

Introduction

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In this chapter I outline how animals have been used in history to advance human knowledge, how animals are used in research today, where research is carried out, how many animals are used, and the extent of various types of harm caused to them. This leads on to the need on ethical grounds to reduce harm to a minimum, public attitudes to research on animals, and the public's role in permitting research on animals.

1.1 Reasons for Using Animals in Research

The history of the use of animals to advance human knowledge is long. Even in prehistory, the butchering of animals must have provided some insights into human anatomy and disorders for those who were wise enough to see. However, our earliest records of animal studies date back to the ancient Greeks. Aristotle pioneered the experimental method and carried out dissections some 300 years BC, but he was certainly not an experimental scientist as we would recognise one today, his biological works being described by the Nobel Prize-winning scientist Peter Medawar as 'a farrago of hearsay, imperfect observation, wishful thinking and credulity amounting to downright gullibility'¹. Alcmaeon of Croton, while in Alexandria (305–240 BC), dissected a living animal to demonstrate the importance of the optic nerve for vision² and Erasistratus, a prominent physician in Alexandria

¹ Medawar and Medawar (1985).

² Maehle and Tröhler (1987).

(third century BC), used vivisection to distinguish between the sensory and the motor nerves. In the second century AD, Galen of Pergamum, a famous physician who became doctor to the emperors Marcus Aurelius and Commodus, used dissection to study the continuity of the nervous system. The experience that he gained from these studies on animals led him to diagnose loss of feeling in the fingers of a patient as being caused by an injury to the spine. This was probably the first time that it was realised that neural problems could be referred from the actual point of injury.

With the arrival of the Renaissance and its associated flowering of scientific endeavour there was a renewed interest in animal experimentation that has continued to the present day. The following are just a few historical examples of the use of animals in studies on anatomy and physiology. William Harvey used living animals (including shrimp, eels, fish, pigeons, dogs and other mammals) to demonstrate the circulation of blood and, in 1661, Marcello Malpighi saw the capillaries as predicted by Harvey in dissected preparations of the frog lung and urinary bladder. In the 1800s, Claude Bernard studied glycogen and its relationship to diabetes, and Sir Charles Bell and Eduard Hitzig studied the nervous system. Incidentally, Bell was extremely reluctant to carry out his experiments, which, like others of the time, must have resulted in extreme animal suffering as this was before the discovery of anaesthesia³. More recently, animals have been used in research into the immune system, and in the development and treatment of diseases such as anthrax, poliomyelitis, influenza, asthma and tuberculosis, blood transfusion, various cancer treatments, muscular dystrophy and neurological disorders such as Alzheimer's and Parkinson's disease amongst many others⁴. In addition, animals have been, and are, used in a wide range of fundamental research including studies to gain knowledge about animal or ecological systems, and ways of improving animal health, welfare, productivity or performance⁵. Animals are also used in the safety testing of pharmaceutical and household products as well as environmental safety testing of chemicals, the legal requirement for which, in Europe, depends on the tonnage of the chemical produced per annum⁶.

Today published statistics provide an overview of the types of research in which animals are used. For example, UK statistics on animal use for 2011⁷ show that fundamental biological research accounted for 35% of the total procedures carried

³ Lapage (1960); Sechzer (1983).

⁴ Lapage (1960); Smith and Boyd (1991), p. 27. See also the Understanding Animal Research website www.understandinganimalresearch.org.uk, accessed 8 May 2013.

⁵ A comprehensive list of various uses to which animals are put as models for various diseases can be found in Hau and Schapiro (2011).

⁶ The European Community REACH regulation (2007) deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances and includes regulations on the testing of chemicals, see http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm. For the USA, see The Toxic Substances Control Act (1976) at <http://www.epa.gov/lawsregs/laws/tsca.html>, accessed 8 May 2013.

⁷ Home Office (2012).

out on animals⁸, applied human medicine 13%, applied veterinary medicine 5%, and protection of humans, animals or environment 3%. Only 1% of procedures were used in the direct diagnosis of conditions while 43% involved animals in breeding programmes, a category that includes harmful mutant animals and genetically modified animals⁹. The development of genetic modification and mutant techniques has resulted in greater numbers of animals, particularly mice and fish, being used in fundamental research aimed at elucidating gene function and the control of genetically mediated disease. This has been a contributing factor to the reversal of the downward trend in the use of animals in research in the UK seen in the mid 1990s¹⁰. However, the UK statistics have recorded all animals bred with a genetic modification unless the researcher can prove over two generations that there is no welfare impact. In practice this means that all have been recorded, even though some are simply used for breeding purposes, are not used directly in research and may not show any ill effects (possess a harmful phenotype). Some have argued that this practice artificially increases the statistics of animal use, but others have pointed to the various harms caused in the production of genetically modified animals. However, implementation of European Directive 2010/63/EU will change the reporting requirements so that those shown not to possess a harmful phenotype will not need to be reported¹¹.

1.2 Where Animal Research is Carried Out

There are various types of institution in which animal research is carried out. Universities and non-profit organisations use animals in fundamental studies, or work in collaboration with pharmaceutical companies. Academic research includes areas such as neurobiology, gene function, and metabolism, but animals are also used in more applied settings such as studies on Parkinson's or Alzheimer's disease. Academic research also includes studies of behaviour or animal welfare that may sometimes be carried out outside the laboratory. Pharmaceutical companies use animals in the research and development of medicines. In these studies animals are

⁸ Regulated procedures prior to January 2013 were defined as 'any experimental or other scientific procedure applied to a protected animal which may have the effect of causing that animal pain, suffering, distress or lasting harm'. The implementation of European Directive 2010/63/EU resulted in a revision of this definition (see Glossary and <https://www.gov.uk/research-and-testing-using-animals>, accessed 8 May 2013).

⁹ See Glossary for definitions of genetically altered (GA) and genetically modified (GM) animals.

¹⁰ The UK statistics show a fairly regular increase in the number of genetically modified and harmful mutant animals from 1995 to 2010. However, the 2011 figure was slightly lower than that in 2010 due to a 6% reduction in the breeding of harmful mutants, partially offset by a 3% increase in the numbers of genetically modified animals.

¹¹ Commission Implementing Decision of 14 November 2012 establishing a common format for the submission of the information pursuant to Directive 2010/63/EU of the European Parliament and of the Council on the protection of animals used for scientific purposes, available from http://ec.europa.eu/environment/chemicals/lab_animals/home_en.htm, accessed 3 April 2013.

used in trials of efficacy of potential drugs and to assess their likely toxicology. Some of this research, typically the efficacy studies, is usually done in-house by the company developing the medicine, while the toxicology studies necessary to obtain a licence from the drug regulators¹² to market the drug may be carried out by independent contract research organisations (CROs). However, there has been an increasing trend for contracting laboratories to offer more and varied research services to the pharmaceutical companies. In addition, CROs carry out safety and environmental toxicity testing of non-pharmaceutical chemicals. Organisations that breed animals for research may also carry out certain types of research, and have begun to offer some of the services traditionally provided by CROs. A further category of research institution is government or other public research facilities. These include establishments whose function may be to monitor and provide advice on serious health risks to the population, monitor and control the standards and quality of biological products, research into agricultural or pest-related issues, or counter defence threats.

