Normalising the Unthinkable:

The Ethics of Using Animals in Research

A Report by the
Working Group of the Oxford
Centre for Animal Ethics

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The Ferrater Mora
Oxford Centre for Animal Ethics

Commissioned by The BUAV and Cruelty Free International

BUAV

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1. Introduction

1.1. Each year millions of non-human animals (hereafter 'animals') are used in research. Animal experimentation generates public and political concern worldwide. In this report, we offer a new assessment of the central ethical issue, namely whether such experiments can be justified morally. There have been some recent reports in the United Kingdom (hereafter 'UK') that address the ethics of our use of animals in research, notably the *Review of Cost-Benefit Assessment* by the Animal Procedures Committee (2003), the Select Committee of the House of Lords report (2002), and the report of the Weatherall Committee (2006), all of which we address in detail, as well as reports by the Nuffield Council (2005) and the Boyd Group (e.g., Smith and Boyd, 1991). But we find that these reports insufficiently address the deeper ethical issues raised by animal experimentation. Our report is also one of the very few to focus on the ethical dimension and to do so from a variety of disciplines, including philosophy, science, history, theology, law, critical animal studies, and sociology. We especially consider arguments that arise from changing ethical views based on recent discussions of the status of animals, the moral relevance of animal sentience, and the limits that morality imposes on the treatment of sentient creatures.

1.2. In 2013, the Oxford Centre for Animal Ethics was commissioned by the British Union for the Abolition of Vivisection (hereafter 'BUAV') to produce an independent review of the ethics of using animals in research. The BUAV is not a neutral bystander in the debate about animal testing, of course, but it is all to the BUAV's credit that it was prepared to commission independent academic research on this topic. While we have requested research information from the BUAV, it has at no point sought to place restrictions on the nature and type of our deliberations, or the nature of our conclusions. All members of the working group voluntarily offered their services.

1.3. This report is produced by the Oxford Centre for Animal Ethics, which was founded in 2006 to pioneer ethical perspectives on animals through academic teaching, research, and publication. The centre is independent and is not under the aegis, control, or sanction of the University of Oxford. The centre comprises an international fellowship of more than ninety academics drawn from the sciences and the humanities and more than one hundred academic advisers. The report has been written by a working group consisting of twenty academics from six countries, all but one of whom are fellows of the centre.

1.4. Since most of our historic language denigrates animals – for example, as 'brutes', 'beasts', 'beastly', 'dumb animals', and 'sub-humans' – we have strived to use ethically sensitive language. The term 'companion animals' is used rather than 'pets', 'free-living' or 'free-ranging' or 'wild' in inverted commas rather than 'wild' alone, and 'carers' rather than 'owners'. 'He' or 'she' is utilised in relation to individual animals rather than 'it'. Also we have placed the words 'model' and 'models' as applied to animals, as well as 'animal model' and 'animals models', in inverted commas since these terms suggest the commodification or objectification of animals (as well as assuming what needs to be demonstrated). Otherwise, we have adhered to the Harvard system of referencing. We are grateful to Stephanie A. Ernst for her expert copy-editing of the text.

1.5. With the insights of various disciplines, we have endeavoured to raise the fundamental ethical question in relation to almost all aspects of animal experimentation, not only examining the procedures themselves, but also addressing such questions as animal experimentation's history, scientific validity, philosophy, institutionalisation, and purported controls, including legislation, regulation, inspection, licensing, and regulation. In doing so, we have had to challenge much conventional wisdom and many standard justifications. Examining the evidence and thinking outside the box has not been an easy experience, and we deeply wish we could have published a more emollient and less controversial report. But we have felt constrained to follow the evidence as it has led us and, most of all, to be faithful to where we believe the weight of moral argument resides.

1.6. We commend our report to fellow academics, governments, and the media in the hope that it will engender a more progressive discussion of the morality of animal testing.

2. The scale of the problem

2.1. The animal research we consider should be distinguished from purely observational studies in which the animals are not harmed. In this report, we use the words 'animal experimentation', 'animal tests', and 'animal research' interchangeably to denote procedures that entail, inter alia, the capture, handling, transport, confinement, manipulation, and subjection of living sentient beings to procedures against their own individual interests, including those that involve the deliberate infliction of suffering, harm, and/or death.

2.2. We intend our report to be relevant to experimentation worldwide, and while we make references to research in various countries, we principally focus on animal experimentation in the UK. We have done this for two reasons. In the first place, the UK (rightly or wrongly) is often held up as a model for how animal experimentation should be regulated. For example, Lord Winston, speaking in the House of Lords, claimed that 'the overall standard of inspection, control and regulation conditions for laboratory animals are remarkably high' in Britain compared with six other countries in which he has worked (Winston, 2011, column 623, cited and discussed in Linzey and Cohn, 2012, p. v). In order to avoid any accusation of bias, we have therefore tried to focus on the country that many scientists themselves apparently believe to exhibit 'best practice'.

2.3. Second, if animal experiments can be effectively regulated, then the UK– with its detailed laws, licensing procedures, inspectorate, and ethical review committees – ought to achieve this. Hence, we analyse the ethical rationale provided by UK advisory bodies and provide examples of various experiments in the UK, as well as focusing on the methods of regulation and control.

2.4. We begin by outlining the scale and diversity of the usage of animals in research.

Numbers and uses worldwide

2.5. It is important to grasp the scale of animal usage in research, including the numbers of animals used worldwide, the range of animals used, and the variety of uses to which animals are subjected. Relatively few countries collate and publish statistics on the number of animal subjects used in research laboratories. Estimates are often based on little more than guesswork. Using a range of statistical techniques, some authors estimate that 115.3 million animals worldwide are used every year. However, they also caution that this is likely to be an underestimate (Taylor et al., 2008).

2.6. It is hard to accurately estimate the number of animals used in research worldwide for two main reasons. First, relatively few countries produce statistics on the numbers of animals used or the purposes for which they are used. Second, among those countries that do keep statistics on animal research, the definitions of the terms 'animal' and 'use' vary widely. For example, the United States of America (hereafter 'US') publishes statistics on animals used in research, but those statistics do not include mice, rats, birds, fish, reptiles, and amphibians (i.e., the vast majority of animals used).

2.7. To date, only one journal article has attempted to calculate the scale of worldwide animal use (Taylor et al., 2008). The study calculated the estimates for animal use in research using the definitions of 'animals', 'purposes', and 'an experiment' given in the *Glossary of Terms and Guidelines for Statistical Tables* for European Union (hereafter 'EU') statistical reports (European Commission, 1997). The definition of 'animal' includes mammals, birds, reptiles, amphibians, and fish but excludes their respective foetal or embryonic forms. Purposes include biological studies, research and development of products for human medicine, dentistry, veterinary medicine, military uses, toxicology, disease diagnosis, education, and training. The EU definitions exclude the maintenance of breeding genetically modified (hereafter 'GM') animals, animals killed solely to provide tissue, 'surplus' conventional animals bred but then killed, and animals exploited in behavioural research, including the marking of 'wild' fish. The definitions exclude, as well, most invertebrates (cyclostomes and cephalopods are included in the definitions).

2.8. The study estimates that under the aforementioned EU definitions, there are conservatively 58.3 million animals being used in research in 179 countries worldwide. However, if animals being killed for the provision of tissue, animals used to maintain GM strains, and animals considered 'surplus' who are bred for laboratory use are included, that figure rises to a more comprehensive estimate of 115.3 million animals.

2.9. A wide variety of animals are used in research globally, varying by country. In the EU, categories of animals include all kinds of mammals – including non-human primates (hereafter 'NHPs' or 'NHP'), mice, rats, guinea pigs, hamsters, other rodents, rabbits, cats, dogs, ferrets, other carnivores, equids, pigs, goats, sheep, and cattle – as well as birds, reptiles, amphibians, fish (European Commission, 1997), and more recently, cyclostomes and cephalopods (European Commission, 2010; European Parliament, Directive 2010; for discussion see Peggs, forthcoming). Since many countries in which animal experiments occur do not publish statistics on animal use – for example, the People's Republic of China, Egypt, Iran, India, and Thailand – it is hard to give an accurate account of all the animals used. However, it seems reasonable on the basis of the EU list to conclude that animals are used from all biological categories of animals.

2.10. Although many countries do not publish statistics on animal use in experiments, Taylor et al. (2008) provide informed estimates of the numbers of animals in laboratories who were used per country in 2005. The top ten users (ranked in order of standardised, estimated number of animals used per year) are as follows: US, 17,317,147; Japan, 11,154,961; People's Republic of China, 2,975,122; Australia, 2,389,813; France, 2,325,398; Canada, 2,316,281; UK, 1,874,207; Germany, 1,822,424; Taiwan, 1,237,337; and Brazil, 1,169,517.

2.11. Two general conclusions may be gleaned from the foregoing. In the first place, the use of animals in research is a worldwide phenomenon. Almost every country allows the practice. Second, in many countries no information or actual figures are provided regarding the number of animals or number of experiments.

Examples of experiments

2.12. We detail here experiments drawn from twelve selected categories of use during the last five years. The examples are taken from six countries but principally focus on the UK and have been drawn from published scientific reports. These experiments range from the standard to the non-standard and were chosen to illustrate the breadth of the use of animals. The examples by no means illustrate the most (or least) severe types of experiments.

a. Military

2.13. In order to simulate the effects of explosions on soldiers and civilians in terrorist attacks, researchers subjected large white pigs to bomb blasts to induce severe blast injuries. Pigs were anaesthetised and then wrapped up in protective blankets before they were left on trollies two and a half meters away from explosives that were then detonated remotely. Immediately after the blast, 30 per cent of their total blood content was pumped out through an artery in their legs. The researchers then tried to resuscitate the pigs using two different techniques. However, eleven pigs (out of twenty-eight) died despite the resuscitation. All of the animals were killed and dissected at the end of the experiment (Garner et al., 2010). *Porton Down, England, UK.*

2.14. Guinea pigs were poisoned with an extremely toxic nerve agent (VX) so that researchers could test the efficacy of a combination of drugs and human enzyme as a treatment after exposure. VX is a lethal substance that can be used as a chemical weapon and enters the body through the skin or the lungs, where it causes severe systemic damage leading to seizures, breathing difficulties, coma, and eventually death. VX was applied to the shaved backs of conscious guinea pigs before drugs were injected into their muscles. The animals received treatment only when they displayed observational signs of poisoning, which included severe tremors, tearing, salivation, and seizures followed by rapid physical and/or mental impairment. No mention of pain relief was given. Some of the guinea pigs died because of the nerve agent, and the ones who survived were killed at the end of the study. All of the animals were dissected, and most (even those who survived) showed signs of internal damage to the lungs such as bleeding, swelling, and excess fluid build-up (Mumford et al., 2013). *Porton Down, England, UK.*

b. Food/drink

2.15. To investigate whether Lipton black tea could reduce diarrhoea caused by the bacteria E. coli, researchers housed ninety-six one-month-old piglets in isolation and fed them a diet containing the tea for six days before force-feeding them the bacteria in order to induce diarrhoea. The daily prevalence of diarrhoea, weight, and behaviour of the piglets was measured while they were still on the diet for a further twenty-one days. During the experiment, eight piglets died from severe diarrhoea, and some of the surviving animals developed skin abnormalities and behavioural problems (Bruins et al., 2011). *Unilever, the Netherlands.*

2.16. To investigate whether black cumin seed extract could alleviate the symptoms of food allergies in humans, researchers force-fed the extract to mice daily through a tube down their throats every day for forty-three days. During this period the mice were forced to become allergic to a protein found in chicken eggs after it was injected into their abdomens twice and force-fed to them six times. The animals were examined throughout the experiment and given scores based on the severity of their diarrhoea. They were then killed so that their intestines could be dissected for further analysis (Duncker et al., 2012). *Nestlé, Switzerland.*

c. Recreational drugs

2.17. So that researchers could investigate the effect of age and nicotine on the brain, both young and old rats had pumps surgically implanted under their skin for the administration of nicotine. The rats were separated into two groups; animals in the high-dose group were infused with enough nicotine to mimic 'heavy smokers', which according to data from a different study would be the equivalent of 266 cigarettes per day (Scerri et al., 2012). *University of Dundee, Scotland, UK.*

