a; Hediger, 1957; Russell and Russell, 1958). In this connection, it is worth noticing a fact brought out by the tables: besides claiming the special protection of the Home Office, cats and dogs are, to a substantial extent the objects of experiment in the interest of their own species. Out of the 5,465 cats returned, at least 890 were used for research on feline enteritis. The dog story is even more striking. Out of 7,442 returned, 3,669 were used in the production of canine distemper prophylactics and a further 1,954 for research in canine infectious diseases--a total of 5,623, or over 75 percent. The third specially protected species, the horse, shows a similar trend: 12 out of 53 were used for research on equine infectious diseases. (It is perhaps worth noting also that almost all the teleosts--3,418 out of 3,548--were used to study the toxicity of effluents into rivers, a study from which their fellows will benefit.) Veterinary experiments, in general, make up a substantial proportion of the total. However the rational humanitarian will decide that mice, rats, and guinea pigs, which are used in huge numbers (mainly for medical purposes), are those most urgently in need of assistance by constructive research.

Cursory examination of Tables 6-9 and 17 displays the elegant symmetrical distribution of purposes between the main types of laboratory. It is hardly a surprise that teaching is almost wholly restricted to U laboratories, nor is the general distribution unexpecte: diagnosis and P.D. to Group I, research to Group II, bioassay, etc. to Group III. The attempt to select out Groups I and III has been successful; as a result, Group II spreads over all three main purposes, but with a heavy preference for research. All the same, the peculiar neatness of Table 17(c) is interesting. Clearly in the taxonomy of laboratories we are on firm ground. Each of the three types has its highly characteristic pattern. Within Group I, HP and PH laboratories are found to be almost identical in pattern, making the group as a whole highly uniform. U and N are less perfectly similar. Through the predominance of diagnosis in the former and bioassay, etc. in the latter, they form bridges to the extreme groups; but they are much more like one another than they are like either Group I or III. This sketch can be filled in by reference to Tables 6-9, which provide some additional information. For instance, U laboratories are more versatile than N ones in research, and are the main sites of work on the smaller "pure" research subjects.

Turning to Tables 14 and 15, we consider the distribution of species to types of laboratory. A glance shows us that in this respect also Groups I, II, and III have characteristic patterns. Group II are the most versatile in their use of species, and U, as before, somewhat more so than N: the lesser used species are mostly found in U laboratories, except for the larger farm animals, which are found in both. Group III use considerably fewer species, but still a substantial number; each species tends to serve a special set of purposes within the division Bioassay, etc. (see Tables 10-13). Group I are remarkable for their very restricted usage, PH laboratories being still more conservative than HP ones. The latter use only mice, rats, guinea pigs, rabbits (in varying amounts, see Table 14 and also Tables 6-9), hamsters, Xenopus, toads, and a few ferrets, monkeys, sheep, chickens, and pigeons. The rationale of these usages can be developed by reference to Tables 6-9 and 10-13; I shall not enlarge upon it here.

Tables 14 and 15 present similar pictures so far as main laboratory types are concerned.

Each species can usually be alloted a special pattern of distribution between the laboratory Groups, but the pattern may not be the same in terms of numbers of animals (Table 14) and numbers of user laboratories (Table 15). By both criteria, mice are freely used in all types of laboratory (mainly for P.D. in Group I see Table 6), but over half are reserved for Group III; this compartment includes over a third of all animals used. Rats and guinea pigs are also fairly widely distributed, but the former are primarily research and secondarily bioassay animals, while the latter are overwhelmingly used for diagnosis. The great absolute numerical superiority of mice puts them at the head of the list for all except PH laboratories. In general, however, these three species can be seen characteristically as bioassay (mice), research (rats), and diagnostic (guinea pigs) animals. The reasons for this would constitute an extensive inquiry. Rabbits, dogs, and most of the lesser-used species are definitely U animals.