1.3 Numbers of Animals Used

The number of animals used in experiments is not trivial. Statistics from the UK¹³ show that, in 2011 for example, over 3.79 million procedures were started that were likely to cause pain, suffering, distress or lasting harm to animals (this figure is more than the 3.71 million animals used as some re-use of animals is permitted); 77.5% of these procedures were carried out on mice, rats or other rodents, while other mammals (a category that includes dogs, primates, cats, ferrets, etc.) accounted for only 2% of procedures and fish were used in 15% of procedures. As we shall see in Chapter 6, despite a fall in animal use in the 1980s and 1990s, the development of genetic modification technologies has resulted in increased use of certain animals, particularly mice.

This, however, is only one country. Unfortunately, as the Nuffield Council on Bioethics¹⁴ points out, statistics for other countries can be hard to come by and are not necessarily equivalent. For example, the Animal and Plant Health Information Service (APHIS) of the United States Department of Agriculture publishes statistics on the numbers of animals used in research in the USA in each state by fiscal year (Table 1.1), but the numbers used seem very small (approximately 1.1 million animals per annum) compared with equivalent statistics for the UK. The discrepancy between the UK and US figures is, however, easily explained. In the USA the Animal Welfare Act excludes birds, rats of the genus *Rattus* and mice of the genus *Mus*

¹² There are various regulatory bodies that license medicines: e.g. in the USA the Food and Drug Administration (FDA); in the UK the Medicines and Healthcare products Regulatory Agency (MHRA); and within Europe the European Medicines Agency (EMA).

¹³ Tables and graphs can be found in Home Office (2012), available from <https://www.gov.uk/research-and-testing-using-animals#publications>, accessed 3 April 2013.

¹⁴ Nuffield Council on Bioethics (2005).

Table 1.1 United States Department of Agriculture Animal and Plant Health Information Service (APHIS) Annual Report on Animal Usage by Fiscal Year. Fiscal Year 2010, published 27 July 2011.

Cats	21 578
Dogs	64 930
Guinea pigs	213 029
Hamsters	145 895
Marine mammals	126
Non-human primates	71 317
Other farm animals	38 008
Pigs	53 260
Rabbits	210 172
Sheep	13 271
All other covered species	303 107
Total	1 134 693

Source: http://www.aphis.usda.gov/animal_welfare/efoia/7023.shtml,
http://www.aphis.usda.gov/animal_welfare/efoia/downloads/2010_Animals_Used_In_Research.pdf, accessed 13 May 2013.

bred for use in research. As these in the UK account for just over 87% of the total procedures, a more reasonable estimate of the animals used annually in the USA might be 8.6 million. Using available statistics and estimates of this sort, it has been estimated that fewer than 60 million animals are used worldwide in research¹⁵. Whatever the exact figure, it is clear that a significant number of animals are used for research purposes and that this justifies serious ethical consideration. However, it is easy to be seduced by numbers, especially when you have nothing with which to compare them. So to provide some perspective, let us turn to the food industry. Many of the animals produced for food suffer some welfare compromise in the processes of breeding, production, transport and slaughter, and the number that we use is truly astonishing. To take just one animal that we breed and kill for food: in 2011, provisional figures suggest that 931 million broiler chickens were slaughtered in the UK¹⁶, and many broiler birds suffer welfare problems such as lameness and ascites¹⁷. Does this then mean that we should ignore the issue of animals in research? I would argue not. Numbers can be a useful tool to target and prioritise resources effectively, but it would be wrong to use the fact that more animals are used in the food industry to suggest that the laboratory animal issue is less important. After all, for each animal, it is the personal experience that is important, not the numbers of its fellow sufferers.

¹⁵ Understanding Animal Research <http://www.understandinganimalresearch.org.uk>, accessed 28 March 2012. Taylor *et al.* (2008). See also Knight *et al.* (2008) for suggestions that the number of animals used worldwide is much larger.

¹⁶ Department for Environment, Food and Rural Affairs www.defra.gov.uk/, accessed 22 October 2012.

¹⁷ For example Julian (1998); Butterworth *et al.* (2002); Knowles *et al.* (2008).

1.4 Harmful and Harmless Research

A common misconception about animal research is that it inevitably results in animal suffering¹⁸, usually as a result of surgery or as a response to substances administered to the animal. In some cases research will involve these sorts of harms, but many other types of harm (e.g. fear, discomfort, boredom, hunger) can also occur. Potential harms of whatever sort, whether deliberately induced or as an unintended consequence of the research, need to be taken into account alongside the proposed benefits of the research when considering whether the research is justified, as we shall see in Chapter 5.

Not all animal research is likely to result in harm to the animal. Ethologists, for example, are interested in what factors stimulate particular behaviours (why animals do what they do), what evolutionary processes led to the behaviour, how behaviour develops and what is its purpose, or to put it another way, the study of the causation, evolution, development and function of animal behaviour¹⁹. Ethological studies are generally carried out for reasons of curiosity as to how the world works, rather than with the aim of reducing human or animal suffering²⁰ so it is a good thing that many studies of behaviour do not result in pain, suffering, distress or lasting harm. Animals may, for example, be observed in zoos with no additional ill effects on the animals whatsoever. Observations can also sometimes be made on animals in the wild with minimal impact, but it is certainly not the case that all ethological studies are neutral in their effect on the animal.

A personal example may be instructive. In the early 1980s I carried out research into the ranging behaviour of free-living marmosets in north-eastern Brazil. I was interested in their natural history, in particular how they used their environment and the structure of their social groupings. In order to do this I needed to be able to track them through dense vegetation and to do this reliably required the use of radio tags. To fit these I had to trap and anaesthetise some animals to allow me to fit the tag, make measurements and take samples. In those days few people discussed the ethical issues involved in such field research but it was obvious that there were both potential and real costs to the animals in this research. The first harm was trapping, which frightened and stressed the animals. The marmosets then had to be removed from the trap, and anaesthetised by injection. This was again stressful, and there was a potential risk of harm from the anaesthetic (fortunately no ill effects were seen on this occasion). A radio tag was then fitted which added a weight to the marmoset, and may have caused discomfort or affected energy

¹⁸ Even today not everybody believes that animals are capable of suffering, but many believe that at least some should be given the benefit of the doubt that they may experience feelings, both good and bad. This is the basis for many of the concerns about the welfare of animals. These issues will be discussed in Chapters 3 and 4.

¹⁹ Tinbergen (1963).

²⁰ There is, however, a flourishing science of applied animal welfare science aimed at improving animal welfare that grew out of the ethology discipline.

expenditure and subsequent survival. The collar might also have rendered the marmoset more visible to predators, could have snagged on branches or chaffed. Finally, the marmoset was left in a quiet place to recover fully from the anaesthesia before release. Again, waiting in the cage in proximity to humans, even though the cages were covered with a cloth, may well have resulted in fear and stress, and perhaps foraging time was lost. This example may seem to be rather an obvious one as there were manipulations to the animals, but in the past field investigators have often underestimated the impact to the animal of their studies. Even watching animals can have effects, which may be either beneficial for the animals watched (scaring off predators and thus reducing the risk of being eaten), or negative (perhaps through disturbance of the animals or habituation to humans which may be risky if others are not so kindly disposed to the animals).

The detrimental effects described above were not a required part of the study, but occurred as a consequence of the techniques used. However, other sorts of ethological research may cause harm to animals as an integral function of the experimental procedure. Examples include the deliberate manipulation of clutch size, which might be done to study how parents allocate resources to their offspring, or studies on aggression, predation or territorial displays and communication. As in all other areas of research using animals, an ethologist is expected to identify potential harmful effects (even those that may not at first be obvious) in order to try to eliminate or reduce them and to assess whether the work justifies any remaining harm. Organisations such as the Association for the Study of Animal Behaviour have published guidelines to help researchers do this²¹.