2.18. In an attempt to discover a treatment for alcohol abuse, researchers used a strain of male mice who 'like' alcohol as well as standard male rats in a series of experiments. Substances thought to encourage an aversion to alcohol were injected into the rats' abdomens. One hour later, the rats were injected with a large dose of alcohol equivalent to seventeen and a half units of alcohol in a seventy-kilogram human (the recommended daily allowance in the UK is three to four units). Blood samples were then taken from the rats' tails every hour for three hours. In another experiment, one of the alcohol-aversion drugs was injected into the rats' abdomens every day for four days. On the third day, the rats were deprived of water for eighteen hours before being tested to see how much alcohol-laced water they would drink two hours after the final injection (Badawy et al., 2011). *University of Cardiff, Wales, UK.*

d. Stem cells

2.19. So that researchers could discover whether stem cells could be found in the spaces between the joints after a knee injury, mice were subjected to surgery to purposefully damage their knees. Under anaesthesia their knee joint was dislocated, and a deep wound was carved into their kneecap before the knee was relocated and the joint capsule and skin were sewn back up. The mice were injected with stem cell–detecting chemicals after surgery to help the researchers detect the presence of stem cells after the mice had been killed and dissected (Kurth et al., 2011). *University of Aberdeen, Scotland, UK.*

e. Genetics

2.20. Some Asian people carry a mutated version of a gene that is known to play a key role in the development of hair, sweat glands and other skin features. The mutation is common in people from East Asia and is thought to have arisen 30,000 years ago as an adaptation to the humid environment. To demonstrate the effects of the mutation, a group of international researchers from the US, China, and the UK GM mice to possess the mutated gene. As anticipated, the mice developed thicker hair, more sweat glands, and denser mammary glands. The six-week-old animals were then killed, and their eyelids, mammary glands, and skin were dissected for examination (Kamberov, 2013). *Harvard Medical School, US.*

2.21. Researchers in China have used a new technology to create GM monkeys, which they claim will help produce better models to mimic human diseases. The work was carried out using a genetic engineering system called CRISPR/Cas9, which allows researchers to cut and paste DNA to create specific mutations. To produce just two GM monkeys, researchers collected 198 eggs from an unknown number of donor females and then

modified them to possess three mutations using the CRISPR system. Eighty-three embryos were found to develop the desired mutations and were subsequently surgically implanted into twenty-nine surrogate mothers. Only ten monkeys became pregnant with a total of nineteen foetuses, and as of this writing, five of the mothers have already miscarried while four are still 'waiting' to give birth. Only one female, who gave birth to twins, carried two of the three mutations that the researchers had originally expected (Niu et al., 2014). *Nanjing Medical University, China.*

f. Chemical testing

2.22. Bisphenol A (hereafter 'BPA') is a chemical that has been used for over sixty years to produce polycarbonate plastics and epoxy resins that are found in many consumer products. Scientists have become increasingly concerned about its widespread use because BPA is thought to be an endocrine disruptor that can lead to fertility and developmental problems. In order to examine the effect of prenatal BPA exposure on egg formation, scientists from Washington State University forced pregnant rhesus macaques to ingest pieces of fruit containing the chemical every day throughout their pregnancy. Another group of pregnant monkeys received continuous BPA exposure through tubes implanted into their bloodstream. At the end of the study, the foetuses were removed by caesarean section and dissected and examined (Hunt et al., 2012). *Washington State University, US.*

2.23. Triclosan is an antibacterial chemical commonly used in lipsticks, soaps, deodorants, toothpastes, mouthwashes, detergents, and thousands of other cosmetic and household products. Although it has been widely used for over forty years, scientists have recently begun to question its safety. Researchers from the University of California found that in mice, triclosan hinders the process by which muscles, including the heart, receive signals from the brain. In their experiment, eight ten-week-old male mice were anaesthetised before undergoing surgery in which the carotid artery in their neck was exposed. A pump was inserted into the artery to measure the volume and pressure of blood that passed through. Under anaesthesia various doses of the chemical were then injected into their abdomens. During the surgery their hearts were punctured to collect blood for analysis, and they were then killed. In another procedure, conscious three-month-old male mice were injected with triclosan into their abdomens before being subjected to a grip-strength test in which they were made to grab onto a wire mesh with all four paws before being pulled away by their tails (Cherednichenko et al., 2012). *University of California, US.*

g. Product testing

2.24. Researchers forced two different types of mouthwash into the mouths of rats via syringe twice a day for fourteen days to see whether either mouthwash had an effect on healing after tooth extraction. One contained chlorhexidine, which is an active ingredient found in most commercially available mouthwashes, while the other was a herbal mouthwash containing persica plant extract. On the eighth day of the study, the rats were placed in closed chambers, where they were anaesthetised with a gas before their molars were pulled out using forceps. The animals were then killed, and their tooth sockets were dissected. During the study, one of the rats choked on the mouthwash and died (Dorri et al., 2010). *University of Dundee, Scotland, UK.*

h. Food toxicology

2.25. In an attempt to test the safety of aloe vera juice (produced by a US company called Herbalife), researchers forced ninety-six rats to drink various concentrations of the juice in their drinking water for three months. They were observed to see whether they would die over this period and at the end were anaesthetised and bled out through a puncture in their hearts so that their tissues could be removed and examined (Shao et al., 2013). *Huntingdon Life Sciences, England, UK.*

2.26. Researchers carried out a carcinogenicity test on GM maize using rats. They fed 200 rats for their entire lifetime (two years) a diet of one of the bestselling strains of GM maize produced by agricultural biotechnology giant Monsanto along with the company's popular weedkiller Roundup in order to induce cancer in the animals. The rats developed large, cancerous tumours that led to multiple organ damage and premature death in 50 per cent of males and 70 per cent of females. No mention of pain relief was given (Séralini et al., 2012). *Caen University, France.*

i. Brain research

2.27. To investigate how the cells in the brain process information, researchers surgically implanted electrodes into the brains of two macaque monkeys. Researchers required the monkeys to sit still for hours in restraint chairs where their heads were fixed into place. Their brain activity and eye movements were monitored as they were made to stare at colour pictures of animals, nature scenes, patterns, and everyday objects presented on a computer screen. They were given juice-drop rewards throughout the procedure in order to keep them working. They had been deliberately deprived of water to make them thirsty prior to each experimental session (Oram, 2011). *University of St Andrews, Scotland, UK.*

2.28. To find out whether childhood stress leads to an increased risk of developing psychiatric disorders in adulthood, researchers subjected baby rats to a sequence of stressful tests. On the first day (when the rats were twenty-five days old), the rats were forced to swim in a water-filled tank from which they could not escape for ten minutes. The next day, they were pushed into narrow plastic tubes to restrain them for three periods of thirty minutes each. On the final day, they were placed in chambers where they were given electric foot shocks every thirty seconds for three minutes. When the rats became adults, they were subjected to various behavioural tests and assessed for signs of anxiety (Brydges et al., 2012). *University of Edinburgh, Scotland, UK.*

j. Medical research

2.29. So that researchers could investigate changes in heart wall stress and stretching associated with heart disease, mix breed dogs were anaesthetised before undergoing open-chest surgery where part of their heart was stretched by 22 per cent for six hours by a stretching device that was sewed directly onto their heart muscle. The dogs in one group were injected with a blood pressure–lowering drug before the stretch and again three hours after the stretch. The dogs were then killed by electrical stimulation of the heart before their hearts were dissected. The experiment was funded by the British Heart Foundation and the NIHR Biomedical Research Centre in the UK but was probably conducted in the US (Hussain et al., 2010).

2.30. In a study supported by Breast Cancer Research Scotland, breast tissue excised from twenty human patients with breast cancer was surgically implanted under the skin of mice (six to twelve mice per patient). Four days after surgery, the mice were placed in chambers where they were subjected to four hours of radiation, so that researchers could study the radiation's effect on cancerous breast tissue. The mice were then killed four hours after radiation exposure so that the xenografted breast tissue could be harvested (Coates et al., 2010). *University of Dundee, Scotland, UK.*

k. Drug testing

2.31. To test a potential drug treatment for lazy eye in humans, researchers anaesthetised fourteen kittens (twenty to twenty-six days old) in order to sew one of their eyes shut. The kittens were left in that state for two months before they were subjected to brain surgery at the age of three months. The kittens were anaesthetised, and each kitten's eye was reopened. Both eyes were covered with a contact lens to help the eyes focus on a computer screen placed fifty centimetres away from the kittens' faces. The kittens were injected with a neuromuscular blocking agent (hereafter 'NBA') so that their eyes would not move. NBAs pose additional risks to animals because they cause paralysis and prevent animals from indicating to researchers by movement or vocalisation that they are actually coming round from the anaesthetic. The kittens' scalps were cut to expose their skulls so that a piece of skull could be removed to expose their brains. The researchers then cemented a metal recording device into their skulls and covered it with a glass 'window' so that they could see the kittens' brains. A head-restraining device was also glued onto their skulls to keep the head still during recording. Images were then presented on the screens to stimulate the eyes while recordings were made for two hours. The test substance was also injected into their brains throughout the recording session. The kittens were woken up and then subjected to further recording sessions one and two weeks later. At the end of the final session, all of the kittens were killed, and their brains were dissected (Vorobyov et al., 2013). *University of Cardiff, Wales, UK.*

2.32. Eleven sheep had tubes surgically implanted into their spines for the administration of a new drug that was thought to reduce pain sensitivity. Fourteen days after surgery, their legs were injected with formalin, which slowly damaged the tissues, causing serious pain to the animals. Researchers recorded how often the sheep flinched

in pain or how long they held their legs up because they were unable to put any weight on them. Blunt pins were also pushed into their skin with increasing force until the sheep lifted up their legs in pain. Since the point of the experiment was to assess pain reactions, there was no mention of pain relief during the tests, but there was no mention of pain relief afterwards either (Dolan et al., 2011). *University of Glasgow, Scotland, UK.*

I. Eating disorders

2.33. Researchers have used sheep as a model of human obesity. In one experiment they kept eighteen young (ten-month-old) female sheep on their own in individual pens. Under surgery, tubes were implanted into their heads so that drugs could be delivered directly into their brains. Over the next forty weeks, some of the sheep were then allowed to consume a high-calorie diet consisting of three times the normal amount of food required, while the others were fed a restricted diet for forty weeks. Members of the 'obese group' were then 'put on a diet' and had their food restricted for sixteen weeks, while the others were given high-calorie food to fatten them up for the remaining weeks. The sheep were subjected to regular anaesthesia so that their bodies could be scanned by a machine. They also had to undergo repeated blood-sample draws via cannulas in their jugulars as well as insulin injections directly into their brains. At the end of this experiment, all of the sheep were killed, and their fat was taken off their bodies and weighed (Adam et al., 2012). *University of Aberdeen, Scotland.*

2.34. In an attempt to mimic anorexia, researchers fed mice severely restricted diets and encouraged them to exercise, leading to severe weight loss. Mice were kept on an increasingly restricted feeding schedule for three months until they were being given access to food for only two hours per day. Mice whose bodyweight dropped below 70 per cent of the normal bodyweight were killed. In one experiment, mice were kept in cages with running wheels, where they were encouraged to exercise excessively. In another experiment, a chemical derived from cannabis was injected into the animals daily to see whether it would increase their appetite. Some of the mice had to be killed due to the severe weight loss (Lewis and Brett, 2010). *University of Strathclyde, Scotland, UK.*

2.35. Two conclusions can be drawn from these examples and from the numbers and uses worldwide. First, the range of uses to which animals are subjected is very wide, and second, all biological categories of animals are utilised. Almost all of these animals are sentient. Indeed, sentiency is a precondition of the need for a licence to experiment under UK law and the current EU Directive. These sentient beings experience suffering, distress, harm, and death, as illustrated by the preceding examples.

2.36. Since these experiments cause not only physical and/or psychological harm but also death, it follows that they require strong moral justification. We shall explore whether such justification is available to researchers, but first we shall look briefly at the history of the debate.

3. The old debate

3.1. Animal experimentation has been practised since the time of the Greeks, and possibly even before (Westacott, 1949; Cohen and Loew, 1984). But it was only in the nineteenth century that experimentation began to be officially regulated through legislation. Since passage of the Cruelty to Animals Act 1876 in the UK, there has been a long, and frequently acrimonious, debate between supporters and opponents of the practice. This old debate provides lessons for us and provides impetus for a new assessment. Numerous aspects of the old debate have effectively blocked progress in the discussion. Here we centre on four major aspects.

Four blocks to ethical discussion

3.2. The first block is nomenclature. The words 'vivisection' (meaning the practice of cutting an animal while alive) and 'antivivisection' (opposition to such a practice) became the standard terms of the pre- and post-1876 debate. In context, when the first uses of animals were preponderantly of this kind, the terms had some relevance.
But the use of animals, as already shown, now widely exceeds such strictly invasive techniques. As such, sole concentration on these outdated terms now obscures the nature of the debate, which encompasses a myriad of factors, including the antecedent conditions of actual use (capture, rearing, transport, handling, and conditions of

captivity) as well as the uses themselves, including any reuse and the killing of the animals who can no longer be used. Clarity of terms helps to ensure clarity of ethical analysis.

3.3. The second aspect concerns the limited ethical framework within which many of the previous debates were (and continue to be) conducted. Many opponents of animal experiments focused on such considerations as the need to promote kindness and prevent cruelty. While, of course, promotion of kindness and prevention of cruelty both are admirable goals, this approach did not challenge many of the underlying assumptions about the moral priority of human interests or indeed about the nature and status of animals. It is worth noting that the Society for the Prevention of Cruelty to Animals (SPCA, founded in 1824) sought the extension of charity to what they termed to be the 'inferior classes of animated beings', namely animals (Kean, 1998, p. 36). We shall return to this issue in a subsequent part of our report (see section 5).

