Laboratory Animal Science AD 2000

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Laboratory Animal Science is but one of many disciplines available to investigate health and disease problems in man and animals and the object of this paper is to attempt to predict some factors likely to affect its future practice.

The logical starting point is to identify these problems and how they will be investigated over the next decades and relate this to the use of laboratory animals. Much of the fundamental research in biochemistry, genetics and physiology, it is expected, will be increasingly at the cullelar level rather than in the whole animal. Likewise, there will be more research, again at the cellular level, into the mechanisms of viral infections and cellular immunity in relation to cancer and degenerative diseases.

In Europe, the major human health problems, especially with its increasing geriatric population, are cardiovascular disease, cancer, cerebrovascular disease and a variety of degenerative diseases of immunological origin, e.g. renal failure, arthritis. Most research expectedly will be directed at defining their aetiology, pathogenesis and means of prevention and treatment. Infectious diseases, it is assumed, will be controlled by existing immunisation programmes and a spectrum of new antimicrobial agents produced by the pharmaceutical industry. Overall therefore, research on these diseases, with the exception of some of viral origin – notably AIDS, may decline relatively from its previous level.

Experience over the last twenty years indicates how the major human non-infectious diseases listed will be investigated. Man and not the mouse, it appears, will be the principal experimental subject.

The basis for this prediction is as follows. Technological developments to date, and expectedly these will advance greatly over the next decades, now provide the means to investigate disease problems extensively and directly in human populations. This technology includes the computer, cell counter, autoanalyser, non-invasive investigative and diagnostic equipment and expectedly soon, major advances in histological automation and screening. There is also the wide range of products that can be prepared by monoclonal antibody culture. Consequently, the requirement to study experimentally the somewhat distorted images of human diseases produced in laboratory animals will be reduced.

Coincidental to advances in medical technology have been those in media communication and education to promote the knowledge that the individual has an important role in matters pertaining to his health. The efficacy of this »epidemiological and educative« approach is evident, for example, in the reduction in cardiovascular disease through dietary and other health measures, the lower incidence of lung cancer following the anti-smoking campaign and the results of breast and cervical cancer screening programmes. Neither must one forget the mass-radiography campaigns in controlling tuberculosis and the »don't drink and drive« and »car safety belt« legislation in relation to road traffic accidents.

One can expect, therefore, governments and charitable organisations which support research undertaken in universities, hospitals and institutes, to direct available finance primarily to this method of investigating and controlling disease problems.

The pharmaceutical industry too will doubtless follow similar lines of epidemiological research as well as continuing to investigate production of different drugs. Their use of animals may be reduced if there is agreement on the standards of testing pharmaceutical products retailed internationally and with development of in-vitro screening methods.

By how much, changes in the methods of research, i.e. studies at a cellular level rather than of the whole animal and of man rather than the mouse, have affected already the number of animals used experimentally, is difficult to as-

sess. Between the mid-1970's and 80's, however, the British Home Office recorded a decline from over 5.5 million to just over 3 million in the number of animal experiments performed annually. This trend appears to be continuing and a reduced use of animals experimentally has been reported in other European countries.
Two other factors undoubtedly contributed in the United Kingdom to the decline in use of experimental animals. The first, and probably most important, has been the effect of the economic recession. In British universities, for example, base funding for research, in real terms, has over the last ten years been halved and academic staff levels cut by 20%. Between 1981 and 1984 there was a loss of 317 staff - clinicians, technicians and secretaries - from British medical schools; equivalent more or less to one whole medical school. Research institutes have been badly affected, as has the National Health Service, and consequently the medical staff in many teaching hospitals now have little opportunity to undertake animal-based research. The gravity of this situation which is still continuing, is obvious and is one which will not be easily or speedily rectified. Support for research on farm animals has been reduced also, and, with the problem of dairy product and meat surpluses in Europe, there would seem little reason to expect governments to give priority funding to such research.
A noticeable effect of the economic recession precipitated by the reduction in the number of technical staff employed in animal houses, has been to make animal house managers and scientists assess more critically the number, cost and quality of animals bred, held and used experimentally. Many now accept that cheaper, healthier and better genetically standardised animals are available from commercial suppliers than can be produced in their own animal houses.
The second factor has been a change in the attitude of society, including that of many directly involved, to the experimental use of animals.
Just how much this relates to the impact of the antivivisectionist lobby and enactment of stricter legislation (In the United Kingdom: the Animals (Scientific Procedures) Act 1986), is open to speculation. One does detect in many scientists and technicians, however, an enhanced sense of responsibility to be more rational and less prodigal in their use of animals experimentally. Particularly noticeable in this respect has been the effect on the use of animals for teaching purposes.
Accepting that fewer animals will be used for experiments, fewer bred in animal houses because they are available commercially, a continuing economic recession and that research funding will be directed away from animal-based studies, how will the practice of Laboratory Animal Science change?
Human nature is such, as is the administration in many organisations, that it resists change. It is important to recognise therefore the policy and underlying philosophy that was operative apparently in many animal houses. Viewed dispassionately, this often appeared a vicious circle, albeit a self-protective one. Thus, to justify their accommodation, expense and sufficient staff to meet a daily and year round commitment, the animal house management, aided and abetted by their technical staff, endeavoured to keep the facility fully and apparently usefully occupied, by maintaining a remarkably constant population of a variety of animals for 365 days of the year. This, management claimed, was because they were expected to meet, on demand by the scientists, a requirement for animals of a variety of species, strains, genetic selection, sexes and ages.
The scientists in turn claimed they must have available at all times, when and in case they were required, a suitable choice of experimental animals. The administration for their part, faced with the regular expense of the animal house which always appeared busy, generally accepted the scientists' claim for the need for the facility and the animal house management's explanation of their purposes to satisfy the scientist. Consequently, administration rarely questioned the operative policy or the budget of the animal house.
It was not perhaps surprising therefore that the large majority of animals kept in many animal