1.5 How Much Suffering is Caused by Research?

It is hard to obtain good evidence on the suffering experienced by animals in research. The UK has for many years published detailed statistics on animal experimentation, but the only data relating to suffering has come from the severity banding of licences (Table 1.2). These provide a prospective assessment of suffering whereby licences to carry out research are assigned as ‘mild’, ‘moderate’, ‘substantial’ or ‘unclassified’, based on an assessment of the likely experience of suffering of the average animal²². The revised UK legislation required by European Directive 2010/63/EU requires that applicants will have to report the actual severity of procedures from 1 January 2014, and the publication of this data should provide much greater transparency.

My own experience, as a member of various ethics committees, has been that the majority of licence applications are classified as either mild or moderate severity²³,

²¹ ASAB (2006).

²² Animal Procedures Committee (2009a).

²³ These severity limits refer to the maximum suffering or harm that the animal may experience, without the researcher referring back to the Home Office, the UK government department responsible for issues relating to the use of animals in science.

Table 1.2 Severity banding of licences for use of animals in scientific procedures in the UK.

Severity banding	Licences in force on 31 December 2011
Mild	936
Moderate	1591
Substantial	55
Unclassified (procedures carried out under terminal anaesthesia)	42
Total	2624

Note that these are a prospective assessment of the experience of the 'average' animal involved in a given project, which may contain many different protocols, and so give no indication of the level of suffering imposed on individual animals. From 1 January 2013 UK licences are no longer banded (given an overall severity rating). Individual procedures are classified into non-recovery, mild, moderate and severe categories. From 2014 onwards, statistics on actual suffering will be published.

Figures from UK Home Office Statistics (Home Office, 2012). © Crown Copyright 2012. Contains public sector information licensed under the Open Government Licence v2.0.

the mild category including procedures that can be as minor as the taking of a blood sample or an injection of saline. I have also visited many animal houses, and most of the animals, at any one time, in these buildings appeared to be healthy and free of pain. However, we should not underestimate the extent of suffering that can occur. Sometimes pain or other harm is an inevitable consequence of procedures; surgery, for example, is always likely to result in some pain, and electric shocks have been used as part of experimental paradigms. In the past, the notorious LD₅₀ test required that test compounds be given to animals in increasing amounts until a dose was arrived at which killed 50% of the animals tested. Nowadays, special justification and permission is required to use the LD₅₀ test in the UK, and there are alternatives that require far fewer animals. Another example of a test that causes considerable suffering is one in which mice are used to detect toxins absorbed by shellfish when they ingest certain bloom-forming dinoflagellates such as *Gymnodinium breve*. These neurotoxins can be extremely dangerous to humans, in some cases resulting in death. The mouse assay uses lethality as an endpoint and causes considerable suffering, but fortunately humane alternatives that may also be scientifically better are being developed to replace this test²⁴.

Finally, it is worth noting that some experiments may cause so little harm to the animal that they fall outside legislation. Within Europe, the level at which a procedure requires licensing has been set at 'practices not likely to cause pain, suffering, distress or lasting harm equivalent to, or higher than, that caused by the introduction of a needle in accordance with good veterinary practice'²⁵. Studies that therefore involve only observation of the animals or perhaps collection of faeces or urine would normally not require regulation, but if they resulted in significant fear or stress then, even if there is no invasive component, licences would be needed. Some would wish to go much further, arguing that just keeping animals in confinement

²⁴ See Cefas website www.cefas.defra.gov.uk, accessed 8 May 2013.

²⁵ European Directive 2010/63/EU, Article 1.

within research institutions results in harm to the animals that should not be permitted. As we shall see in Chapter 5, animals used in research certainly can, and do, experience harms that are not a planned part of the study (so-called non-contingent harms). These harmful effects may not be trivial and can include stress from handling, transport, unnatural social groupings, or inadequate housing.

1.6 Attitudes to Animal Experimentation

Knowledge derived from animal experimentation comes at a cost to the animals used in the research, which is why many countries have laws to regulate animal experimentation. However, attitudes towards animals have not always been as favourable to their welfare as they are today. Over time, attitudes to animals have generally moved towards treating them in a way that would reduce suffering, although there has always been a spread of opinion regarding their ability to suffer and how this should impact on their use including animal research. There are a number of excellent accounts, referenced below, that provide great detail on the development of these attitudes and the factors that influenced these changes but it is worth providing a short summary here.

Even amongst the ancient Greeks there was a range of beliefs regarding our relationship to animals and the correct way to treat them. For example, Aristotle and the Stoic and Epicurean philosophers excluded animals from considerations of moral concern. On the other hand, the Cynics considered animals to be superior to humans while other philosophers developed the concept of a kinship between humans and other animals²⁶. Galen, who lived in the second century AD, was not particularly concerned with the suffering of the animals that he dissected, although he did refuse to dissect the sexual organs of living animals or even dead animals in upright man-like postures, largely on aesthetic grounds, and recommended using pigs or goats instead of primates to avoid seeing the unpleasant expression of the ape when vivisected. Indeed, much early animal research was carried out in the belief that the distinction between humans and animals was such that the only ill effect of causing suffering to animals came from the possibility that these actions might lead to inhumanity to humans (a view taken by Thomas Aquinas, René Descartes and Immanuel Kant)²⁷. Descartes, writing in the seventeenth century, has been quoted as considering that as animals lacked the necessary soul, they were unable to feel real pain although they might feel some form of inferior sensation. In fact, his position has probably been overstated, his views being rather that animals did have feelings but that they were not self-consciously aware of those feelings²⁸. Unfortunately, some of his followers were firmly of the view that animals had no feelings and went so far as to cause them deliberate and pointless pain, laughing at

²⁶ Grayson (2000), p. 3.

²⁷ Maehle and Tröhler (1987).

²⁸ Cottingham (1978); Bekoff and Meaney (1998), p. 131.

those who objected. Indeed, the vocalisations of vivisected dogs dissected to show the circulation of blood (demonstrated by William Harvey in 1628) were interpreted as nothing more than the creaking of the animal 'clockwork'. Animals were considered irrational beings, and as such did not fall within the system of 'natural right' and thus humans had no obligations towards animals²⁹.

By the beginning of the eighteenth century there were growing concerns about ethical aspects of such experimentation from a number of literary men³⁰. Samuel Johnson, for instance, was highly critical of animal experimentation, writing 'he surely buys knowledge dear, who learns the use of lacteals [lymphatic ducts] at the expense of his humanity'. He took particular issue against the repeated and popular demonstrations of vivisections to the public. However, his concern may have been more for the corrupting influence of experimentation on the researcher than for the animals themselves³¹. The physiologist Claude Bernard may have also been expressing some concern about the means required to achieve biological knowledge when he wrote that 'If a comparison were required to express my idea of the science of life, I should say that it is a superb and dazzling hall that can only be reached by passing through a long and ghastly kitchen'. Humphrey Davy, who used animals to study the effects of various gases, similarly became increasingly concerned about the pain he caused them. Charles Darwin, while explicitly supporting the use of vivisection to advance physiological knowledge, also wrote that its use for trivial purposes to satisfy 'damnable and detestable curiosity' made him sick with horror³². More practically, some were already considering means of avoiding using animals in research. The Scottish astronomer and instrument maker James Ferguson suggested a non-animal, mechanical alternative to the use of animals in demonstrations of Boyles' vacuum pump experiments.