3.4. The third issue concerns the fascination with the newly emerging sciences – for example, pathology and immunisation – and the promise they held out for human betterment. It is impossible to read the history of the debates pre- and post-1876 without being struck by the optimism of scientists that human ills could be prevented and disease could be vanquished with the use of animal research (Westacott, 1949). Such claims were not entirely unfounded, of course. In the nineteenth and twentieth centuries, there were great strides in the development of treatments and drugs that have undoubtedly benefited humankind. But it is also true that some of the earlier claims were exaggerated. We are only now, with hindsight, beginning to assess more critically the role of animal research and its practical benefits. We have to confront the fact that animal research may have hindered progress, at least in some respects. Indeed, it is inevitable, given that over 90 per cent of drugs passed for safety and efficacy in animal tests do not pass clinical trials, that some, probably many, treatments wrongly have been rejected after animal tests. Therefore, the earlier claims regarding the indispensability of animal research must be addressed critically. We address this further in section 4.

3.5. The fourth issue that has tended to stymie ethical discussion concerns the complexity of animal awareness, especially of animal sentience (defined as the capacity to experience pain and pleasure). Unlike our forebears, we now know, as reasonably as we can know of humans, that animals (notably, mammals, birds, and reptiles) experience not only pain but also shock, fear, foreboding, trauma, anxiety, stress, distress, anticipation, and terror to a greater or lesser extent than humans do. This is the conclusion of many scientific books and scientific papers in peer-reviewed scientific journals. In a comprehensive study, David DeGrazia concludes:

> The available evidence, taken together, suggests that many species of animal – indeed, there is some reason to think, most or all vertebrates – can experience anxious states of mind … Additionally, given the close – probably overlapping – relationship between fear and anxiety, it is reasonable to conclude that these animals can also experience fear. Supporting this proposition is the fact that all vertebrates have automatic-nervous systems and limbic systems, which contain the basic substrates of anxiety and fear. In conclusion, the available evidence suggests that most or all vertebrates, and perhaps some invertebrates can suffer. (DeGrazia, 1996, p. 123; see chapters 4–7 for survey and analysis of the empirical evidence about animal consciousness and sentiency)

3.6. Ironically, animal experiments have themselves helped reveal the extent of animal sentience and also animal sapience (the capacity for intelligence). There is scientific evidence to support not only animal awareness, but also the kinds of cognitive capacities required for the ascription of mental states such as self-awareness and rationality. Along with this body of scientific research, there is the argument from evolutionary continuity to support these claims. There is no distinct difference in kind between humans and other animals: we are all on the same biological continuum. It is rather a matter of degree. The old debate's characterisation of animals in such terms as 'beasts', 'brutes', and 'sub-humans' relies on pre-scientific depictions that no longer do justice to our understanding of animals.

3.7. Allied to this is the greater appreciation of the ways in which animals can be harmed. In the nineteenth century, a rather limited notion of 'cruelty' was employed which focused on the adverse physical harm inflicted on animals in research experiments. 'Cruelty' was defined, wholly or largely, in terms such as stabbing, kicking, or hitting another creature. That it was possible to harm animals by emotional or psychological means was almost

entirely absent from the notion of cruelty as previously defined. Thus, the literature in relation to animal research, both for and against, was for many years almost entirely focused on the nature of the physical cruelties inflicted by experiments, rather than, for example, the psychological harms that animals had to endure or the conditions under which they were kept. The narrow view of cruelty is now outdated: when assessing the harms done by experiments, we must take into account a range of factors, such as trade, capture, control, conditions, and killing as well as psychological and emotional pain. Without taking these myriad factors into account, we cannot conduct a proper moral assessment of the ethics of animal research.

3.8. This view is buttressed by the increasingly acknowledged link between animal abuse and human violence (e.g., Flynn, 2011). There has also been a growing awareness of the connection between the treatment of animals and public health at large (Akhtar, 2013). It is only right to take account of the empirical evidence that animal abuse has socially unwelcome effects. Exploration of the link was pioneered by the FBI among others in the 1970s when the agency began to systematically interview serious offenders as to their past history of animal cruelty, if any (Lockwood and Church, 2009). The results showed that high proportions of serious criminals had histories of animal abuse, and in the light of that, the FBI now includes animal cruelty as one of its diagnostic criteria for assessing dangerousness. Of course, this does not mean that researchers who experiment on animals will experiment on humans non-consensually (though some have) or will develop antisocial traits, but it does mean that we must question the old assumption that there is an absolute dividing line between what is done to 'them' (animals) and how it might affect 'us' (humans). We can no longer assume that abuse of animals in any context is socially cost-free.

3.9. In support of this, it is worth recalling the long history of anti-cruelty law since the nineteenth century, which has been predicated on, inter alia, the basis that humans have an interest in the creation of a cruelty-free society. Even philosophers and theologians not known as supporters of animal protection (e.g., Aquinas) still saw the possibility of adverse social consequences from allowing animal cruelty to flourish. Now, this previously largely un-evidenced assumption has received empirical confirmation (Ascione and Arkow, 1999; Beirne, 1999; Linzey, 2009a; Nelson, 2011; Gullone, 2012).

3.10. All in all, these features of the old debate have contributed to an intellectual impasse and have helped obscure the underlying moral issue.

Early controversy

3.11. It is also interesting to note the relative unimportance accorded by the scientific community to Charles Darwin's T*he Expression of the Emotions in Man and Animals* (1872), which cannot be explained merely by reference to the rejection of Lamarckism. Evolution more generally is probably the single most influential underpinning of modern scientific thought in zoology, biology, botany, and physiology, yet this work, which Darwin thought just as important as *The Origin of Species*, was afforded little notice until the recent growth in the discipline of evolutionary psychology. It is tempting to conclude that this is because ignoring of Darwin's subsequent book enables an emotion-free zone when it comes to 'animal modelling' and a more comforting outcome for experimenters. Daniel M. Gross has pointed out:

> Though initially a bestseller, the Expression lapsed into relative obscurity during the next century as Darwin's evolutionary theory established itself primarily on other terms, including, most importantly, the fossil record, homologies across related life-forms, geographic distribution of related species, and artificial selection like dog breeding. Meanwhile the ambiguities of studying emotion rendered it a difficult and even suspect science for the next century … (Gross, 2010, p. 36)

3.12. Animal testing has long been a subject of public revulsion. Even some physiologists found the work of vivisection distasteful. Robert Hooke (who performed many animal experiments in the pursuit of his understanding of the circulation of blood) was unhappy about the cruelty involved in an experiment he regularly conducted

with Richard Lower, which involved the opening of a dog's thorax. In the 1660s Robert Boyle conducted many experiments involving an air pump, and these all led to the deaths of animals. One such experiment was depicted much later in Joseph Wright's painting *An Experiment with a Bird in the Air Pump* (1768). Here a wild-haired natural philosopher (sometimes said to be a portrait of Joseph Priestley) suffocates a bird while a bourgeois family looks on. Two young girls are tearful, and another gentleman sits pensively with his eyes fixed on the table and not on the dying bird, while a servant operates the bellows, looking fearfully over his shoulder. The audience for the experiment is clearly not uniformly happy with what is happening to the bird, and of course, the experiment is needless because the effects of depriving an animal of oxygen had been demonstrated many times over the previous century (Guerrini, 2007).

3.13. Dr George Hoggan, one of the earliest proponents within the medical camp of a humanitarian approach to research, was moved to remark after his visits to Claude Bernard's laboratory that he was 'prepared to see not only science, but even mankind, perish rather than have recourse to such means of saving it'. In a letter to the *Morning Post* in 1875, Hoggan added:

> We [i.e., the scientists in Bernard's laboratory] sacrificed daily from one to three dogs, besides rabbits and other animals, and after four years' experience I am of the opinion that not one of these experiments on animals was justified or necessary. The idea of the good of humanity was simply out of the question, and would be laughed at, the great aim being to keep up with, or get ahead of, one's contemporaries in science, even at the price of an incalculable amount of torture needlessly and iniquitously inflicted on the poor animals.

3.14. Bernard himself claimed:

> The physiologist is no ordinary man. He is a learned man, a man possessed and absorbed by a scientific idea. He does not hear the animals' cries of pain. He is blind to the blood that flows. He sees nothing but his idea, and organisms, which conceal from him the secrets he is resolved to discover. (cited in Preece, 2002, p. 309)

3.15. By the late nineteenth century, a complex number of humanitarian causes (animal welfare, vegetarianism, feminism, and early manifestations of the gay rights and green movements) had come together to create a climate in which a more active response to experimentation might be enacted. In fact, it was the interventions of the feminist Frances Power Cobbe that led to the foundation of the National Anti-Vivisection Society in 1875 and the British Union for the Abolition of Vivisection in 1898. In 1895 and 1896, the *Animals' Friend Magazine* published a series of articles, each titled 'Why I Oppose Vivisection'. These included three by physicians (Dr Arthur Beale, Dr Lawson Tait, and Dr John Makinson), all of whom argued that not only was experimentation cruel, but that also it was medically valueless and led to no discoveries which could not have been made by diligent clinical observation. In the US, Dr Albert Leffingwell was publishing material along the same lines at much the same time. Middle-class women had shown in their letter-writing campaigns to other women wearing hats with feathers – what the humanitarian Henry Salt called 'murderous millinery' – that campaigning could be effective on animal issues. This campaign also led to the formation of the Society for the Protection of Birds in 1889 (Moss, 2011).

3.16. But the most spectacular eruption of public feeling about experiments came in the form of the 'Brown Dog affair' (Lansbury, 1985; Kean, 1998). In 1903, the physiologist William Bayliss successfully defended himself against the charge of unnecessary cruelty and won damages for libel. But the controversy rumbled on in the press, and public protest resulted, so much so that by 1907 full-scale rioting between medical students and radicals (especially feminists) broke out around a London monument to a specific dog who had been the subject of the case. The monument had the following inscription:

In Memory of the Brown Terrier
Dog Done to Death in the Laboratories
of University College in February
1903 after having endured Vivisection
extending over more than Two Months
and having been handed over from
one Vivisector to Another
Till Death came to his Release.

Also in Memory of the 232 dogs Vivisected
at the same place during the year 1902.
Men and Women of England
how long shall these Things be? (Lansbury, 1985, p. 14)

3.17. The monument was removed in 1910, but a new one was erected in 1985 with the original inscription restored and the following addition:

> This monument replaces the original memorial of the brown dog erected by public subscription in Latchmere Recreation Ground, Battersea in 1906. The sufferings of the brown dog at the hands of the vivisectors generated much protest and mass demonstrations. It represented the revulsion of the people of London to vivisection and animal experimentation. This new monument is dedicated to the continuing struggle to end these practices. After much controversy the former monument was removed in the early hours of 10 March 1910. This was the result of a decision taken by the then Battersea Metropolitan Borough Council, the previous council having supported the erection of the memorial.
>
> Animal experimentation is one of the greatest moral issues of our time and should have no place in a civilized society. In 1903, 19,084 animals suffered and died in British laboratories. During 1984, 3,497,355 animals were burned, blinded, irradiated, poisoned and subjected to countless other horrifyingly cruel experiments in Great Britain. (Lansbury, 1985; Mason, 1997)

3.18. Historically, then, we can readily trace a pattern in which the public expresses distaste for live animal experiments, scientists who doubt the value of such experiments register objections, and other scientists defend the experiments on the grounds of the greater good for humankind. This offers some background for understanding the contemporary debate.

4. The new scientific critiques

4.1. The terms of the old debate have been challenged in recent years by the emergence of scientific critiques of the validity of animal experimentation. We need to attend to these critiques if we are to understand why a reassessment of the morality of animal research is so important.

The unreliability of animal experiments

4.2. The first factor in the scientific critiques of animal experimentation is the scientific debate on the utility of animal tests (LaFollette and Shanks, 1996). At the outset of legalised animal testing, the issue of utilitarian justification was in its infancy. It was impossible at that time to know with certainty whether animal tests would yield the results that many claimed and would unambiguously lead to scientific progress. In the intervening years, many also assumed that such utilitarian justifications contributed so decisively to new discoveries that the issue hardly bore further scrutiny. But this assumption has now been radically questioned from two quarters: the first is

the growing evidence of animal tests that have not proved beneficial and that may indeed have hindered scientific progress, and the second issue is whether 'animal models', as they are sometimes termed, are themselves satisfactory models for human disease[1].

4.3. In recent decades, 'evidence-based medicine' has become the mantra of sound, scientifically based medical research and practice. Evidence-based medicine is implemented in virtually every facet of health research, ethics, and practice save one – the use of animal experimentation to inform human health. Animal experimentation is most often viewed as the default or 'gold standard' method of testing. Yet despite this or perhaps because of it, animal testing does not receive the critical examination needed to determine its relevance to human health. As a result, there is a dearth of published, peer-reviewed evidence that supports the usefulness and validity of animal experimentation. The Nuffield Council on Bioethics (2005) noted this lack of critical studies examining the relevance of animal experiments. Nevertheless, the work that has been done tends to demonstrate the unreliability of animal experiments, and we shall now review some of those studies.

