CAN BIOMEDICAL RESEARCH BE JUSTIFIED?

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'Animal experimentation, also known as vivisection, is directly responsible for the rampant growth of cancer, heart disease, diabetes, birth defects, arthritis, mental disease and an endless list of other maladies, both old and new'[1].

'The typhoid vaccine is made from the excrement of typhoid-infected people'[1].

'Smallpox would have disappeared around 1870 if Jenner and his cronies had not persuaded Parliament to force the smallpox vaccine into children'[1].

'American health authorities are considering a complete change of policy in the face of strong evidence that all cases of polio are caused by the polio vaccine'[1].

POINTS OF VIEW

It is tempting to assume that the authors of these statements approve of letter bombs being sent to scientists and cars being blown up. These statements and many others in similar vein and acts of sabotage and arson against research establishments and agencies concerned with biomedical work, represent the extreme of anti-biomedical organisations. Not all resistance to biomedical work comes from such extreme quarters. There is a huge variety of such organisations and about 60 are listed[2] whose attitude to biomedical work ranges from intransigent condemnation and calls for immediate cessation, to reluctant acceptance of such work for the time being[3].

Some of these organisations spend large amounts on propaganda and much of it is directed towards the impressionable young. The effect of propaganda is enhanced by the allegation that the profit motive is the driving force for biomedical work. As legislation is borne on the shoulders of public opinion, the end result is likely to be progressive legal limitation of such work. One could of course claim that some 'anti' organisers may also make a living out of the organisations they run.

Their claim is that no good ever came out of animal work. Sir Henry Dale must be turning in his grave to hear adrenaline, histamine, and serotonin summarily discounted. Prostaglandin, H_2 antagonists, antibiotics and transplant techniques are totally ignored by the opponents of animal work.

Certainly, animals have different diseases from those of humans, but numerous animal models for human disease have been created in the past and been used to design therapy. Nowadays, gene manipulation (to be mentioned shortly) allows the creation of precise replicas of human disease in test animals.

Much has been made of different reactions to some drugs between man and some animals: morphia excites cats and mice, chloramphenicol does not cause aplastic anaemia in rats, arsenic does not kill mice, penicillin kills guinea pigs and aspirin causes birth defects in cats and rats. Two dozen such differences are commonly quoted. This accounts for the comparatively large numbers of animals used in toxocity testing as every substance has to be tested in several different species.

Progress in sanitation, housing, nutrition and living conditions are claimed to be the only cause of a decrease in the incidence of tuberculosis, smallpox, polio, diphtheria and many other diseases. This is clearly a half-truth. These factors certainly contributed but medicine, including biomedical work and vaccination, contributed as well.

The real dilemma arises from the emotional and moral aspects of the problem. Heart-rending photographs of pretty and appealing pets are a standard feature in the 'anti' literature[1, 4], which totally ignores the fact that one of the conditions for the granting of an animal licence for research by the Home Office is that animals must be purchased from a registered breeder. Other conditions for the granting of a licence concern the competence of the researcher, the suitability of the premises for the work, the use of anaesthetics and the approval of the objective of the work by an ethics committee. The aim of the work must justify its undertaking.

The ultimate aim of even the most dedicated researcher is reduction of animal use. The term vivisection is obsolete because not much cutting is done nowadays and the work mainly involves immunisation or genetic or dietary manipulation and observation.

THE HEART OF THE MATTER

Here lies the nub of the debate: does the human species have the right to make use of other species (usually mammals) for its own good? It is claimed – and truthfully by some - that animal work also benefits animals but obviously the main objective is human health.

The cost to the animal has to be weighed up. Suffering may range from the loss of freedom to physical pain, nowadays probably no more than an injection, yielding a blood sample, drug manipulation or embryonal gene interference.

Modern thought has been aroused by Singer[5] and carried forward by many thinkers. By far the best overall presentation of the modern moral concept is 'Lives in the Balance'[6] and a review of the changing attitude of man towards animal welfare from Plutarch to today is provided by Tester[7]'.

The current apparent shift against animal use for medical research is undoubtedly due to the intense and amply-funded indoctrination of young people by bodies like the BUAV[7] (British Union Against Vivisection) in the UK and PETA (People for the Ethical Treatment of Animals) in the United States who have large budgets at their disposal. The widely reported increase in vegetarianism is probably due to the same influence.

Observing the 'anti' movement from close quarters, however, one cannot but realise that not all the people concerned are genuine animal lovers. For some their movement provides a welcome quasi-legitimate cover under which to exert their aggressive, antisocial and ultimately anti-establishment actions. Their terrorist behaviour and bizarre, uninformed arguments do not justify the discontinuation of animal work.

IS BIOMEDICAL RESEARCH JUSTIFIABLE?

Before considering the medical and scientific justification of animal work, one has to record the legal requirement to carry out certain tests. These acts (see table) probably provide liability cover for the manufacturers as well as a safeguard for the consumers.