Concern about animal experimentation did not occur in a vacuum, but was part of growing discomfort regarding various uses and abuses of animals. Animals were property and as such, when the owner perpetrated the abuse, were not subject to any legal protection; both deliberate and unnecessary cruelty such as cock fighting, bull baiting and to food animals was rife³³. Perhaps most influentially, philosophers such as Rousseau, Primatt and Jeremy Bentham argued that it was the ability of animals to experience feelings, such as pleasure and suffering, that made them valid objects of moral concern, which is essentially an argument based on empathy. Although these philosophers had some influence amongst educated persons, the majority in the UK was still largely unconcerned by the suffering of animals³⁴, but views were gradually changing. James Wright of Derby produced a series of paintings of scientific demonstrations, and in one, painted in 1768, he vividly depicted the varied attitudes to experimentation at the time. The painting shows a scientist

²⁹ Maehle (1994).

³⁰ Daly (1989).

³¹ Maehle (1990).

³² Browne (2002), p. 421; Holmes (2008).

³³ Radford (2001).

³⁴ Radford (2001).



Figure 1.1 *An Experiment on a Bird in the Air Pump* by Joseph Wright, 1768. Reproduced with permission from The National Gallery, London.

demonstrating the effects of a vacuum pump on a bird (Figure 1.1). The painting is Romantic, in that the light of reason dispels the surrounding darkness, but the painting conveys fear as well as wonder³⁵. The watchers display responses that seem to reflect the range of views that we might recognise in today's debates, from the didactic, through interested, to the distress of the girl covering her eyes.

Eventually the disquiet caused by these demonstrations, and by vivisection in general, which until about 1850 was carried out without anaesthesia³⁶ (Figure 1.2), led in 1870 to the British Association for the Advancement of Science publishing voluntary guidelines. However, these were not sufficient to satisfy public concern and, following the submission of two proposals for bills by members of the Houses of Lords and Commons, the Government announced a Report by the Royal Commission for the Advancement of Science. As a result, the UK, in 1876, passed the very first legislation anywhere in the world that controlled animal experimentation. However, this did not by any means bring an end to the vivisection debate³⁷.

Today, in the UK it seems that although there is general concern about animal welfare and some question the validity of the use of animals in research³⁸, there is

³⁵ Holmes (2008).

³⁶ Smith and Boyd (1991).

³⁷ See Grayson (2000), chapters 2 and 3.

³⁸ It is often not easy for those not expert in a particular research area to assess competing claims regarding the benefits, or otherwise, of using animals. Some argue that all animal experiments for biomedical purposes are scientifically invalid, a position that has not been accepted by various reviews into the subject, e.g. Nuffield Council on Bioethics (2005). However, the Bateson Report (Bateson, 2011b)



Figure 1.2 *A Physiological Demonstration with the Vivisection of a Dog* by Émile Édouard Mouchy, 1832. Reproduced with permission from the Wellcome Library, London.

also some evidence that the public accepts that such use should be allowed as long as it is well justified and regulated. Within the UK, a 2012 Ipsos MORI poll carried out on behalf of the Department for Business, Innovation and Skills (BIS)³⁹ found that 66% could accept animal experimentation so long as there is no unnecessary suffering to the animals. On the other hand, 37% of British adults objected to animal experimentation, with 21% of those polled agreeing, or tending to agree, with the proposition that the government should ban all experiments on animals for any form of research. Interestingly, 66% agreed with the statement that they accept animal experimentation as long as it was for medical research purposes, when in fact the law in the UK also permits it for the much more general purpose of advancing human knowledge. Until recently, polls carried out by MORI on this subject have tended to be reasonably constant in their findings, as well as being consistent with focus group research⁴⁰. However, this latest poll shows a small but significant decline in public support for research using animals. It will be interesting to see how opinions move in future years.

points out that those arguing for animal experimentation sometimes make incomplete cases, in which there is often not enough background information on the importance of the condition, or subject being investigated, nor on progress relating to alternatives to animal use.

³⁹ MORI poll, 2012, Views on the Use of Animals in Scientific Research, <http://preview.tinyurl.com/cog74fh>, accessed 8 May 2013.

⁴⁰ For example Macnaghten (2004).

Not surprisingly, there are cultural differences between countries in their attitudes to animals. A survey of polls in 1994 showed that the UK and some European countries seem to have had a higher level of opposition to animal research than Japan or the USA. Even so, a Gallup poll in 2010, questioning the use of medical testing on animals, indicated that 59% of Americans found the practice morally acceptable, while 34% thought it was wrong. Across cultures, women tend to be more concerned by the issue than men.⁴¹

However, polls need to be treated with caution as they can deliver widely different conclusions depending on how, when and where they are carried out. An analysis of a range of surveys from different countries showed that 0–27% accept the use of animals in research while 0–68% opposed it⁴², which is not a clear answer. It also indicated that much depends on how questions are asked and who asks them. For example, if questions include words like ‘pain’, then respondents are less likely to support animal research, even though many experiments do not cause the animals much, if any, pain. A MORI poll carried out by *New Scientist* in 1999⁴³ showed that responses to the question ‘On balance, do you agree or disagree that scientists should be allowed to conduct any experiments on live animals?’ were affected by whether the respondent had been first told that ‘Some scientists are developing and testing new drugs to reduce pain or developing new treatments for life-threatening diseases such as leukaemia and AIDS’. Similarly, the purpose and type of research can also affect its acceptability, so that the public are more willing to accept the use of animals in testing the toxicity of chemicals to humans than to establish the effect on the environment⁴⁴. Another factor to keep in mind when studying polls is that special interest groups frequently use public opinion as a tool to advance their cause in the animal research debate⁴⁵, and that polls carried out by these organisations have often not been subject to rigorous peer review that would scrutinise the survey techniques and instruments⁴⁶. It may not be surprising, therefore, that poll results often correlate with the views of the organisations that commission them⁴⁷.

If it is hard to find out what people think, then it is even harder to find out why they think it. In assessing the results of such polls it is worth considering whether their views are based on adequate knowledge. Managhten’s study⁴⁸ of a series of

⁴¹ Pifer *et al.* (1994); Gallup Politics website article by Lydia Saad, 2010, Four Moral Issues Sharply Divide Americans, <http://preview.tinyurl.com/26mdavu>, accessed 26 April 2013. See also a survey posted by Michael Foust, 2006, Baptist Press, <http://www.sbcbaptistpress.org/BPnews.asp?ID=23322>, which reported that 61% of those polled felt that medical research on animals was acceptable.

⁴² Hagelin *et al.* (2003).

⁴³ *New Scientist* MORI Poll, 1999, Attitudes Towards Experimentation on Live Animals, <http://preview.tinyurl.com/blplnjn>, accessed 26 April 2013.

⁴⁴ MORI, 2009, Views on Animal Experimentation, <http://preview.tinyurl.com/csfvx2n>, accessed 26 April 2013.

⁴⁵ Hobson-West (2010).

⁴⁶ Hagelin *et al.* (2003).

⁴⁷ Grayson (2000); Nuffield Council on Bioethics (2005).