4.4. In 2006, the *Journal of the American Medical Association (JAMA)* reported: 'While investment in basic research in the United States doubled from 1993 to 2003, the number of therapeutics entering the clinic has actually declined' (Hampton, 2006). New compounds entering phase 1 trials (almost exclusively in vivo animal assays) have about an 8 per cent chance of reaching the market. Many drug candidates that enter later phases of the drug development process are also falling by the wayside. Overall, in the US, 92 per cent of drugs that pass preclinical tests, mostly animal tests, fail to make it to the market because they are proven to be ineffective and/or unsafe in people (Archibald and Coleman, 2012). This information is supplied by the 2004 US Food and Drug Administration (hereafter 'FDA') 'Critical Path' report. This report also notes that if topical medicines are excluded, the failure rate is around 97 per cent. In response to the standard reply in support of animal research – namely, 'That's just the way it is with research' – it is worth noting that this was emphatically not the FDA's conclusion.

4.5. Leaders in the biotechnology and pharmaceutical industries published a paper outlining the major problems underlying the drug development process (Palfreyman et al., 2002). They concluded that the poor predictability of animal experiments is one of the major challenges facing the drug discovery community. One of the more notable studies highlighting the lack of relevancy of animal experiments to the human condition is a *British Medical Journal (BMJ)* systematic review, which examined the clinical (human) data of six different interventions to treat head injury, respiratory distress syndrome, osteoporosis, stroke, and haemorrhage (Perel et al., 2007). The investigators compared the human results with the published animal experimental results and found that the human and animal results were in concordance only half of the time. In other words, the animal experiments were no more likely to predict whether those interventions would benefit humans than a flip of the coin. The study authors suggested, among other things, that the discordance between human and animal results might reflect biases in reporting and publication. As LaFollete and Shanks comment, 'many researchers do not interpret the failure to correlate findings in non-human animals as humans as suggesting *disanalogies* between model and subject modeled' (LaFollete and Shanks, 1996, p. 25).

4.6. Notably, a 2014 review published in the BMJ found that over the past decade, despite rigorous discussion of the foregoing problems in animal experimentation, these problems are still ubiquitous throughout the field, and systematic studies examining the validity of animal experiments remain few. As a result, it is 'nearly impossible to rely on most animal data to predict whether or not an intervention will have a favourable clinical benefit-risk ratio in human subjects' (Pound et al., 2014). An accompanying editorial in the *BMJ* by editor-in-chief Fiona Godlee reports:

> Better conduct and reporting of animal research will help, say [review authors] Pound and Bracken. This could come from better training and education of basic researchers and from a cultural change fuelled by greater scrutiny and public accountability. But how much would this really improve the rate of successful translation from animals to humans? Not much, it seems. Even if the research were conducted faultlessly, argue the authors, our ability to predict human

[1] The obvious example is thalidomide, which was first used in the late 1950s to alleviate nausea in pregnant women. It was developed by the German drug company Chemie Grünenthal. The first reports that thalidomide caused severe congenital anomalies in babies born to those women who took the drug were made independently by McBride (1961) and Lenz (1962) .

responses from animal models will be limited by interspecies differences in molecular and metabolic pathways.

Funds might be better directed towards clinical rather than basic research, where there is a clearer return on investment in terms of effects on patient care. The authors conclude: 'If research conducted on animals continues to be unable to reasonably predict what can be expected in humans, the public's continuing endorsement and funding of preclinical animal research seems misplaced'. (Godlee, 2014)

4.7. As highlighted in the BMJ editorial, while biases and poor quality of animal research may certainly play a role, there are immutable factors inherent in the use of animals in experimentation that are more likely to account for the unreliable nature of the testing results. These factors include (1) unpredictable influences of laboratory environments and procedures on experimental results; (2) discordance between human diseases and 'animal models' of disease, and (3) interspecies differences in physiology and genetic function. We shall now explore these in turn.

a. Unpredictable influences of laboratory environments and procedures on experimental results

4.8. Elements of the laboratory environments and procedures may cause unpredictable influences on animal experimental results (Akhtar et al., 2008). Arguably, every procedure conducted on animals in laboratories causes them substantial distress (Morgan and Tromborg, 2007). Mice in laboratories commonly show clear signs of distress, and at the New England Regional Primate Research Center, almost 90 per cent of monkeys showed behavioural abnormalities (Hart, P. et al., 2009; Lutz et al., 2003).

4.9. Routine laboratory procedures, such as catching an animal and removing him or her from the cage, in addition to the experiments themselves, cause significant and prolonged elevations in animals' stress markers (Balcombe et al., 2004). These stress-related changes in physiological parameters as a result of the laboratory procedures and environment can have a significant effect on test results (Baldwin and Bekoff, 2007). An article in New Scientist argues that stressed rats develop lasting inflammatory conditions, which cause their intestines to leak: 'This inflammation adds uncontrollable variables to experiments … confounding the data' (Baldwin and Bekoff, 2007).

4.10. Conditions in the laboratory are shown to cause unpredictable changes in neurochemistry, genetic expression, and nerve regeneration (Akhtar et al., 2008). In one study, mice were genetically altered to develop defects in their hearts (Baldwin and Bekoff, 2007). But when the mice were put in larger cages, those defects almost completely disappeared. It has also been shown that the noise levels in laboratories damage blood vessels in animals (Akhtar et al., 2008). Even the type of flooring on which animals are tested in spinal-cord injury experiments can affect whether a drug shows a benefit or not. The cumulative effect is that these stressors cause animals to be less reliable and less representative of human biology.

b. Discordance between human diseases and 'animal models' of disease

4.11. Additionally, the lack of sufficient congruency between 'animal models' and human disease is another frequent and significant obstacle. In the laboratory, diseases that occur naturally in humans are artificially induced as substitute diseases in animals. The inability to reproduce the complexity of human diseases in animals is a crucial hindrance to the use of animals (Curry, 2003; Dirnagl, 2006). Even if design and conduct of an animal experiment are sound and standardised, the translation of its results to the clinic may fail because of disparities between the 'animal model' and the clinical trials (van der Worp et al., 2010).

4.12. In stroke research, for example, frequent disparities include pre-existing diseases in humans that lead to stroke, such as diabetes and atherosclerosis, use of additional medications to treat these risk factors in humans, and nuances in the pathology of the disease that are absent in animals. As a result of the recognition of these discrepancies, several publications argue for the need to use animals who also have the co-diseases (co-morbidities) that occur naturally in humans and who are given medications that are part of standard clinical care for human patients (Dirnagl, 2006; Sena et al., 2007). Reproducing the co-diseases, however, leads to roadblocks as well because of the inability to replicate the complexity of these co-diseases. For example, most animals do

not naturally develop significant atherosclerosis, which is characterised by a narrowing of blood vessels. In order to reproduce the effects of atherosclerosis in animals, researchers ubiquitously clamp their blood vessels or artificially insert clots. These mechanisms to induce disease, however, do not replicate the elaborate pathology of atherosclerosis and the causes behind it.

4.13. In attempts to reproduce the complexity of human diseases in animals, the complexity of the predisposing diseases and physiology must be reproduced, which also proves difficult to accomplish. Every time an 'animal model' is found to be lacking, no shortage of reasons is proffered to explain what went wrong – poor methodology, publication bias, lack of co-disease and medications, wrong gender or age, and so on. Recognition of each potential difference between the 'animal model' and the human disease creates a renewed effort to eliminate these differences. What is too often ignored is that these 'models' are intrinsically lacking relevancy to human diseases (Wiebers et al., 1990).

c. Interspecies differences in physiology and genetic function

4.14. Ultimately, interspecies differences in physiology, metabolism, pharmacokinetics, and genetic function cause insurmountable obstacles in translation to human physiology. In spinal cord injury, for example, drug testing results vary according to which species, and even which strain within a species, is used because of numerous interspecies and inter-strain differences in neurophysiology, anatomy, and behaviour (Akhtar et al., 2008). Again, the micropathology of the spinal cord injury, injury repair mechanisms, and recovery from injury vary greatly between different strains of rats and mice. Surprisingly, even rats from the same strain, but purchased from different suppliers, produce different test results (Akhtar et al., 2008). In one study, responses to twelve different behavioural measures on pain sensitivity varied among eleven strains of mice, with no clear-cut patterns that would allow prediction of how each strain would respond (Mogil et al., 1999). Each of these and numerous other differences influenced not only how the animals responded to the injury, but also how they responded to any potential therapy being tested. A drug might be shown to help one strain of mice recover but not another.

4.15. Although we share most of our genes with other mammals, there are critical differences in how our genes actually function. The best analogy is perhaps a piano: just as pianos have the same keys, humans and animals share the same genes. Where we mostly differ is in the way the genes or keys are expressed. Play the keys in a certain order, and you hear Chopin; play them in a different order, and you hear Ray Charles; choose yet a different order, and it is Jerry Lee Lewis. In other words, the same keys or genes are 'played', but their different order results in very different outcomes.

4.16. To circumvent these differences, experimenters alter animals' genes in attempts to make them more 'human-like'. Mice are used extensively because of their ostensible genetic similarity with humans and because their entire genome has been mapped. Their genes are modified to make them more 'human'. However, if a human gene is inserted into the mouse genome, that gene is likely going to function quite differently from how it functions in humans. A study published in *Science* found that a crucial protein that controls blood sugar in humans is missing in mice (Ledford, 2009). When the human gene that produces this protein was expressed in genetically altered mice, it behaved differently. In fact, the effect in mice was opposite: the gene caused *loss* of blood sugar control in mice. To continue the piano analogy, the key that had been playing Chopin (in humans) was now playing Ray Charles (in mice).

4.17. Even among mice, corresponding genes can behave very differently. The disruption of a gene in one strain of mice is lethal, whereas disruption of that gene in another strain has no deleterious effect (Horrobin, 2003). Six strains of mice who share the same genetic mutation that causes Fragile X syndrome (a genetic condition that causes intellectual disability and behavioural problems) show radically different behaviours (Spencer et al., 2011). In other words, one strain of mice is not predictive of another strain of mice. Such findings question the wisdom of extrapolating data that is obtained in mice to other species, most notably humans. 'If one mouse gene is so difficult to understand in a mouse context,' asks Dr David Horrobin 'and if the genome of a different inbred strain of mouse has so much impact on the consequences of that single gene's expression, how unlikely is it that genetically modified mice are going to provide insights into complex gene interactions in the … human species?' (Horrobin, 2003, pp. 151–154).

4.18. Genetically engineered 'animal models' are not living up to their promise. Perhaps the major reason GM animals will not solve the problems of animal experimentation translation to humans is the fact that the 'humanised' genes are still in non-human animals. When a 'humanised gene' is introduced into a mouse, that gene may be expressed quite differently from how it is expressed in humans, and it will be affected by all of the physiological mechanisms that are unique to the mouse.

4.19. Instead of mice, many experimenters use NHPs, hoping they will better mimic human results. Chimpanzees share at least 98 per cent of our genes, yet there are many differences between chimpanzees and humans in DNA sequence and how our genes function (Akhtar, 2012, p. 148). These genetic differences ultimately cause differences in physiology. HIV/AIDS vaccine research using NHPs is one of the most notable failures in animal experimentation. Immense resources have been devoted to studying HIV in chimpanzees and other NHPs. Yet all of about ninety HIV vaccines tested so far that worked in animals have failed in human trials (Bailey, 2008).

4.20. Hormone replacement therapy (hereafter 'HRT') was originally hailed for preventing heart disease and strokes. The campaign to prescribe HRT to millions of women was based in large part on experiments on NHPs. HRT is now known to *increase* the risk of these diseases in women (Pippin, 2013). In March 2006, six human volunteers were injected with TGN 1412, an experimental therapy created by TeGenero. The results were described by *Slate*:

> Within minutes, the human test subjects were writhing on the floor in agony. The compound was designed to dampen the immune response, but it had supercharged theirs, unleashing a cascade of chemicals that sent all six to the hospital. Several of the men suffered permanent organ damage, and one man's head swelled up so horribly that British tabloids refer to the case as the 'elephant man trial'. (Allen, 2006)

4.21. TGN 1412 had been tested in mice, rabbits, rats, and NHPs with no ill effects. Cynomolgus monkeys were used because they best replicated the human mechanisms specifically targeted by TGN 1412 (Attarwala, 2010; Hanke, 2006). Thus, not only were several different species used; those deemed most relevant to humans were used. NHPs also underwent repeat-dose toxicity studies and in fact were given 500 times the dose given to the human volunteers for not less than four consecutive weeks. Still, none of the NHPs manifested the ill effects that humans showed within minutes of receiving a miniscule amount of the test drug. Experiments using NHPs prove to be no more predictive of human responses than those using other animals.