houses were breeding stock, breeding stock replacement, old breeders, weaners and a motley collection of animals of a variety of species, strains, indeterminate genetic backgrounds, sexes and ages, some of which had been notionally allocated to particular scientists for experiments to be started on unspecified dates, and animals used for experiment awaiting the scientist's decision on their destruction.

This analysis of the philosophy and operational policy of many animals houses is deliberately exaggerated but few will fail to recognise features identifiable in their organisations, particularly the relationship between the three interested parties – management, scientists and animal house staff. To adapt to a declining requirement for experimental animals and to meet economic constraints, it is obvious that all three need to alter their policy.

Germane to the problem is the way scientists use animals. Do they in fact require so many animals or can the number be reduced by better statistical planning, better experimental design and by using fewer species and inbred strains? *Russell and Burch* (1959) formulated their classic three »R«s – Reduction, Refinement and Replacement – on the use of experimental animals many years ago. It is foreseeable their laudable objectives will now be achieved more effectively through economic and other current factors. How quickly scientists can be educated into a more rational use of animals is difficult to assess but few universities include as yet the rudiments of Laboratory Animal Science and Experimental Design in the curricula of their medical or biology courses.

Perhaps some stimulus to the better planned experimental use of animals may be effected by the commercial suppliers in their efforts to promote business. Indeed, in this last respect, it is interesting to speculate on the genetic variability and divergence and on the health status of animals bred, reared and then used experimentally in various animal houses.

As the scientists, and especially those financing their work and facilities, recognise the actual need for animals for teaching and research is declining and often sporadic and that these needs can be met by the suppliers usually more cheaply than by breeding and holding large numbers of their own stock, it is realistic to predict there will be a requirement for fewer and smaller animal houses and that these may be periodically empty. Indeed, this trend is already evident in many institutions which are rationalising their animal facilities. In some respects, these changes predicted in animal house practice are comparable to those which already have happened in traditional clinical laboratories. There, automation, the use of disposable plastic »glassware« and prepared reagent solutions, have altered dramatically the working practices of the laboratory technician whose required intellectual and practical skills today are very exacting compared with a decade or so ago. Indeed, the status of British laboratory technicians is such that they are styled now »Medical Laboratory Scientific Officers«.

To maintain or expand their professional status, one expects animal technicians in the future will have to practice new skills and be appropriately trained. Relevant to this is whether they will still be working in a comparable environment and expect, or would be prepared, to undertake mundane cleaning and husbandry duties, or whether these chores should be delegated to a less highly quialified person or significantly reduced by improved facilities and technology in the animal house.

Because less laboratory animals will be required and consequently smaller and fewer animal houses will be needed, one hopes the logic will prevail of directing available capital and recurrent finance to provide therein better equipment and facilities to improve efficiency. For an organisation's administration, there is an attraction in having optimal flexibility in the use of available accommodation and control over its recurrent costs. To this end, one expects rooms would be built to a specification which would readily enable their alternative use as offices, laboratories, stores or animal rooms.