⁴⁸ Macnaghten (2004).

focus groups indicated that there appears to be general ignorance amongst the public about the broad issues of animal experimentation, for example relating to the numbers of animals used, how they are used and how they are regulated. This finding is supported by the fact that when respondents are asked what controls should be included in the UK regulatory system, they often list provisions that already exist⁴⁹. On the other hand, a Eurobarometer report in 2005⁵⁰ indicated that knowledge of biotechnology in European countries was growing. Perhaps the truth of the matter is that most people do not think very hard or often about the ethics of animal experimentation, except when forced to do so by inclusion in surveys or opinion polls. Certainly, Macnaghten's focus group study suggested that people often prefer to avoid the issue, because, when they think about it, they find themselves in the uncomfortable position of realising that their views on the treatment of animals conflict with their desire to provide appropriate care for humans in distress or need. Many people feel that humans are, in some sense, fundamentally different to other animals and worthy of special consideration. However, Darwin's publication of *On the Origin of Species* in 1859 followed by *The Descent of Man* 12 years later, and backed up by 150 years of subsequent research have made it clear that we share not only a common origin but also many anatomical, physiological and behavioural features with other species⁵¹. Inevitably, this relationship has had important consequences on our understanding and views as to how animals should be treated.

The scientific establishment now generally accepts that we share with at least some animal species the ability to experience feelings, although we may not experience them in the same way or be sure what the feelings are⁵² (this will be covered in more detail in Chapters 3 and 4). The consequence of this belief that complex animals, such as mammals, birds, fish and others, are capable of suffering, combined with a view that some animal experimentation is necessary to advance human fundamental or medical knowledge (both propositions are disputed by some), is that one finds oneself in an ethical dilemma. The deliberate causation of suffering to another being is clearly a wrong, and some feel, like Regan and Singer⁵³, that if it is ethically wrong to carry out certain experiments that would cause suffering or harm to humans, then it must also be wrong to carry out these experiments on animals that are similarly capable of suffering. On the other hand, if the research is not carried out, then harm to humans and other animals may also ensue: sick people and animals may not be cured, people and animals may suffer unnecessary harm as a result of poisoning from an untested chemical, and we may be less well

⁴⁹ Festing and Wilkinson (2007).

⁵⁰ Gaskell *et al.* (2005).

⁵¹ At the end of *On the Origin of Species* Darwin implies a common origin. More explicitly, in *The Descent of Man* he writes of humans and other vertebrate animals: 'Consequently we ought frankly to admit their community of descent; to take any other view is to admit that our own structure, and that of all the animals around us, is a mere snare laid to trap our judgement.' Darwin (1871), p. 43.

⁵² Kirkwood and Hubrecht (2001).

⁵³ See Chapter 3.

equipped to make crucial decisions that affect our environment and the animals living within it. Therefore, others counter that while it may be wrong to carry out such experiments on animals, it is a greater wrong not to do so, either because the experiments have the potential to reduce future suffering of humans, and possibly some animals, or because the benefit to humans outweighs the cost to the animals. People who take this position base it on a special utilitarian approach that combines aiming to achieve the greatest good for the greatest number, with a view that there are some things that are ethically unacceptable to do to humans but which you can do to other animals⁵⁴.

At the extremes of the debate, the pro and anti positions are mutually incompatible and, sadly, there is no way of proving which is right. These polarised positions are based on two different moral frameworks, both of which have an internal consistency and logic, which explains why the debate over the rights and wrongs of animal experimentation have been so heated and long-lived. However, it is important to emphasise that debate is not as rigidly polarised as this. There are a range of middle positions in which it is argued that some experimentation should be allowed, as long as there are proper controls and restrictions on the conduct and types of experimentation⁵⁵. These controls generally include (1) that the potential benefits of the research must be justified by weighing them against the likely harms that will accrue to the animals; and (2) that some types of research, or the use of some species, should never be permitted. Most people's views lie somewhere in this middle area, and legislative controls on research (where they exist) reflect this, although some may feel that more needs to be done to find alternatives or to reduce the welfare costs of research. Such a system requires decisions to be made on prohibitions, such as which species should or should not be used, and requires the benefits and harms of a specific piece of research to be weighed. However, the practicalities involved in making these decisions are not simple and will be covered in more detail in later chapters.

The presumed current public acceptance of restricted and regulated animal experimentation raises the question what is different about other animals that makes it morally acceptable for us to carry out experiments on them. Philosophical arguments that have been put forward to support this use include (1) animals are not able to form moral contracts and therefore are not entitled to equal consideration; (2) humans owe more to other humans than they do to animals; (3) the comparative value of human and animal lives, both to themselves and more generally; and (4) that there is a moral tradition that animals' interests are treated as subordinate to ours⁵⁶.

It is likely that the majority of people have not studied these arguments in detail, but just generally feel that humans are in some way superior, more valuable, or more

⁵⁴ Grayson (2000). Richard Ryder argues against a Utilitarian justification of the use of animals, arguing that the harm of many (in this case humans) cannot be summated to justify animal research. However, see Leuven and Višák (2013) for a critique of Ryder's approach.

⁵⁵ Nuffield Council on Bioethics (2005).

⁵⁶ See also Smith and Boyd (1991), chapter 11; Bekoff and Meaney (1998), p. 163.

powerful than other animals, and that while experimentation may be regrettable, our human interests come first. The problem with the human superiority position is that justifications based on perceptions of humans as superior to other animals are very easily criticised on ethical grounds. For example, if might is right, then why is it wrong to experiment on powerless humans? If the justification is the mental superiority of humans, perhaps exemplified by our capacity to be self-conscious and able to reflect on our feelings, then why is it wrong to experiment on a fetus or a brain-damaged human, either of which may be less sentient than certain animals? Indeed Ryder and Singer argue that to treat animals as morally inferior to humans is speciesism⁵⁷, which, Ryder has suggested, is as unacceptable as racism. It is perhaps important to clarify that Singer does not argue that it may never be right to use animals in research, only that making decisions on the basis of species alone is wrong.

So what factors should be taken into account when we try to make moral decisions about the broad rights and wrongs of animal experimentation? Singer suggests that some organisms (either animal or human) will possess features that make them more valuable than others. So, for example, pain is as bad for an organism that is self-aware as for one that feels pain but is not self aware, while the loss of life matters much more to one that is self-aware (hence the life of a human will, usually but not always, be worth more than that of another animal). Incidentally, some would argue that the use of animals in biomedical experiments is more justifiable than using them for food, because we need not rely on animals for food, while without animal research some people would die. However, is the difference as great as it first appears? Medicine is concerned with making us feel better or speeding our recovery from disease. The reason for doing this is essentially hedonistic, that is to make us feel good and to banish unpleasant feelings, as is the desire of some of us to supplement our diet with meat.

The Nuffield Council on Bioethics⁵⁸ in an in-depth review of the ethics of animal experimentation identified five features that they considered to be relevant when comparing the moral status of humans with particular species of animals: sentience, higher cognitive capacities, the capacity to flourish, sociability, and the possession of a life. They explain why these features are important as follows. Sentience is considered important as it is usually considered to be the capacity to feel pain or pleasure. Higher cognitive capacities include abilities such as language or tool use and may be important as they could affect how the animals see themselves in the world. The capacity to flourish is a factor as there can be practical difficulties in providing research housing and husbandry conditions in which animals do well. Sociability is seen by some as important as it places the animal in a broader context where what happens to it may also matter to others, either animals or humans. Finally, there is the question as to whether life itself has a value or whether it is only important when the owner of the life has expectations about it. Clearly, all animals possess some of these features, but some animals are thought to be better endowed in some of these features than others,

⁵⁷ Ryder (1975); Singer (1990).