4.22. In summary, in addition to extrinsic factors, such as publication biases and the poor quality of animal experiments, such tests fail for three primary and inherent reasons:

> 1. Stressed animals yield poor data. The unnatural laboratory environments and procedures cause animals substantial stress. Their distress causes changes in their physiology (Garner, J. P., 2005) that affect research data in very unpredictable ways.
>
> 2. Animals do not naturally develop most human diseases. The inability to recreate human diseases accurately in other animals is a fundamental flaw in the use of animal experiments.
>
> 3. Animals are not miniature humans. Despite attempts to genetically alter animals to mimic human physiology or use closer genetic species such as NHPs, physiological and genetic differences that are unalterable and inherent to species diversity remain an insurmountable obstacle to using animals to predict human outcomes.

The development of more predictive human-based testing

4.23. The second factor in the scientific critiques of the validity of animal experimentation is the development of alternatives to animal testing. In the nineteenth century, the scientific community did little to seek alternatives to the then-emerging (and largely unproven) scientific techniques involving animals. Indeed, the whole idea of developing alternatives had to wait until the 1960s and 1970s. But such alternative techniques and methodologies have now emerged, largely through the efforts of animal protection organisations. It is these bodies that have

principally funded (indeed were the only initial funders of) the main alternative research bodies in the UK, such as the Fund for the Replacement of Animals in Medical Research (FRAME), the Lord Dowding Fund, the Dr Hadwen Trust, and the Humane Research Trust. It is often unacknowledged that animal protectionists have pioneered new fields of scientific research and have contributed many millions of pounds in the process. The range of alternatives to animal research offers new possibilities. Examples include adult stem cell research, human organs-on-a-chip, lab-grown human organs, and systems biology.

4.24. Currently, many of these testing methods are being used in conjunction with animal experiments prior to clinical trials. The problem with using both human-based and animal experiments, however, is that the animal experiments may contradict findings from the human-based tests. When this occurs, as is often the case, the animal experimental results may be incorrectly favoured (leading researchers down the wrong path of investigation) because they represent 'whole animal system' results. However, the animal tests provide the wrong whole systems. For genetic and physiological reasons that are immutable, animal experiments are less trustworthy than even incomplete systems of the human body.

4.25. Some have argued that in vitro or other similar testing methods are simplistic and cannot accurately mimic the complexities of the human body – hence the need for animal experiments. In vitro tests certainly are pro ne to some of the same problems as animal experiments in that they can be relatively simplistic models of disease or physiological mechanisms and are not always very accurate. But are the animal experiments necessarily *more* accurate or predictive?

4.26. A multicentre team of researchers evaluated sixty-eight different methods to predict the toxicity of fifty different chemicals (Clemedson et al., 1996; Clemedson et al., 2000). The animal tests were only 59 per cent accurate, whereas a combined human cell in vitro test was 83 per cent accurate in predicting actual human toxicity. Again, cultured human skin cells outperformed live rabbit tests in detecting chemical skin irritants. Tests in rabbits misclassified ten of twenty-five chemical irritants, whereas the cultured cells classified all irritants correctly (MatTek Corporation, 2008). Researchers compared in vitro human tumour cell lines with mouse cancer 'models' for their reliability in predicting clinical phase-two trial results of thirty-one potential cancer drugs. The study found that the in vitro tests were reliable in predicting the clinical utility of these drugs for all four cancer types tested, whereas the mouse allograft cancer 'model' (in which cancerous tissue from one mouse is transplanted into another) was not predictive (Voskoglou-Nomikos et al., 2003).

4.27. The human xenograft mouse 'model' (in which cancerous tissue from a human is transplanted into a mouse) was predictive for only two of the four cancer types studied. The study authors concluded that cancer drug development emphasis should be placed on in vitro cell lines. An in vitro test developed by UK researchers could have predicted TGN 1412's serious adverse effects before it was ever tested in humans (Mayor, 2008). In all of these examples, in vitro tests were far more accurate than whole 'animal model' systems. This is because of the simple fact that non-human animal 'models' are not the correct systems. At a fundamental level, non-human 'models' cannot be accurate – and cannot be made to be accurate – because of distinctions in genetic make-up and expression and evolutionary issues, such as causal disanalogy between species, which makes 'animal models' insufficient for making reliable predictions in humans (LaFollette and Shanks, 1996). An understanding of *human* physiology is critical.

4.28. Although there is no perfect predictive approach to human medicine, a combination of human-based testing methods, including in vitro tests, will bring us closer to the true answers than animal experiments, which are inherently flawed. Human-based in vitro tests may not always be accurate predictors of human responses, but they have great potential to become more accurate, particularly as new methods are developed that are closer to depicting whole human systems. Perhaps the most exciting new development is human organs-on-a-chip, microchips lined by human cells connected by microfluidic channels that could revolutionise medical testing and drug development. In addition, there is an array of emerging methods that can replace animals, including, for example, microdosing.

4.29. The upshot of these scientific developments in cutting-edge human-based testing methods is that it is no longer accurate or reasonable (if it ever was) to say that the only moral choice is between experimenting on animals and giving up on medical progress. This is a false dilemma. The choice instead is the choice between experimenting on animals and using improved human-based methods of testing.

5. The changing ethical paradigm

5.1. We now turn to the most important change of all, namely the emergence of a new ethical paradigm.

5.2. During the last forty years, there has been considerable growth in intellectual work on the ethical status of animals. Philosophers have led the way, and there is now a multidisciplinary corpus of hundreds of academic books and papers that argue for changes in the ways in which we use animals. Of course, they are not all in agreement, but it is fair to say that there is a growing consensus among ethicists and philosophers about the need for fundamental change. The intellectual context in which we discuss the issue of animals today is considerably different from the one that operated a hundred or even fifty years ago.

5.3. In order to understand this change, it is important to engage with the intellectual legacy to which these philosophers and ethicists have responded and are still responding. We may delineate three dominant tendencies in their responses.

The challenge to moral anthropocentrism

5.4. By 'moral anthropocentrism', we mean the assumption that human needs, wants, or desires should have absolute or near absolute priority in our moral calculations. Of course, there have been thinkers who have challenged moral anthropocentrism in almost every age stretching right back to the pre-Socratics, but such ideas have often lacked any organisational or institutional backing and have therefore had limited social influence.

5.5. Perhaps the most obvious example of moral anthropocentrism stems from the perceived relation between justice and friendship. Aristotle was clear that there could be no friendship between the ruler and the ruled – 'for where there is nothing in common to ruler and ruled', he continues, 'there is not friendship either, since there is no justice' (Aristotle, 1915, vol. IX, 1161a–b). Aristotle provides examples of how there is no justice between humans and inanimate ('lifeless') objects, since 'each case is benefited by that which uses it'. He further explains that 'neither is there friendship towards a horse or an ox, nor to a slave *qua slave*' (Aristotle, 1915, vol. IX, 1161a–b; original emphasis). Aristotle avers that perhaps owners and slaves can be friends insofar as they can 'share a system of law or be a party to agreements' and insofar as they are humans, but animals are not obviously included within those stipulations (Aristotle, 1915, vol. IX, 1161a–b).

5.6. St Thomas Aquinas develops this line of thought by proposing that charity (which is defined as a kind of friendship) extends only to God and fellow humans. We cannot have friendship with 'irrational animals'. But he does stipulate that 'we can love irrational creatures out of charity' but only 'if we regard them as good things *for others*' – namely, 'as we wish for their preservation, to God's honour *and man's use*' (Aquinas, 1918, part 1, question 65.3; our emphasis). Put more simply, animals are considered 'irrational', and because of their lack of reason, humans cannot be friends with them, and neither can animals *in themselves* deserve justice or charity.

5.7. This Aristotelian-Thomist core, despite various challenges, remains at the heart of much philosophical and theological thought about animals. Thomas Hobbes, for example, argues that because there can be no social contract with animals, so humans can have no duties towards them (Hobbes, 1841, pp. 63–75; cited and discussed in Linzey and Clarke, 2004, pp. xv–xvi). David Hume also argues that there is no society with animals and hence no possibility of an equal claim to justice. Our 'intercourse with [animals] could not be called society, which supposes a degree of equality, but absolute command on one side, and servile obedience on the other' (Hume, 1902, pp. 189–192; cited and discussed in Linzey and Clarke, 2004, p. xix).

5.8. To bring the issue up to date, John Rawls argues that animals are outside the scope of a proper theory of justice. In only a mild departure from the Thomist-Aristotelian tradition, he argues that only human persons are entitled to equal justice. He writes that 'it is wrong to be cruel to animals and [that] the destruction of a whole species can be a great evil', but 'it does not seem possible to extend the contract doctrine so as to include them in a natural way' (Rawls, 1972, pp. 504–512; cited and discussed in Linzey and Clarke, 2004, p. xix).

5.9. At root, then, contractualists conceive morality as a set of rules that are derived from the unanimous consent of rational, self-interested individuals who share the aim of living in a stable society that encourages human

flourishing. In such a picture, animals – as creatures incapable of the rationality required for participation in such a conference – will be accorded indirect and derivative moral status, if any status at all. Of course, contractualism does not always entail such a low view of animals. Contractualism can include animals if it is allowed that rational agents can represent the interests of other non-rational or less than rational beings. For example, in the work of Mark Rowlands, animals have direct moral status that can be championed by others (Rowlands, 1998, 2002, 2009). But in its classical form, contractualism, like most philosophy and theology, has been morally anthropocentric.

5.10. The obvious weakness of moral anthropocentrism is that it fails to take account of the interests of animals, or if it accepts that animals have interests, it denies that these interests have any moral weight. Unsurprisingly, Albert Schweitzer likened the history of Western philosophy to that of a person who cleans the kitchen floor, only to find that the dog comes in and muddies it with paw prints (Schweitzer, 1923, p. 119). The problem of how to square obligations to humans with obligations to other sentient beings is resolved by not addressing them. Thus conceived, morality becomes a humans-only affair in which animals are locked out. The arbitrariness of moral anthropocentrism can be shown by selecting some other feature or characteristic of human beings, or of a particular race or nation, and then erecting a system of exclusion based on that feature or characteristic alone. There is an obvious self-serving aspect to all such exclusions that belie the supposed objectivity of the exercise. Most importantly, such exclusions most usually overlook the common ability of humans and animals to experience pain and suffering.

The challenge to instrumentalism

5.11. By 'instrumentalism', we mean the assumption that animals exist for human beings, to serve their interests and wants. This idea also has a long intellectual history and has become one of the dominant lenses through which humans perceive other species. The notion that we 'own' animals has been a direct result of this assumption and has been codified in almost all legislation worldwide.

5.12. Instrumentalism, like moral anthropocentrism, has both philosophical and religious roots. Some believe that the religious root can be found in the first creation saga in Genesis chapter one, where God gives humans 'dominion' over animals. While there is good reason to suppose that dominion in its original context did not mean despotism (see 10.4), it cannot be doubted that historically this view has provided a kind of biblical proof-text to justify human exploitation of animals.

5.13. The philosophical root of instrumentalism reaches as far back as Aristotle (if not earlier), who famously wrote: 'Since nature makes nothing without some end in view, nothing to no purpose, it must be that nature has made them [animals and plants] for the sake of man' (Aristotle, 1985, 1.viii, 79). St Thomas's use of Aristotle's view (by combining it with the earlier idea of dominion) baptises the notion within the Christian tradition. Compare the preceding quotation with St Thomas's view in the *Summa Contra Gentiles*: 'By divine providence, they [animals] are intended for man's use according to the order of nature. Hence it is not wrong for man to make use of them, either by killing *or in any other way whatever*' (Aquinas, 1945, pp. 221–222; our emphasis). What was thought 'natural' or 'according to nature' in Aristotle becomes in Aquinas a matter of 'divine providence' as well.

5.14. Aquinas also argues that 'dumb animals and plants are devoid of the life of reason whereby to set themselves in motion'. He continues, 'They are moved, as it were by another, by a kind of natural impulse, a sign of which is that they are naturally enslaved and accommodated to the uses of others' (Aquinas, 1918, part 1, question 64.1). Notice the development of the argument: animals are on the same level as plants in being non-rational (or 'irrational' as St Thomas actually puts it). Rationality is a sphere entirely reserved for the human species; everything else within creation is 'devoid of the life of reason'. What directs or 'moves' animated beings (animals and plants) is not rational direction or any self-chosen goal (because animals cannot rationally choose anything), but the movement of others or 'a kind of natural impulse'. Animals, in other words, act 'naturally', or as occasioned by others, rather than through deliberate will. And the proof of this is that they are 'naturally enslaved' and 'accommodated to the uses of humans'. The logic is plainly circular, of course: how do we know that animals, like plants, are slaves for human use? The answer is because we can enslave them[2].

[2]Some material in this section has been borrowed from Clair Linzey (2014).

5.15. It would be a mistake to minimise the influence of this teaching of St Thomas. In relation to animals, Thomistic formulations have held sway for subsequent centuries of Christian thought. His idea that animals have no mental life and do not act by conscious will, but by 'nature' or 'instinct', has been persuasive right up to the present day.