One of the major expenses in present day animal houses is the building, maintenance and running costs of heating, ventilation and ligh-

ting services which invariably, because of a centralised plant room, are operating continuously and throughout the animal house, irrespective of the extent of its occupancy and usage. Considering today's technology where large isolators are a familiar equipment item in many animal houses, it would seem reasonable to expect the development of independent units, like domestic air conditioning appliances, will provide the means of ensuring necessary environmental conditions in individual »animal« rooms when and as required.

Staff costs are another major item in an animal house budget and inevitably will be scrutinised, as well as the actual nature of duties undertaken by staff and particularly their potential for other duties as the workload in the animal house fluctuates.

Room and cage cleaning are large elements in the running costs of most animal houses, and in some, it seems almost are the basis of an obsessional policy to keep the technical staff occupied. Considering the capital cost of cleaning equipment and materials and of labour, are there not better ways of dealing with the problem? After all, we have seen radical changes in keeping farm livestock and the number of people so employed. Whether, with cheap disposable materials, it would be possible to manufacture economically acceptable disposable liners for standard rigid cages, to reduce the labour of cage cleaning, one can but speculate. Can we also expect to see the development of cheap, disposable watering systems to eliminate the labour intensive operation of washing and filling water bottles?

From the above, one could gain the impression that more and more, laboratory animals – particularly rats and mice – will be viewed almost dispassionately as experimental tools rather than sentient creatures. Scientifically there are grounds for assuming this philosophy for, with their defined genetic background, inherent disease free state, regulated diets and environmental conditions, animals should behave in a consistent and predictable manner. This is a concept alien in some respects to the philosophy of many past and present technicians who rightly considered their role and skills in, for example, breeding and recognising disease and stress in animals and their welfare, as of paramount importance.

While the technician of the future will still require that inherent concern for animals in his custody, his duties nevertheless will change from being primarily the animal's keeper to those of the person who uses them as »scientific tools«. In addition, one would expect the animal technician to assume a greater role in the administration, including the financial aspects of the animal house budget and management of the routine chores of cleaning, washing and watering delegated to less well qualified staff.

To meet this challenge, what attributes, skills and educational training will be required of future animal technicians? First, it is obvious it requires a person with comparable intellectual abilities to the laboratory technician or junior scientific officer, many of whom are graduates or have high grade technical qualifications. Second, that there should be provision for adequate specialist training and a qualification which employers recognise as meriting appropriate grading and status.

Without, it is hoped, offending today's animal technicians, one could say a fault of the employers, the animal technicians and their professional bodies like the Institute of Animal Technicians', has been that they have misconstrued the potential and the actual duties of the animal technician. They have, in fact, considered animal technicians primarily as those who have the educational capacity relevant to what was essentially for most employees, a »cleaner's« role in the animal house.

For animal technology to succeed as a profession and make a real contribution in the scientific field, it is considered there should be a two-tier system of employment in animal houses, i.e. the technician and the cleaner. Inevitably, this means the number of specialist animal technicians would be reduced, irrespective of the effects previously mentioned which will deplete their numbers. Herein lies a major problem that can affect the profession, for the fe-

wer specialist animal technicians there are, the more difficult it becomes to organise, as a professional body, their standards of training and qualifications.

Many animal technicians expectedly will assume a more scientific responsibility than previously and this may include laboratory work in disciplines like biochemistry, haematology and microbiology as likely progression from their practical work on animals. One would hope therefore that many of tomorrow's technicians who, in addition to seeking their specialist qualifications, will attend courses in a number of relevant medical and scientific disciplines. Additional to this training, the animal technician of the future should ideally be trained also in management, computing and electronics, all of which could be very pertinent to his duties.

So far as specialist training in Animal Laboratory Science, e.g. anaesthesia, surgery, genetics, is concerned – this, because of the small number of candidates in any one area, may be difficult to organise and candidates may have to resort to home studies organised centrally through their professional body and attend short residential courses. This type of training in specialist subjects is not a novel situation but can be expensive to establish and one would hope that professional bodies like the Institute of Animal Technicians can finance and organise such tuition.