⁵⁸ Nuffield Council on Bioethics (2005).

and it is these distinctions that are important in deciding which animals should be protected, and to what extent (see Chapter 4). However, philosophers and scientists have debated the nature, importance, and in some cases reason for using these features as the basis for moral concern. Moreover, people's ethical concerns about animal research are not just linked to the issue of suffering but can include other issues, such as concerns relating to the intrinsic value of the animal, or how other people might feel about the issue and whether it is right to mutilate or destroy another organism⁵⁹. Many people feel strong concern regarding the use of techniques such as xenotransplantation (transplantation of tissues or organs from one species to another) and genetic modification. While often expressed as a feeling that it is, in some sense, wrong to meddle with species boundaries and thus with nature, these concerns are often based on rational fears about the fundamental safety of such techniques⁶⁰.

Given the variety and complexity of these issues, it is not surprising that there appears to be no easy answer to the fundamental issue as to whether it is right in some circumstances to allow animal experimentation. The difficulties were demonstrated by the fact that while members of the Nuffield Council on Bioethics Working Party were able to identify four different ethical viewpoints (Box 1.1), they simply

Box 1.1 Four different positions on the ethics of animal research identified by members of the Nuffield Council of Bioethics Working Party

The 'anything goes' view

If humans see value in research involving animals, then it requires no further justification (no member of the Working Party takes this position).

The 'on balance justification' view

In accepting research on animals one acts with full moral justification, while accepting that every reasonable step must be taken to reduce the costs that fall on animals.

The 'moral dilemma' view

Most forms of research involving animals pose moral dilemmas: however one decides to act, one acts wrongly, either by neglecting human health and welfare or by harming animals.

The 'abolitionist' view

There is no moral justification for any harmful research on sentient animals that is not to their benefit.

Source: reproduced from *The Ethics of Research Involving Animals*, para. 14.12 (pp. 244–245) (Nuffield Council on Bioethics, 2005), with permission from the Nuffield Council on Bioethics. Available at <http://nuffieldbioethics.org/sites/default/files/The%20ethics%20of%20research%20involving%20animals%20-%20full%20report.pdf>, accessed 26 April 2013.

⁵⁹ Smith and Boyd (1991), p. 307; Nuffield Council on Bioethics (2005).

⁶⁰ Macnaghten (2004).

agreed to differ on this issue. While those who take a polarised view of animal experimentation are unlikely to be satisfied with such an outcome, their decision reflects the diversity of views held on the subject and identification of various viewpoints is at least a basis for much-needed rational discussion. With this aim in mind, the Boyd Group⁶¹ has performed a valuable service in the UK by bringing together organisations and individuals with a variety of views on the use of animals in research with the aim of promoting dialogue and identifying areas of commonality. The group is chaired by the ethicist Professor Kenneth Boyd, and was established after a meeting between Colin Blakemore, Professor of Physiology at the University of Oxford, and Les Ward, then Director of Advocates for Animals, during a media debate on animal experimentation. Such affairs are usually run on the basis that the greater the disagreement, the better the programme; however, after the event Professor Blakemore and Les Ward found that they were able to have a constructive exchange of views. Those that have subsequently joined the Boyd Group have helped it to produce a number of reports and papers that have greatly helped to clarify why different views are held, and have found significant areas of agreement.

1.7 The Moral Imperative

1.7.1 The need to reduce suffering to a minimum

Most would agree that if society allows animal experimentation, there is a moral imperative to do all that is necessary to reduce any harm to the animals to a minimum. The various harmful effects that can occur and means of minimising them through the implementation of the 3Rs (Replacement, Reduction and Refinement) developed by W.M.S. Russell and R.L. Burch⁶² will be discussed in Chapter 6, but briefly include harm caused by the procedures carried out on the animals as well as disease, injury and, possibly, a range of adverse mental states such as fear, anxiety and frustration.

Unfortunately, the apparently simple imperative to reduce suffering to a minimum is not as simple as it might at first appear. First, how do we measure something that is a private sensation? For example, while I may believe you if you tell me you have a headache, it could be very hard for me to know that you had one if you didn't tell me. Even if you do tell me, I have no easy way of evaluating the extent of your suffering. Human pain scoring systems have been developed by the medical community to try to address this problem and to provide a standardised system of measurement and I might use one of these. Alternatively, I might measure your voluntary intake of an analgesic such as aspirin, but pain is essentially a private experience, and the response to it by individuals is very variable and very dependent on culture and context⁶³. In battle, soldiers have continued fighting with

⁶¹ The Boyd Group, <http://www.boyd-group.demon.co.uk/>.

⁶² Russell and Burch (1959).

⁶³ Rollin (1989), pp. 150–153 discusses the variability of pain experience in humans and likely individual variability in animals.

terrible wounds that would probably have incapacitated them under other conditions, or have required less morphine for some hours after the injury⁶⁴. So, if pain is a private experience for humans, then it is even harder to evaluate in other species⁶⁵. Even veterinarians, for whom animal pain assessment is particularly important, consider their ability to assess pain as inadequate, and are uncertain to what extent pain scoring systems can be generalised from the particular procedures for which they were developed (e.g. laparotomy vs. castration)⁶⁶. Further, humans can experience many unpleasant sensations other than pain, and some animals are likely to experience some of these as well. Examples include loss, anxiety, fear and panic, as well as discomfort such as hunger, thirst, heat, cold, itching, respiratory distress, and nausea⁶⁷. If we humans find it difficult to assess pain in other animals, it is perhaps even harder to know whether, and how much, an animal is suffering as a result of some other emotional state such as boredom or fear.

Second, if our aim is to reduce suffering to a minimum, is it better that fewer animals should suffer a lot, or that many animals should suffer less? An example of this sort of dilemma might arise where animals used in an experiment need to be housed apart from one another. We generally consider that social animals suffer if housed singly, but if the alternative is to supply a companion, then the total numbers of animals used would have to be doubled. We shall return to this problem again in Chapter 6, when we consider conflicts between the desire to reduce animal numbers and the desire to refine studies so as to reduce suffering.

Third, some would argue that it is better, on animal welfare grounds, to use some species rather than others in an experiment, based on their capacity to suffer. As we shall see in Chapter 4, although the animal kingdom is very diverse, including very simple as well as complex animals, it is often very difficult to tell whether any particular species has a greater capacity to suffer than another.

1.7.2 How important is death?

Many people would argue that, in addition to the moral imperative to reduce suffering to a minimum, there is another to avoid killing animals. In fact, most animals used in experiments are killed, either because the animal has been judged to have reached a point where euthanasia is the humane option or because the experiment has finished and there is no more need for the animal. Indeed, new EU legislation restricts the re-use of animals, so as to prevent animals being repeatedly used in experiments that might cause suffering. In addition, there has always been a certain proportion of animals that are bred which end up not being used in experiments. This is not as culpable as it sounds. A report produced by the UK Laboratory Animal Science Association on the breeding of surplus rodents⁶⁸ showed that while

⁶⁴ Melzack and Wall (1988).

⁶⁵ Bateson (1991); Gregory (2004).

⁶⁶ Flecknell (2001). Akhtar (2011) discusses how animals' experiences of pain might in some cases be worse than those of humans if they lack, for example, the ability to rationalise experiences.

⁶⁷ Gregory (2004).