Medicines Act	1968
Agriculture Act	1970
Poisons Act	1972
Health & Safety at Work Act	1974
Biological Standards Act	1975
Food & Environmental Protection Act	1975
Consumer Protection Act	1987
Food Safety Act	1990
EC Pesticide Regulations	ongoing

Table1 – Acts requiring toxocity testing

Responsible bodies like the RSPCA[3], the Research Defence Society[8] and others accept the need for animal use at present but support the call for RRR (reduction, refinement and replacement) of animal tests. Replacement by tissue culture, computer models and CT scanning are already contributing to a reduction in the number of animals used. Even newer non-invasive tests are being introduced:

PET (positron emission tomography), MRI (magnetic resonance imaging) and MEG (magneto encephalography). The public trend against cosmetic testing and vaccine production in tissue cultures also helps to reduce the numbers of animals used. Blood may well be examined under the microscope and the action of the heart on an X-ray screen but an intact model is needed to assess, for example, the effect of a substance on blood pressure Tissue and organ transplants and assessment of transplant materials will, as far as one can see, always require animal testing.

Advances in biochemistry and immunology since the discovery of the DNA structure have broadened the horizon of molecular biology and have permitted the creation of monoclonal antibodies. Whereas in the past histological diagnosis was based predominantly on morphology, monoclonal antibodies directed against specific tissue elements allow a more precise tissue identification and hence a more reliable prognosis and guidelines to treatment. Monoclonal antibodies are raised by injecting specific target elements into a suitable animal (rat, mouse or rabbit), combining the resultant antibody with a myeloma cell line in a number of tissue culture tubes and assaying these for the highest titre against the original target elements. One of the largest producers of such tissue markers, DAKO Ltd[9] lists several hundred of such antibodies or tissue markers. They can be directed against melanoma cells or T lymphocytes or myelin or Vimentin (reacting with mesenchymal tissue elements) or any of a large number of tissue elements. Similarly, numerous antibodies are now available for microbiological diagnosis. For example, adenovirus or chlamidia and other viruses and organisms may be rapidly and accurately identified, which would otherwise take a long time to grow in culture before they could be identified by traditional tests. Likewise, immunochemistry is used in haematology for the identification of coagulation factors and blood group substances, and in biochemistry for the estimation of hormones and steroids. Vaccine production also requires the use of animals, at least for primary production. Subsequently they may be produced by tissue culture[10].

Granting that toxicity testing and vaccine production can, to a certain extent, be replaced by alternative techniques[3,10] and that the production of monoclonal antibodies by tissue culture has reduced the number of test animals required, is there any scope for further animal work?

Perusal of the literature provides the answer: since the discovery of the structure of DNA and partial identification of the human genome, gene manipulation and transfer have become possible and opened up new avenues for basic research and the creation of exact models of human disease. Accomplishments unimagineable a few years ago are reported quite often in the press and in the scientific literature. Here are some examples:

- Clotting factors for the treatment of some types of haemophilia can now be produced in sheep. Efforts are underway to produce pigs with some human genes which would prevent the rejection of their organs by human recipients and thus alleviate the chronic donor shortage for kidneys and hearts.

- Fibrocystic disease is due to α_1 antitrypsin deficiency. The human gene for its production has been stitched to the gene for lactoglobulin production in sheep embryos and some of the resultant sheep now produce large amounts of α_1 antitrypsin along with lactoglobulin in their milk, for the treatment of fibrocystic disease[11].

- Likewise, factors IX and X for the treatment of some types of haemophilia are being produced in sheep. On a sheep farm in Carmarthen, large amounts of antivenom for snake bites are being produced in sheep and exported[12].

- In order to simplify the diagnosis of Down Syndrome, Cytocell Ltd has produced a fluorescent antibody which links to nuclei in the interphase in the Down-specific region of chromosome 21, thus greatly simplifying its diagnosis[12].

- The demonstration of defective axonal transport in a transgenic mouse model of amyotrophic lateral sclerosis (ALS) suggests that a similar mechanism may apply in human ALS – and presents a useful lead towards treatment[13].

- The tumorigenesis and metastasis of a Kaposi's sarcoma cell line in immunodeficient mice is blocked by the β chain of human chorionic gonadotrophin: this may explain why Kaposi's sarcoma is commoner in men than in women[14].

- In June of this year, Nature had a paper on thalassaemia using mice[15], on leishmaniasis using mutant mice[16] and on brain damage recovery using rats[17].

These are random examples of the large amount of work using gene transfer in laboratory animals and obviously amply justify the use of biomedical research. It would be tragic and unjustifiable if the road to further similar work were permanently blocked by the vociferous terrorists sailing under the banner of animal liberation. The growing danger to animal research comes not only from the activity of the animal rights movement but also from the inactivity of those who should be defending it[9].

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