If the training of animal technicians is a problem for their professional bodies, then its effectiveness must be of concern to the scientist and employer, for the success of most organisations is dependent on the qualifications and training of all its employees. The technician with the specialist knowledge of Laboratory Animal Science, the appropriate practical and managemental skills and a broad scientific training, is, after all, the one person who, working as a member of a team, should be particularly able to realise the potential of laboratory animals for research efficiently, economically and of course humanely. As the success of research is so obviously dependent on those factors, it would seem imperative that efforts to improve the skills, training and status of the technicians involved in animal work should be recognised and supported. Hopefully, this will be one of the major advances in Animal Laboratory Science over the next decades.

Summary

The writer attempts to predict events likely to affect the future practice of Laboratory Animal Science. It is expected the number of experimental animals used will decline over the next decades for several reasons. These include a greater emphasis in research at the cellular, rather than the whole body, level and the redirection of much of the present animal based research of human diseases to man himself as the main experimental subject. This last prediction is based on an assessment of developments in technology and socio-economic factors whereby knowledge and control of human diseases will be obtained by epidemiological and non-invasive studies of human populations.

The longterm effects of the economic recession which have affected considerably animal based and other research in most countries, are also considered, as too is the impact of new legislation in some and, overall, the changing attitude of scientists, technicians and the general public on the experimental use of animals.

The consequences of the decline in the number of experimental animals used, the availability of better experimental animals commercially, the recognition of the need for better experimental models and design upon the management of animal houses and the employment of animal technicians is then assessed.

It is concluded that economic and scientific factors will lead to new concepts of animal house design and function. Of critical importance, it is considered, is recognition that the animal technician of the future should be selected, trained and qualified to fulfil an exacting scientific role if Laboratory Animal Science is to be effectively, economically and humanely practised.

Yhteenveto / K. Pelkonen

Kirjoittaja pyrkii ennustamaan koe-eläintoimintaan vaikuttavia tulevaisuuden tapahtumia. Koe-eläinten käyttömäärät tulevat pienenemään useista syistä tulevina vuosikymmeninä: lisääntyvä kiinnostus solutason tutkimuksiin, ihmisen ottaminen koekohteeksi suoraan, koska teknologia ja sosioekonomisten tekijöden kehityksen pohjalta ihmisen sairauksista saatava tieto ja kontrolli voidaan saada epidemiologisilla ja non-invasiivisilla ihmispopulaatiotutkimuksilla. Taloudellinen laskusuhdanne on vaikuttanut merkittävästi kaikkeen, myös eläinten käyttöön perustuvaan tutkimustoi-

mintaan useimmissa maissa. Samoin on vaikuttanut uusi lainsäädäntö ja tutkijoiden, koe-eläinhenkilökunnan ja yleisen mielipiteen muutos koe-eläinten käytön suhteen.
Seuraavaksi arvioidaan mitä seurauksia koe-eläintilojen johtamiseen ja koe-eläinhoitohenkilökunnan palkkamiseen on sillä, että koe-eläinten käyttömäärät ovat laskussa, että parempia koe-eläimiä on kaupallisesti saatavissa, ja että tietoisuus parempien eläinmallien ja korkempitasoisen koe-eläinhoidon tarpeesta on lisääntymässä.
Kirjoittaja päättelee, että taloudelliset ja tieteelliset tekijät johtavat uusiin määritelmiin koe-eläintilojen suunnittelussa. Ratkaisevan tärkeää on, että eläintenhoitajat tulevaisuudessa valitaan ja koulutetaan täyttämään tieteellisyyden vaatimus, mikäli koe-eläintiedettä aiotaan harjoittaa tehokkaasti, talmoudellisesti ja humaanisti.

Sammendrag
Artiklen behandler de faktorer, som forventes at få indflydelse på brugen af forsøgsdyr i fremtiden, og det forventes, at brugen af forsøgsdyr vil aftage. Denne nedgang i brugen af forsøgsdyr og en heraf følgende reduktion af avlen inden for institutionerne vurderes i relation til design af forsøgsdyrfaciliteter, ledelse og den tekniske stabs rolle. Det konkluderes, at få teknikere i fremtiden vil være beskæftiget udelukkende med rutinearbejde, hvilket betyder, at de skal være bredt uddannet i videnskabelige og tekniske discipliner, samtidig med at de er uddannet i pasning af forsøgsdyr.

References
Russel, W. M. S. and *Burch, R. L.* »The Principles of Humane Experimental Technique«, ch.5 Methuen, London (1959).

This paper is based, in part, on a presentation to the Institute of Animal Technicians at their Congress in Warwick, England, in April 1987.

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