5.16. St Thomas's negative theology undoubtedly contributed to a dismissive Christian view of animal welfare. Historic Catholic moral textbooks deny that humans have any *direct* duties to animals. *The Dictionary of Moral Theology*, written as recently as 1962, explains why:

> Zoophilists [animal lovers] often lose sight of the end for which animals, irrational creatures, were created by God, viz., the service and use of man. In fact, Catholic moral doctrine teaches that animals have no rights on the part of man. (Palazzini, 1962, p. 73)

5.17. Notice how animals are deemed to have no independent worth other than their service to human beings. Their end (telos) is understood entirely in instrumentalist terms. It should not come as a surprise then to discover that Pope Pius IX, in the nineteenth century, reputedly forbade the opening of an animal protection office in Rome on the grounds that humans had duties to other humans but none to animals (Gaffney, 1986, pp. 149, 159–160).

5.18. Although the Christian tradition is very diverse and comprises many traditions that are favourable to animals, the dominant voices in Western Christianity have laid great emphasis upon instrumentalism. But it is not only within the Christian tradition that instrumentalist attitudes have persisted. Immanuel Kant, for example, held that 'inasmuch as crops (for example, potatoes) and domestic animals are products of human labour, at least as far as their quantity is concerned, we can say that they may be used, consumed, or destroyed [killed]' (Kant, 1965, pp. 345–346). Kant divides the moral universe into persons and things: persons are rational beings, and things are non-rational beings. Morality is, on this view, a reciprocal relationship among persons; thus, we have no moral obligations to animals, understood as non-rational beings. Kant's fundamental moral principle – the categorical imperative – is that persons are to be treated as ends in themselves, not merely as means to an end. This principle does not apply to our interactions with animals because they are things, or mere means to human ends.

5.19. It does not follow, however, that we may not hold some indirect duties to animals insofar as some human interest is involved. Aquinas held that cruelty to animals may be wrong if it dehumanises the perpetrator (Aquinas, 1945, pp. 220–224). Kant judged likewise: 'Our duties towards animals are merely indirect duties towards humanity'. He provided an example of how it would not be wrong to kill a dog who could no longer provide service, but the owner must be careful not to stifle humane feelings since 'he who is cruel to animals becomes hard also in his dealings with men' (Kant, 1963, pp. 239–241). Some contemporary Kantians, such as Christine Korsgaard, have attempted to include animals in the moral universe by considering what animals would consent to if they could consent (Korsgaard, 2011).

5.20. Again, the obvious weakness in instrumentalism is its circularity. We know that animals are slaves because they are enslaveable. As such, the argument seems to be little more than the working out of the notion that might is right – that power is its own justification. Both anthropocentrism and instrumentalism reject the idea that we have direct duties to animals and that we should consider their interests independently of human wants or needs. Moreover, it is not obvious (as it was for Aristotle and Aquinas) that there exists (or should exist) a rational hierarchy in the world such that the rationally 'inferior' should exist for or serve the 'superior'. At the very least, the contrary implication should be enjoined – namely, that the species blessed with greater rationality should demonstrate that 'superiority' (if such there be) by a particular regard for the weak of all species. As Alexander Pope argued, 'I cannot think it is extravagant to imagine that mankind are no less, in proportion, accountable for the ill use of their dominion over creatures of the lower rank of beings, than for the exercise of tyranny over their own species' (Pope, 1950, pp. 159–165).

The challenge to dualism

5.21. By 'dualism' in this context, we mean the tendency to distinguish and separate humans from other animals in terms of a binary 'us' and 'them'. In dualistic perspectives, animals are invariably judged inferior to humans.

Animals are judged to be devoid of immortal souls, minds, rational capacities, and language. There are, of course, differences (sometimes important ones) within and between species. Nevertheless, such distinctions have often been used to explain and bolster the presumed moral priority of the human species to the detriment of others.

5.22. The distinction between 'rational' and 'non-rational' has led to entrenched dualisms in Christian thought that separates humans from the rest of creation. The view emerged that animals are 'just animals'. For example, while humans have 'spirit', animals have only 'flesh'; humans have 'minds', whereas animals are just 'matter'; humans are 'persons', and animals are mere 'things'; humans have rational immortal souls, while animals have non-rational souls. These distinctions in favour of humans are reinforced by the historic language we use about animals: 'brutes', 'beasts', 'irrational', and 'dumb'. Dualistic distinctions have always tended to disadvantage animals and elevate humans.

5.23. It is worth noting that the foregoing arguments do not of themselves necessarily lead to the justification of animal cruelty or abuse. Lack of rationality and absence of an immortal soul should logically lead to greater solicitude. If animals are not rational, then this may increase their suffering since they experience the raw terror of confinement or injury without knowing why they are suffering or for what purpose. If animals are really non-rational, it follows that their suffering cannot be softened by intellectual comprehension of the circumstances. Also, as C. S. Lewis observed, if animals are not to be recompensed with an eternal paradise for the sufferings that they have to undergo in the present world, then that surely makes their current suffering of greater, not lesser, significance (Lewis, 1947).

5.24. From the denial of mental life and rational soulfulness to animals, it was only a short step to the idea that animals had insufficient consciousness to feel pain. The suspicion that animals did not really feel 'like us', if at all, was given impetus by René Descartes. According to Descartes, animals 'act naturally and mechanically, like a clock which tells the time better than our own judgement does' (Haldane and Ross, 1950, pp. 115ff.). Animals, in short, are automatons, without consciousness, rationality, or feeling. It is sometimes claimed that Descartes was more well-intentioned towards animals than the plain reading of his work might suggest. But closer examination shows that he put his own idea into practice since he himself performed vivisections (Gombay, 2007, p. 43). It is said of his followers, the Port Royalists, that 'they kicked about their dogs and dissected their cats without mercy, laughing at any compassion for them, and calling their screams the noise of breaking machinery' (Mahaffy, 1901, p. 118).

5.25. Doubtless, this view represents the Christian tradition at its worst and would be held by few Christians today, but it is worth remembering that various forms of Cartesianism have been implicitly or explicitly accepted by many theologians. In the twentieth century, even the celebrated biologist, natural theologian, and Cambridge professor of divinity Charles Raven doubted whether animals could feel pain without a frontal cortex (Raven, 1927, p. 120). And Raven was not alone among theologians in the twentieth century.

5.26. It is important to stress that Cartesianism would not have been possible without the ground laid by Aquinas and subsequent Thomists. As we have seen, the strength of Thomism consists in its circularity: God put animals here for our use; we know that they are meant to be slaves because they are enslaveable; because they are without reason and therefore only merely means to human ends, they cannot have individual worth or a rational soul. Thus, to posit that they also have insufficient consciousness to know pain, or anything like what humans experience when we experience pain, was a significant step, but not a surprising or illogical one.

5.27. Neither is Cartesianism wholly disavowed in contemporary philosophy. The contemporary philosopher Peter Carruthers shows the influence of Descartes when he suggests that animals can experience pain, but that because they lack 'phenomenal consciousness', their pain has no 'subjective feel' to them. They experience pain, but they are not aware that they experience pain (Carruthers, 1989, 2011).

5.28. The common theme in the mainstream history of Western ethics is that humans, by virtue of their reason, are morally special and that animals, because they lack reason, are properly subordinated to and used by humans. Yet even among contemporary philosophers working in these traditions, there are attempts to extend

the moral realm to include obligations to animals. Working in the Aristotelian virtue ethics tradition, Rosalind Hursthouse rejects the concept of moral status and argues that a well-developed account of the virtues would require compassion for animals (Hursthouse, 2011).

Grounds for extending moral solicitude

5.29. In contrast to these dominant tendencies in Western thought, the consensus among ethicists has moved towards embracing three positions.

> The first is that animals have worth in themselves, what may be termed 'inherent' or 'intrinsic' value. Sentient beings, or sentients, are not just things, objects, machines, or tools; they have their own interior life that deserves respect. This view extends worth to sentients as individuals not just as collectivities or as part of a community.
>
> The second position is that, given the conceding of sentience, there can be no rational grounds for not taking animals' sentience into account or for excluding individual animals from the same basic moral consideration that we extend to individual human beings.
>
> The third position is that it follows that causing harm to individual sentients (except when it is for their own good – for example, in a veterinary operation) requires strong moral justification. Some would argue that such acts of harming innocent (i.e., morally blameless) sentients is wrong in itself, and such acts are usually termed 'intrinsically wrong' or 'intrinsically evil'.

5.30. There are a number of considerations that provide grounds for granting animals moral solicitude:[3]

a. Animals cannot give or withhold their consent.

5.31. It is commonly accepted that informed consent is required in advance from an individual when anyone wishes to override the legitimate interests of that individual. The absence of this factor requires, at the very least, that we exercise extraordinary care and thoughtfulness. The very (obvious) fact that animals cannot agree to the purposes to which they are put increases our responsibility.

5.32. It may be claimed that although animals cannot talk consensually and non-consensually, their actions may manifest consent and the lack thereof. So, for example, it may be presumed that an animal who fights (and howls perhaps) to stay out of a kennel is registering her will against being placed in a kennel. So maybe an animal can behaviourally, and even vocally, manifest his or her lack of consent.

5.33. Although we cannot deny the importance of these behavioural indications, they obviously fall short of what humans mean when they speak of voluntary, informed consent. Consent makes sense, logically, only if an individual is presented with alternative possibilities and has both the knowledge of what these possibilities represent and the freedom to choose one of them – and to do so without coercion. When an animal cries or howls or reels in pain, she registers displeasure at her predicament, but registering displeasure (or pleasure) is not voluntary consent. In short, we can sometimes know how animals feel (largely negatively) about their state (and we do well to be sensitive to such indications). In that sense we do often (rightly or wrongly) presume consent, but presumed consent is still a long way from voluntary, verbal consent as we know it between human beings.

5.34. It is pertinent to look at how the issue of consent has evolved historically in relation to the ethics of research involving human subjects. The 1931 German Guidelines on Human Experimentation, which preceded the Nuremberg Code, were claimed to be the first of their kind in providing protection for human subjects of scientific research, even though the 1900 Berlin Code briefly preceded them (Ghooi, 2011). Of note are the following paragraphs:

[3]The following rationale is adapted from Linzey (2009b).

5. Innovative therapy may be carried out only after the subject or his legal representative has unambiguously consented to the procedure in the light of relevant information provided in advance. Where consent is refused, innovative therapy may be initiated only if it constitutes an urgent procedure to preserve life or prevent serious damage to health and prior consent could not be obtained under the circumstances.
6. The question of whether to use innovative therapy must be examined with particular care where the subject is a child or a person under 18 years of age. (Ghooi, 2011, p. 74)

5.35. The Nuremberg Code was drafted at the end of the Second World War. The code was a landmark document in the development of the ethics of research involving human subjects. Six out of the ten points of the Nuremberg Code were derived from the 1931 guidelines. Although the Nuremberg Code was not a legal document, it was the first international document to advocate voluntary participation and informed consent. The Nuremberg Code states that 'the voluntary consent of the human participant is absolutely essential' and that the benefits of research must outweigh the risks (Nuremberg Code, 1949, para 1).

5.36. In 1964, the World Medical Association established recommendations guiding doctors in biomedical research involving human participants. These recommendations were set down in the Declaration of Helsinki (World Medical Association, 2013), which governs international research ethics and defines rules for research combined with clinical care and for non-therapeutic research.

5.37. The declaration has been updated regularly, the last update being in 2013. One ethical stipulation is especially relevant: 'Informed consent from research participants is necessary' (World Medical Association, 2013).

5.38. In response to the prejudice (unjustifiable bias) that had been shown to occur during the Tuskegee Syphilis Study (1932–1972), the National Research Act (1974) was passed in the US. This act created the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (hereafter 'National Commission'). The National Commission was charged with identifying the basic ethical principles that should underlie the conduct of biomedical and behavioural research involving human subjects and with developing guidelines that should be followed to ensure such research is conducted in accordance with those principles. The National Commission drafted the Belmont Report in 1979, which was to become a foundational document for the ethics of research involving human participants in the US. It is pertinent to note that the Belmont Report established three basic ethical principles, as follows: (1) respect for persons, (2) beneficence, and (3) justice (National Commission, 1979).

5.39. The first principle, 'respect for persons', encapsulates the issue well:

a. Individuals should be treated as autonomous agents.
b. Persons with diminished autonomy are entitled to protection.

5.40. Of note is that an autonomous person is defined in the Belmont Report as an individual who is capable of deliberation about personal goals and of acting under the direction of such deliberation.

5.41. The application of this particular ethical principle is in informed consent, as follows:

a. Participants, to the degree that they are capable, must be given the opportunity to choose what shall or shall not happen to them.
b. The consent process must include the following three elements: information, comprehension, and voluntary participation.

5.42. But the question must be asked: if these principles are sound, why should they not apply to non-human subjects as well?

5.43. The irony is rendered acute when it is appreciated that the Declaration of Helsinki (World Medical Association, 2013) expressly endorses experiments on animals as a precursor to ethical experiments on humans.