The discrepancies between Tables 14 and 15 are interesting, and warranted construction of Table 16, in which they are more clearly seen. There are considerable differences in the average numbers used per laboratory between species and types. Group I laboratories are, in fact, numerous (169) and generally small, as appears from their usage of even the populous mouse, rat, and guinea pig; PH are usually somewhat larger and considerably fewer than HP laboratories. Group III laboratories are few (22) and contain heavy concentrations of animals. Group II are intermediate, with N larger and fewer than U laboratories (cf. also bottom row, Table 15).

The average use of mice and rats is not surprising, but I must note here the huge absolute average numbers used in N laboratories (mice) and in Group III (mice and rats, especially the former). An average number of mice used in Group III laboratories is over 100 per diem. In fact, some laboratories use far more.

One interesting feature of this table is the very high average usage of chickens. Comparison of the three tables shows that, while guinea pigs and rabbits are distributed among very many laboratories (more in fact than those using the populous rats and mice), chickens are concentrated in a few.

Finally, we may briefly glance at the distribution of species to purposes (Tables 10-13) and at Table 18, which shows the grand totals of animals used for each purpose. Note first that we can discard a total of 16,094 of the returned experiments as performed on insentient material; this is certainly an absolute minimum. Human P.D. makes up a considerable total; it employs only five species: mouse (Ascheim-Zondek test), rabbit (Friedman test), toad (toad test), Xenopus (Hogben test), and a few rats. General Diagnosis is almost entirely the preserve of guinea pigs, though a proportion of mice and a few hamsters are used. We at once notice the huge preponderance on inoculations for TB--well over half the total at a minimum. Diphtheria, Brucella, Anthrax, Pneumococci, and Complement/WR (= Wasserman Reaction) each account for over 1,000 animals.

In the bioassay category, out of a certain number of specific returns for individual substances, three stand out at once: insulin assay (almost all mice), Vitamin D assay (rats, and D3 on chickens), and the standardization of Pertussis vaccine. Notable also are the large general purposes of chemotherapeutics, vaccine titration, pharmacological research, and above all toxicity tests. These last make up over 18% of the total at least, and a little less than one-tenth of all animals used for any purpose. It was not possible from the returns to separate "toxicity testing" into screening and batch testing. I may add a brief note on digitalis. I have included here the use of frogs; 445 guinea pigs were used, but since the guinea pig test is a non-recovery one under anesthesia (Brit. Pharm., 1948), I diverted these to the non-recovery compartment of Division 3. (All other experiments assigned to the latter compartment were explicitly described as such.)

The general contribution of Bioassay, etc. is enormous--well over half the total number of animals used at all. The information provided in the tables about bioassay is clearly only a starting-point for systematic investigation. The great importance of this part of the subject will be reflected in the treatment of the second Part of this book.

The main object in separating out the many individual subjects in the first part of Division 8 (Research) was to eliminate them. With the sole exception of nutritional research, each individual item is numerically small. This set of purposes exhibits a very wide variety of aims and procedures; it employs a large number of different species, and it is distributed among very many laboratories. Large-scale effects are unlikely to be produced in so heterogeneous a collection by any particular improvement in humane technique, except for the very generally applicable principles and measures we shall consider in Chapter 7. Genetical research is a special case. Some argue that to breed deformed or physiologically incapable animals is as inhumane as any experimental procedure, but such victims probably make up a small proportion of all animals used; and in any case genetical research is virtually insusceptible of replacement or reduction methods (See Chapter 4). From the present point of view, our main interest must logically be concentrated upon the three fields of Nutrition, Cancer, and the combined category Bacteriology/Pathology/Parasitology, where general improvements (such as the cultivation of parasitic protozoa in vitro, e.g. Newton, 1956) are likely to have a wide domain of action. A prerequisite for this study will be the further analysis of the B/P/P category, and its overlap with those of Division 7. Some of the returns provided information which would have made further subdivision possible, but this information was scanty, and the problem remains one for future research.

Much more information could be set out in words, but I may profitably leave the reader to extract it at his leisure from the tables, and with these last comments I close my account of the pattern of experiment in Britain. We shall presently have to consider it in more detail sub specie humanitatis.