⁶⁸ LASA (1998).

approximately twice as many animals were bred as were actually required, there were a number of reasons for the so-called overproduction and that these animals are not usually wasted (dead mice for example were often used to feed captive birds of prey in zoos or wildlife parks). The reasons for producing a surplus included that there is not always an equal requirement to use males and females, and that in order to produce sufficient numbers of animals of the correct age and weight, it is necessary to breed rather more. Moreover, some techniques require a surplus of animals to be bred. For example, genetic modification technologies are still inefficient⁶⁹, and during the breeding process animals are produced that do not possess the transgene and are therefore surplus to requirements. Finally, animals continue to breed, whether scientists are ready to use them or not, and while for mice it is possible to freeze embryos of a particular strain so that there is no need to keep the strain as a breeding line, there will always be occasions when animals are surplus to requirements.

Most of us think of death as being very important, and usually as something to be avoided for as long as possible. As Woody Allen remarked 'I don't want to achieve immortality through my work, I want to achieve it by not dying', but are animals similarly concerned by death? Animals usually do their best to avoid situations that are likely to cause death, although there are exceptions such as parents risking their own lives in defending offspring, and Pacific salmon returning to their natal rivers to put all their resources into spawning before dying. It is also true that all life involves some risk: if an animal is too risk averse, it would not be able to function well when foraging for food or trying to obtain a mate. Generally, however, behaviour that reduces the risk of death is selected for, as animals that are not risk averse are likely to leave fewer, if any, offspring. It is therefore not surprising that when animals detect that they are in a perilous situation, they may show signs of fear and attempt to deal with it through flight or fight. Nonetheless, for most species, with the possible exception of the great apes, there is no good evidence that animals have a concept of death that they can imagine in the abstract and which would cause fear. I tentatively exclude great apes, as Koko the gorilla is reported to have used sign language to discuss the death of both her pet kitten and of another gorilla Michael, but the interpretation of such language studies is not straightforward⁷⁰. It is interesting to note here that in the USA, the only country where invasive experiments on chimpanzees are still permitted, euthanasia of surplus chimpanzees purchased, bred or used in research conducted or supported by the Federal Government is not permitted other than for welfare reasons⁷¹. Provision therefore has to be made for their retirement, which can be long term and expensive.

From the point of view of the staff charged with carrying out euthanasia, there are psychological costs to killing animals. Most people find killing animals distasteful, particularly so to begin with, and find some methods more acceptable than others⁷². It is therefore ironic that the people who have to kill animals in

⁶⁹ Joint Working Group on Refinement (2003a).

⁷⁰ Patterson and Gordon (1993); Taylor (2009).

⁷¹ Schapiro and Lambeth (2010).

⁷² Animal Procedures Committee (2006b); Wallace (2008); Wolfensohn (2010).

laboratories are usually the animal technicians or caregivers who entered their profession because of their love for animals. When I have discussed this issue with technical staff, they frequently mention the numbing effect of killing large numbers of rodents. Staff can also become attached or concerned about particular animals, particularly when working with larger animals such as cats, dogs and primates, leading to emotional issues when they are euthanased⁷³.

If animals are killed humanely, without pain or fear, then there is not a welfare issue, though there is an ethical issue. Unfortunately, truly humane killing is an ideal that is not always achieved in practice. Various regulatory agencies and professional bodies have produced codes of practice or regulations that specify particular techniques for particular species to try to ensure that euthanasia should not be a welfare problem, but things occasionally go wrong⁷⁴. Moreover, as we shall see in later chapters, scientific concerns have been raised about some widely used methods of killing such as the use of carbon dioxide to kill rodents, and chemical methods of euthanasia for fish and other aquatic animals.

1.7.3 Provision of a good life

When considering the ethical requirements of keeping animals in captivity, most people would want to go further than simply avoiding subjecting animals to negative experiences. There is surely also a moral imperative to provide the animals not just with the minimum to avoid suffering but also to allow them to experience some positive feelings and to lead a contented life. As Temple Grandin and others argue, animals share with humans the structures that produce emotions and animals like humans are likely to want to experience good emotions⁷⁵. Such ideas are beginning to become more common in codes of practice or advisory documents on animal welfare, so that a recent Farm Animal Welfare Council report⁷⁶ argues that each farm animal should have as a minimum what they term ‘a life worth living’, from the animal’s perspective, and that a growing number should experience ‘a good life’. Similarly, in the USA, the National Research Council *Guide for the Care and Use of Laboratory Animals*⁷⁷ requires that the environment within the cage should include items that enhance ‘animal well being’.

However, there are difficulties with the aim of achieving positive emotional states. These include knowing both how far and to what extent it is appropriate to go in achieving such positive emotional states. Happiness in humans tends to be a transitory emotional state associated with either seeking or achieving a desired goal, so attempting to produce a permanent positive emotional state in animals is

⁷³ Herzog (2002).

⁷⁴ See section on refining euthanasia in Chapter 6.

⁷⁵ McMillan (2005b); Grandin and Johnson (2009), p. 5. Grandin limits her discussion to vertebrate animals. For a description of the structures involved in experiencing emotions in humans (orbitofrontal, insular, and anterior and posterior cingulate cortices), see Dolan (2002).

⁷⁶ Farm Animal Welfare Council (2009).

⁷⁷ NRC (National Research Council) (1996), p. 37. The latest edition NRC (National Research Council) (2010), p. 41 draws a distinction between health and well-being.

likely to be perverse and doomed to failure⁷⁸. We know that positive emotional states and the best interests of the individual experiencing those states do not always go together, so a drug addict, despite the potential harm involved, will feel a high after taking the drug. Similarly, animals should experience positive emotional states when being fed treats, but the continued use of treats is unlikely to be in the best interests of the animal. There are also real difficulties in assessing whether an animal is in a positive emotional state. It is true that some recent research has tried to identify animals' affective states⁷⁹, but these studies are often more focused on identifying negative states than positive ones. If welfare scientists have struggled to discover good measures that reflect poor welfare or suffering, they have hardly begun to scratch the surface of the problem of quantifying the positive feelings an animal might have, and deciding which of these to try to meet and how to prioritise these needs. Nonetheless, there have been considerable improvements in the captive environments provided to animals in research. In some cases, the provisions may well have gone further than those needed simply to provide the animal with its basic requirements.

1.8 Trust in the System

The scientist and novelist C.P. Snow famously and controversially warned of the dangers of a divide between those educated in the sciences and humanities. With the rapid development of scientific knowledge and techniques there are far more potential divides today, not just between the arts and the sciences, but even between scientific disciplines. None of us can be expert in all areas of human endeavour, and so there is no particular reason to expect a general understanding of the scientific reasons for using animals in research, or the ethical dilemmas and decisions that need to be taken. Instead, this understanding and decision-making is largely devolved to those who regulate the research and to the scientists carrying out the work.

It follows that a central issue in the use of animals is the trust that the public have in those who do the research on their behalf. Outright mad or bad scientists/doctors such as Mengele, Shirō Ishii and Shipman are, mercifully, relatively few in number but their actions cast a long shadow. Moreover, while the advances of science lead to many benefits, the public are often wary of new technologies for which scientists are held responsible (e.g. electricity, nuclear weapons, nuclear power, genetic engineering). Popular perceptions of scientists as portrayed in fiction and film include megalomaniac and mad scientists whose tunnel vision blinds them to the consequences of what they are doing (Drs Frankenstein, Jekyll, Moreau and Strangelove). More positive representations of fictional and real scientists do exist, such as the palaeontologist in *Jurassic Park*, forensic scientists in television shows

⁷⁸ McMillan (2005a) discriminates between being transiently happy and true happiness, which is described as a pervasive sense over time that all is well, and which may even apply to the life as a whole.