5.44. The fact that it is impossible to obtain informed consent (with all that it should entail) highlights the moral difficulty of using animals. Constitutionally, animals are unable to give fully informed, voluntary consent for the following reasons:

a. It is not possible to communicate the relevant information to them.
b. It is reasonable to argue that they may not fully comprehend the information, even if it were possible to communicate the information to them.
c. Therefore, they are not in a position to make sound judgements between alternative (long-term) future optional courses of action.

5.45. In other words, the animals are being coerced, and coercion is an example of pathogenic (situational) vulnerability (MacKenzie, 2014, p. 39).

b. Animals cannot represent or vocalise their own interests

5.46. Animals cannot vocalise their own interests except by behavioural indicators, as illustrated previously. Individuals who cannot adequately represent themselves have to depend upon others to represent them. The plight of animals, like that of children or the elderly who suffer from dementia, should invoke a heightened sense of obligation – precisely because they cannot articulate their needs or represent their interests.

5.47. Again, it may be claimed that animals can and do represent their interest – as in, for example, an animal found scouring rubbish bins may be said to 'represent his interest' in getting food. In such ways animals may be said to 'speak to us' so we have some sense of their interests. But one cannot logically insist upon the 'linguistic deficiency' of animals (as so many philosophers have done) and then refuse its conclusion that animals cannot properly represent themselves – at least in terms that humans can verbally understand. Of course, those who wish to exploit animals pretend to know only too well what 'their' animals 'want'. But in fact, while we can and should take behavioural indications seriously, our general (and sometimes specific) unknowing should be counted in their favour.

c. Animals cannot understand or rationalise their suffering

5.48. The underlying assumption (at least as it is utilised in contemporary debate) is that rational incomprehension makes suffering less morally considerable because the suffering of rational beings is incomparably greater. Rational comprehension might heighten suffering if, for example, it involves anticipation of harm or death, which animals cannot experience. It is sometimes claimed, for example, that animals have no anticipation of death and are therefore spared that ontological anxiety which besets human beings. If that is true, then it must be granted that humans may be liable to more suffering in those situations.

5.49. Another example is when a prisoner of war is told that his country has been destroyed or that his family has been killed or will be killed. Verbal threats or abusive comments may cause considerable suffering, while such threats (as long as they remain purely verbal) would not increase the suffering of an animal. Again, in these cases, it should be accepted that humans suffer more, or rather that they suffer in ways in which animals cannot.

5.50. But is it true that rational comprehension always or generally heightens suffering? The general claim is less well founded. Consider the case of free-living animals – for example, NHPs who are captured, taken from their natural state, and then subjected to captivity in zoos or laboratories. The animals concerned do not know why they have been captured, why they are being transported, and what will happen to them. They experience the raw terror of not knowing. And since the implication of the argument is that animals live closer to their bodily senses than we do, the frustration of their natural freedoms may well induce more suffering than we allow. Human suffering, on the other hand, can be softened by an intellectual comprehension of the circumstances. When, for example, a human visits the dentist, who then performs procedures ranging from the uncomfortable to the traumatic, the patient can at least console himself or herself that the procedures are for his or her own putative good. No such consolations are available to animals who are denied their liberty and who have procedures performed upon them that are equally, if not more, uncomfortable or traumatic.

5.51. It seems reasonable that the imposition of captivity upon free-ranging animals constitutes a considerable harm – what has been termed 'harms as deprivation' (Regan, 1983, pp. 96ff.). Captive animals are frequently denied the opportunity to express even elementary patterns of behaviour. Is that harm lessened by intellectual incomprehension? Not obviously. If it is true that animals are non-rational, then it follows that they have no means of rationalising their deprivation, boredom, and frustration. They have no intellectual means of escaping their circumstances, for example (as far as we can tell) by use of the imagination. They cannot, like Terry Waite in captivity, intellectually appreciate the forces that led to their capture and resign themselves, as he did, to a heroic policy of 'no self-pity' (Waite, 1993). Waite at least had the benefit of communication, however limited, with his captors – an amelioration always unavailable to captive animals. Neither can they, like Waite, write novels in their heads (Waite, 1993). Such considerations also extend to a range of situations in which we manage or use animals.

5.52. The claim, then, that rational incomprehension is a morally relevant difference stands only if it can be shown that comprehension increases liability to suffering or that its absence makes the experience of suffering less acute. In some instances, it surely does so, but in others, there are equal grounds for supposing that the contrary is true. The bottom line is that animals and humans suffer in varying ways. Humans will suffer more in some situations, animals more in others. Rationality is only one of many factors (including, notably, bodily sensibility) that may intensify suffering. It cannot be singled out as the only, or even main, factor capable of justifying the privileged position that human suffering now occupies.

d. Animals are morally innocent

5.53. Some animals may possess moral sense (Rowlands, 2012), but we can be confident that they are not moral agents. Because animals are not moral agents with free will, they cannot be regarded as morally responsible. That granted, it follows that they (unlike, arguably, adult humans) can never deserve suffering or be improved morally by it. Animals can never merit suffering; proper recognition of this consideration makes any infliction of suffering upon them problematic.

5.54. Inflicting pain on those who can never deserve or merit it increases our responsibility; it raises the bar of moral acceptability even higher, and that is true even if some decide that infliction of pain may still be justified by reference to the greater good. The point is that we have as much need to justify intentional infliction of suffering on animals as we do to justify infliction of suffering on humans.

e. Animals are vulnerable and (relatively) defenceless

5.55. Animals are wholly, or almost wholly, within our power and entirely subject to our will. Except in rare circumstances, animals pose us no threat, constitute no risk to our life, and possess no means of offence or defence. Moral solicitude should properly relate to, and be commensurate with, the relative vulnerability of the subjects concerned, or with what might be termed 'ontologies of vulnerability'.

5.56. The massive vulnerability of animals to humans is *like* and unlike other vulnerabilities. It is like the vulnerability of children (particularly infants), comatose patients, and the mentally unwell. These individuals are most readily subjected to us; in fact, almost everything we do to them is done without consent. Such actions incur heavy responsibilities when they involve calculations of the subjects' own interests, especially when the activity involves harm. Few would dissent from this line of reasoning in relation to these subjects.

5.57. But in relation to animals, the case is equally strong, if not stronger. Animal vulnerabilities are *unlike* others in that they, especially managed animals, are almost completely vulnerable and subject to exploitation. We do not breed, choose to create, artificially inseminate, or genetically engineer infants or the mentally unwell. Our institutional control of animal lives is without parallel. In the case of many animals used on farms, as well as in laboratories, we not only determine that they should exist, but also determine the pattern and shape of their lives. We change the 'nature' or physical appearance of animals through, inter alia, genetic manipulation. Our almost total control over billions of animals, properly understood, involves us in a near-total moral responsibility to them.

5.58. Briefly summarised, then, the rational considerations for granting sentients moral solicitude are as follows:

a. animals cannot give or withhold their consent;
b. they cannot represent or vocalise their own interests;
c. they cannot understand or rationalise their suffering;
d. they are morally innocent or blameless; and
e. they are vulnerable and relatively defenceless.

5.59. The presence of just one of the factors so far discussed forms the rational basis for a compelling case for further discussion about moral consideration for animals, and all these considerations make the infliction of suffering on animals not *easier* but *harder* to justify (this argument is adapted from Linzey, 2009b).

5.60. As with children (especially infants), these considerations provide the rational basis for regarding animals as cases of special moral concern. Simply put, the factors that are usually employed to argue against consideration of animals (such as their inability to talk, to claim their interests, or to act as moral agents) mean that they should be granted not weaker but stronger moral solicitude. Rather than adopting a 'might makes right' mentality, we need to recognise that our dominance over animals means that we have special responsibilities to take care of them.

5.61. It is the difficulty in justifying harm to animals that renders animals (like infants) a special moral case. Strictly speaking (because they are not moral agents), animals cannot merit or deserve suffering, and they cannot be morally improved by it. This means that all the usual justifications for inflicting suffering simply do not apply in the case of animals. Now, it is true that some utilitarians may justify inflicting such suffering by appeal to the (alleged) fact that greater positive good would result from such infliction – as in medical experiments – than would result without such infliction of suffering. But that is not the morally usual or accepted way we would act towards humans. The utilitarian response simply shows how such an ethical theory cannot reconcile well with our ordinary (non-utilitarian) notion of justice. In other words, it is inconsistent to suppose that species alone can justify the maltreatment of animals while opposing maltreatment of humans.

5.62. We shall see how this new thinking radically changes our moral assessment in our subsequent discussion.

6. The putative justifications

6.1. We now turn to consider arguments for the use of animals in research. In order to avoid the charge of bias, we have selected the most considered arguments in three authoritative reports, two of which are UK governmental reports. We believe that these arguments represent the pro–animal experimentation case in a more considered and cautious way than may be articulated by individual philosophers and scientists. We therefore judge that we have selected the best arguments for the pro–animal experimentation case. These reports are the *Review of Cost-Benefit Assessment in the Use of Animals in Research* of the Animal Procedures Committee (2003, hereafter 'the APC review' or 'APC') published by the Home Office in the UK; the report of the Select Committee on Animals in Scientific Procedures of the House of Lords (hereafter 'SCHOL') in 2001–2002 (House of Lords, 2002); and the working group report chaired by Sir David Weatherall titled *The Use of Non-human Primates in Research* in 2006 (Weatherall, 2006; hereafter 'Weatherall report' or 'Weatherall').

6.2. We begin by turning to the lengthy assessment of the morality of animal testing in the APC review. The function of the APC was 'to provide Ministers with independent advice about the workings of the [Animals (Scientific Procedures) Act 1986] … and their functions within the Act'[4].

[4]The APC has now been replaced by the Animals in Science Committee (hereafter 'ASC') under the amendments to ASPA that took effect in January 2013 following EU Directive 2010/63. The functions of the ASC are set out in the new section 20, sub-section 2, which like its predecessor says that 'in its consideration of any matter the Committee shall have regard both to the legitimate requirements of science and industry and to the protection of animals against avoidable suffering and unnecessary use in scientific procedures' (Home Office, 2012a, p. 19).

Cost-benefit assessment

6.3. One of the roles of the APC was to consider the morality of using animal subjects in experiments. It included some animal welfare representatives, including ethicists (of various hues), but they were in a minority, and most committee members were pro–animal research scientists. In reply to the submission by the BUAV that 'it is indefensible to knowingly inflict suffering on innocent sentient animals other than in their own [individual] interests', the APC states:

> Even if this claim were accepted, it would not imply that animal experiments should never be carried out. As pointed out in the APC Biotechnology Report (Home Office 2001, para 44), actions that are inherently or intrinsically wrong are not therefore absolutely wrong, in the sense that there are no circumstances in which they could be justified. For example, an action that is judged to be wrong might nevertheless be justified if it could be shown to be the lesser of two wrongs that we have to choose between. Moreover, the claim does not seem to rule out experiments on animals provided that they are anaesthetised. (APC, 2003, pp. 9–10)

6.4. The distinction between 'intrinsic' and 'absolute' may be problematic – at least to those who hold deontological theories of ethics. If something is wrong 'intrinsically' or 'inherently', this logically implies that the action or set of actions *in itself and of itself* is morally illicit. From a deontological perspective, there are some actions that should never be performed whatever the consequences.

6.5. This deontological perspective finds its classic expression in the encyclical *Veritatis Splendor* (John Paul II, 1993). It opposes teleological ethical theories that 'maintain that it is never possible to formulate an absolute prohibition of particular kinds of behaviour which would be in conflict, in every circumstance and in every culture, with those values' (John Paul II, 1993, p. 115). The encyclical argues that 'there exist acts which per se and in themselves, independently of circumstances are always seriously wrong by reason of their object' (John Paul II, 1993, p. 122, para 80). Again:

> If acts are intrinsically evil, a good intention or particular circumstances can diminish their evil, but they cannot remove it. They remain 'irremediably' evil acts *per se* and in themselves they are not capable of being ordered to God and to the good of the person. (John Paul II, 1993, p. 124, para 81)

6.6. From such a deontological perspective, then, the distinction between 'intrinsic' and 'absolute' is not plain sailing. However, one of the tasks of deontological approaches to ethics is to develop a ranking system of rights or obligations – a system of principles that shows when one right can be overridden by another (Regan's miniride [1983, pp. 305ff.] and worse-off principles [1983, pp. 307ff.] are good examples). In such versions of deontological theory, the distinction between intrinsic and absolute wrong is supported.

6.7. But not in all. For some, the deliberate infliction of suffering on innocent sentients (human or animal) can never be morally licit. This position deserves much more consideration than is usually given to it. The moral considerations previously outlined indicate that there are good rational grounds for supposing that certain kinds of activity, directed against vulnerable subjects, are so morally outrageous that they ought never to be countenanced, whatever the circumstances. The deliberate infliction of suffering on captive creatures is, from this perspective, intrinsically objectionable or intrinsically evil. Circumstances, benefits, or compensating factors may limit the offence, but they can never make the practice morally licit (Linzey, 2009b, p. 106).