⁷⁹ See for example Mendl *et al.* (2009).

and the real-life physicist/engineer Barnes Wallace (depicted in the film *The Dam Busters*) but positive representations seem to be fewer or are perhaps less memorable. Even where the motives of fictional scientists are good, they are usually obsessed, or eccentric, and some of the real scientists who present popular science programmes sometimes seem to have been chosen, at least partly, for their slightly unusual looks.

Given all this, it may be considered surprising that the public trusts scientists at all, and yet surveys consistently indicate that they do retain a high degree of trust. A poll carried out for the British Medical Association by MORI in 2001 indicated that two-thirds of the adults polled trusted scientists to tell the truth⁸⁰. Another carried out in 2005 showed that 91% agreed that doctors were the most trusted group followed by teachers (88%), professors (77%), judges (76%) clergymen/priests (73%) and scientists (70%), all these professions, and the police, being seen as more trustworthy than the average man/woman in the street. Similar results were obtained in 2009⁸¹, but not all scientists are equal; university scientists tend to be trusted more than those working for industry⁸². However, scientists should not sit back and relax; trust is a fragile thing and once lost is not easily regained. It seems highly likely that if the public lost their trust in scientists, whether in terms of the quality of the science or the implementation of high standards of animal welfare, public acceptance of animal experimentation would end.

It is therefore also important that the public trust the regulators and the systems that have been set up to provide accountability to the public. In the UK, both the Animal Procedures Committee (now replaced by the Animals in Science Committee) and the Home Office Animals Scientific Procedures Inspectorate provide public annual reports of their activities but, as in many countries, there is considerable secrecy and confidentiality about the details of who carries out animal experiments and what is done. Trust is also based on transparency: if people want to find out what is happening, they can. There are some understandable reasons for secrecy: it may be necessary in cases of national security or to protect intellectual copyright, and after the violent activities of some activists many scientists are concerned for the safety of themselves, their families or colleagues. Nevertheless, secrecy can be destructive, leading to suspicion that worse things are happening than is in fact the case and to further hostility, as well as a range of other disadvantages⁸³. Increasing openness, where reasonable and possible, could help to defuse some of these issues. Some countries have introduced freedom of information legislation, for example the Freedom of Information Act (FOIA) and state 'open record laws' in the USA and the Freedom of Information Act (2000) in the UK. Although not specifically aimed at issues to do with the use of animals, this legislation has had some controversial implications for state and public bodies that carry out animal research⁸⁴.

⁸⁰ Reported in Corrado (2001).

⁸¹ MORI poll, Trust in Professions, 2009, <http://preview.tinyurl.com/d8s8jcn>, accessed 23 April 2010.

⁸² Gaskell *et al.* (2005).

⁸³ Sandøe (1994).

⁸⁴ Cardon *et al.* (2012b).

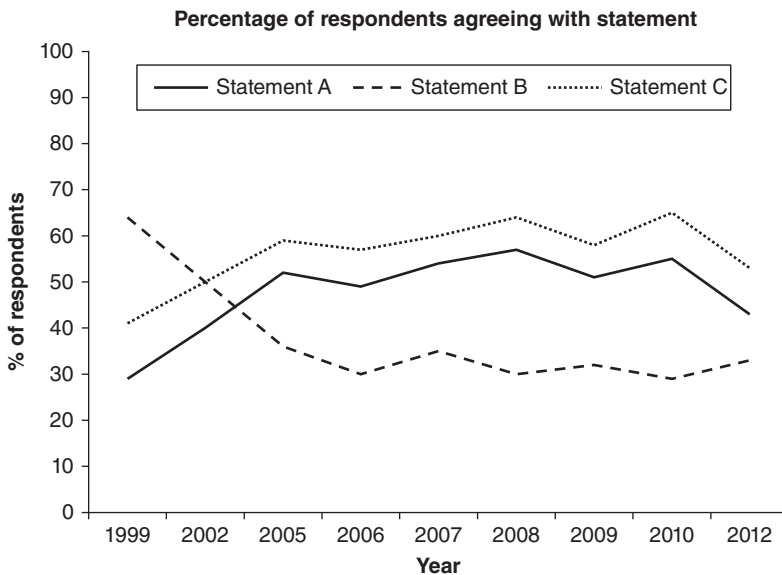


Figure 1.3 Changes in public trust in regulation and enforcement of animal experimentation within the UK 1999–2012.

Statement A: I expect that the rules in Britain on animal experimentation are well enforced.

Statement B: I have a lack of trust in the regulatory system about animal experimentation.

Statement C: Britain probably has tough rules governing animal experimentation.

Redrawn from MORI poll Trust in Animal Experimentation Regulation and Enforcement within the UK 1999–2012, with permission from Ipsos MORI, available from www.understandinganimal-research.org.uk.

Universities, for example, may be required to release information on the research carried out in the establishment, although there are provisions in both jurisdictions to protect information that may compromise the safety of personnel or that would have commercial implications.

Within the UK, the Home Office, in a more targeted step towards greater public transparency, has published online anonymised abstracts of research projects for which licences have been granted⁸⁵, and this will become more widespread in Europe as Article 43 of European Directive 2010/63/EU requires the publication of project summaries subject to certain safeguards. The UK Inspectorate has also published reports that include information on visits made to establishments to ensure compliance with legislation. The Animal Procedures Committee (now replaced by the Animals in Science Committee) provided both reactive advice on applications to carry out research, exposés, news reports, etc., and proactive advice on issues identified by the committee. Much of this advice, including a variety of reports, was

⁸⁵ Home Office website, <https://www.gov.uk/research-and-testing-using-animals>, accessed 29 April 2013.

made available to the public on the UK government website. Government research institutions and research funding bodies are also concerned about public accountability and may use mechanisms such as advisory panels to help them achieve this. Examples from the UK have included the Biotechnology and Biological Sciences Research Council's Bioscience for Society Strategy Panel and the UK Ministry for Defence's Animal Welfare Advisory Committee⁸⁶.

The evidence from the 2012 MORI poll (Figure 1.3) indicates that trust in the regulatory and inspection system increased from 1999 to 2005, but also that this trust has fallen away in the last year, and this may suggest that the public requires more information. Certainly this was the view of Sir Mark Walport, Director of the Wellcome Trust, who explicitly drew attention to the link between openness and public trust when he said

This poll clearly demonstrates that a majority of the public supports experiments involving animals when these are necessary to advance medical research. But it also reminds us that we must communicate openly with the public if we are to maintain this high level of trust.

His statement accompanied an agreement by the major UK funders of research to develop principles of openness, practical steps and measurable objectives underpinning a more transparent approach to animal research⁸⁷. Undoubtedly this initiative is a step in the right direction, but public trust is also dependent on the existence of appropriate legal controls, and these are covered in the next chapter.

⁸⁶ Bioscience for Society Strategy Panel <http://www.bbsrc.ac.uk/organisation/structures/panels/society/society-index.aspx>, accessed 26 April 2013. The Ministry of Defence Animal Welfare Advisory Committee was formally dissolved in 2010.

⁸⁷ Declaration on Openness on Animal Research, available from www.understandinganimalresearch.org.