6.8. The perspective of teleological ethics, however, is typically different. To say that an action is 'intrinsically' wrong or 'wrong in itself' means that the performance of such an action has a moral mark against it and so should not be performed unless there are overriding reasons. An action that is wrong in itself is usually classed as 'defeasibly' wrong.

6.9. From this perspective, the APC is right in claiming that there are (conceivable) circumstances in which an act that is inherently (or intrinsically) wrong is justifiable. The APC argues that 'an action that is judged to be

[intrinsically] wrong might nevertheless be justified *if it could be shown to be the lesser of two wrongs that we have to choose between*' (APC, 2003, emphasis added). Now this qualifier again invites a number of questions. Let us consider the subclause 'that we have to choose between'. This language suggests that we have to make a direct or immediate choice between two wrongs (bad options). But a moment's reflection will show us that there is no 'direct' choice involved. A direct choice is precisely that: a choice that *has* to be made; there is no alternative to making it. To live one further minute or second is to make a choice. That is why (as the APC admits) the 'your child or your dog' argument has no real relevance to judging the morality of animal experiments. As the APC states, 'in animal research we are rarely, if ever, presented with the stark situation in which we can save the life of a child by taking the life of an animal' (APC, 2003, p. 15). In reality, what we are presented with is an actual harm and a hypothetical good. In fact, in the entire history of experimentation on both humans and animals, there is not one direct choice of the kind supposed. It is not a question of 'if ever' but one simply of 'never'. As argued by early anti-vivisectionists, who were equally concerned about experimentation on human subjects, 'It is NOT a question of Your Dog or Your Baby, but one of Your Dog AND Your Baby' (Lederer, 1995, p. 101, capitals in original)[5].

6.10. This consideration is often overlooked in discussions in the media and even in scientific analyses of animal experiments. But it requires much more ethical probing. Let us try to focus the point by way of an example. Suppose an aged professor (who happens to teach ethics) hears a noise in his house one night and comes down to discover a person stealing his books. On closer encounter he discovers that the thief is actually a former ethics student.

> 'Now, Stephen, what are you doing?'
>
> 'Well, very good to see you, Professor Noggins, but I would like to defend what I am doing.'
>
> They both sit down and begin some philosophical discourse.
>
> 'As you may know,' begins Stephen, 'I have always been attracted by consequentialist ethical theory.'
>
> 'I know that', says Professor Noggins.
>
> 'Well, I have decided to begin to act on this theory', the student says, 'and implement some consequentialist thinking in my life.'
>
> 'I see,' says Professor Noggins, 'but what has this to do with you rifling through my books?'
>
> 'Well, everything', says Stephen. 'I'm not just rifling through them. I'm taking them, at least a thousand or so – hence all the noise and the boxes everywhere.'
>
> 'And what exactly are you going to do with them?' asks Professor Noggins.
>
> 'Well, that's the point, or rather the consequentialist point. I intend to sell them and give all the money to Oxfam. Consider, whatever small harm stealing your books involves is outweighed by the benefit stealing them will bring to starving people in desperate need of water, food, and proper sanitation. I judge it to be a simple and readily understood moral assessment.'
>
> 'But what about the injustice to me?' questions Noggins in a state of some alarm.
>
> 'Yes, I'm sorry about that', says Stephen reassuringly. 'But there is a higher choice here. It is plainly wrong for you to enjoy something which, when properly stolen and utilised, can relieve the suffering of others.'

[5]Lederer's much-overlooked thesis is that 'the moral issues raised by experimenting on human beings were most intently pursued by the men and women committed to the protection of laboratory animals' (Lederer, 1995, pp. xiii–xiv).

6.11. Many of us (not only academics) would feel keenly the injustice done to Professor Noggins. But most glaringly, we would want to question the moral assessment that allows an actual harm in the hope (or even reasonable chance) of some hypothetical good. We would judge that the weakness of consequentialism as an ethical theory consists in just that: a failure to take *sufficient* account of actual harm. The student 'takes account' of the harm but thinks that it is 'overcome' by all the good that may, even probably will, be produced. So it is the case with animal experiments; by various mechanisms (some real, others partly so), the harms are minimised, but the hypothetical benefits are often exaggerated. At the very least, there is no 'direct' choice to be made, just as there was not in the case of Stephen stealing Professor Noggins's books.

6.12. Even some animal protectionists have been seduced by variations of this argument. For example, Peter Singer accepts that questions about benefit are often hypothetical, but he still maintains that 'if one, or even a dozen animals had to suffer experiments in order to save thousands, [he] would think it right and in accordance with equal consideration of interests that they should do so' (Singer, 1979, p. 58). This is what Singer should say, of course, since he is a 'preference utilitarian'. By the same standard, of course, it would also be right to sacrifice even a dozen innocent humans to save hundreds of others. But the fallacy in the argument lies in perpetuating the fantasy that there is a direct choice (at least in the case of animals) to be made. It is evident, for example, that in the many examples provided in paragraphs 2.12–2.34, no such direct or immediate choice is involved.

6.13. The APC also maintains that the principle that we should not deliberately cause suffering to innocent sentients 'does not seem to rule out experiments on animals provided that they are anaesthetised' (APC, 2003, p. 10). While it is true that some experiments may not cause significant pain or suffering (although they had the potential to; otherwise, they would not need to be licensed), only a small minority are conducted completely under general anaesthetic. For example, in the UK, the percentage of experiments done completely under general anaesthesia from which the animal is not permitted to wake up (i.e. he or she is killed before waking up) is only 3 per cent (Home Office, 2013).

6.14. Even when experiments do not intentionally involve pain or suffering, it does not follow, of course, that they do not in fact involve pain or suffering. Consider the experience of dental work even under anaesthetic. Although some or all of the direct pain may be ameliorated (at least for a period of time), it does not follow that the whole experience is not sufficiently traumatic to cause suffering. When one considers further how (as is often claimed) animals live closer to their emotions, then experiences such as fear, foreboding, anxiety, terror, and stress seem inevitable. And thus, simply eliminating physical pain does not address the full moral implications of these experiments. Moreover, the outcome of anaesthesia is always in doubt.

6.15. But even allowing for the fact that a very small number of animals may be completely anaesthetised (and accepting that it is to some degree a distraction because the APC argues for the justifiability of many experiments that do cause suffering), it misses the point that the issue of harm or suffering is not confined to the issue of the experiments themselves. As already indicated, the capture, breeding, transport, handling, and killing of sentients also cause harm or suffering or both. Consider, for example, the thousands of NHPs who are 'wild-caught' for laboratories and who experience considerable suffering in the process (see 9.3–9.6). The point about anaesthesia makes the error of presuming that the only way that animals can suffer is by feeling pain. Even if we do not consider the pain that the deliverance of the anaesthesia often causes, most animals used in experimentation have desires in addition to avoiding pain, the frustration of which presents a harm to these animals. Animals generally prefer mobility to lack of mobility, a rich environment to a barren one, and opportunities to express their natural instincts involving companionship and play. When they are made unwilling subjects in animal experiments, these desires are irrevocably thwarted, resulting in suffering.

The issue of necessity

6.16. We now turn more directly to the question of 'necessity'. The word is widely used in literature that seeks to defend animal testing. For example, in an article republished at AnimalResearch.Info, Sir John Vane writes that 'the only way to be confident that a new medicine is likely to be safe and effective is to understand how that medicine behaves in a living system. That understanding can only be obtained from animal studies' (Vane, 1996). Alzheimer's Research UK, in its booklet titled *Why Research Using Animals Can Help Defeat Dementia*, claims that

'research using animals continues to be vital in the ongoing search for treatment that can slow or stop the disease process' (Alzheimer's Research UK, no date). Again, the British Pharmacological Society states that 'the use of animals in drug discovery is an essential component of this research' (British Pharmacological Society, 2013). Understanding Animal Research goes further and suggests that 'mainstream medical and scientific organisations and leading scientists all agree that animal research is essential for medical progress' (Understanding Animal Research, no date). In the light of our subsequent discussion of necessity, and specifically the admissions by the APC (see 6.31–6.33), we can only regard these statements as overblown and tendentious.

6.17. One example of how the contemporary debate is conducted can be seen in the ethical discussion contained in the SCHOL report. The report extends to eighty-one pages, but only one half-page (five paragraphs) is devoted to ethics.

6.18. It is worth examining these paragraphs in full:

> 2.1 There is no doubt that the issues raised by the remit of the Select Committee, besides being practical, are also moral or ethical. They centre on the question of how human beings should treat other animals. Moral beliefs and sentiment differ about the answer to this question.
>
> 2.2 There are those who, following a suggestion by Jeremy Bentham in the late 18th century, hold that all creatures capable of suffering are on an equal footing with human beings, regardless of 'the number of the legs, the villosity of the skin, or the termination of the os sacrum'. These people hold that being sentient confers a moral right on animals that they should not be used by human beings for research whose purpose is mainly to benefit humans. Some activists are prepared to uphold this view by violence.
>
> 2.3 More commonly, there are those who hold that the whole institution of morality, society and law is founded on the belief that human beings are unique amongst animals. Humans are therefore morally entitled to use animals, whether in the laboratory, the farmyard or the house, for their own purposes. And this belief is sometimes combined with a further belief that there is a moral imperative for human beings to develop medical and veterinary science for the relief of suffering, among both humans and other animals. This moral imperative permits the use in research laboratories of animals, whose suffering must be weighed against the ultimate relief of suffering towards which research is directed. This is encapsulated in the weighing of harms and benefits (the 'cost/benefit' assessment) in the 1986 Act.
>
> 2.4 The belief that human beings have the moral right, and in some contexts the moral imperative, to use animals in research, does not entail that animals may be bred and kept for human purposes with total disregard for their suffering. The deliberate or negligent causing of suffering to another, whether human or animal, is a moral vice, cruelty, which is sometimes a crime. Therefore we have a moral duty to avoid or minimise animal suffering wherever possible.
>
> 2.5 The unanimous view of the Select Committee is that it is morally acceptable for human beings to use other animals, but that it is morally wrong to cause them 'unnecessary' or 'avoidable' suffering. (House of Lords, 2002, p. 15; this last paragraph is in bold)

6.19. Let us examine the first paragraph. We are told that the remit of the SCHOL is to consider the ethical aspects, yet the committee's very characterisation of varying moral positions is oddly phrased to say the least: 'Moral beliefs and sentiment differ about the answer to this question'. This way of characterising the ethical dimension implies that what is at stake is only people's moral 'beliefs' or their moral 'sentiments'. The idea that ethics requires disciplined rigorous analysis based on defensible propositions seems to have eluded the Lords. Instead of moral reasoning, we are to engage with 'beliefs' and 'sentiments'.

6.20. The second paragraph states that those who follow Jeremy Bentham hold that animals capable of suffering are on an 'equal footing' with human beings. But that is not the case. Singer's position (following Bentham and J. S. Mill) is that there should be 'equal consideration of interests', but that does not mean that *all* interests should be treated equally or counted equally. Indeed, as shown previously, Singer does not oppose all experiments on animals. Taking suffering into account does not require positing an 'equal footing' of all interests. Humans, for example, will have certain interests (e.g., participation in a parliamentary democracy) that other sentient beings will not and vice versa.

6.21. The second paragraph continues: 'These people hold that being sentient confers a moral right on animals that they should not be used by human beings for research whose purpose is mainly to benefit humans. Some activists are prepared to uphold this view by violence'. And in a footnote to the first sentence, SCHOL says, 'This is the view taken by philosophers as Peter Singer …' (House of Lords, 2002, p. 15, fn 40). But of course, as we have shown, that is not Singer's view since he accepts the legitimacy of some experimentation (and he is also anti-violence in virtually all conceivable cases). Moreover, the view that sentiency incurs 'a moral right' on sentients also misreads Singer. He does not believe that animals have moral rights as such, although this language is sometimes used by him as a shorthand. 'These people' to whom SCHOL refers in the same line implicitly include Bentham himself, yet as a utilitarian like Singer, Bentham does not believe in moral rights and elsewhere even talks of rights as 'nonsense upon stilts' (Schofield et al., 2002).

6.22. Then, the second paragraph ends by saying, 'Some activists are prepared to uphold this view by violence'. Who these 'some' are is nowhere defined, and the statement's relevance to this part of SCHOL's report is unclear, unless it is an attempt at guilt by association. While it is true that a tiny minority of animal activists have resorted to illegality, even violence, in defence of animals, it does not follow that these activists necessarily follow Bentham's argument (or rather, SCHOL's misunderstanding of it) or that Bentham's argument requires violent protest.

6.23. The third paragraph begins: 'More commonly, there are those who hold that the whole institution of morality, society and law is founded on the belief that human beings are unique amongst animals. Humans are therefore morally entitled to use animals, whether in the laboratory, the farmyard or the house, for their own purposes.' Leaving aside the grandiose claim that the 'whole institution' (or, more accurately, institutions) of 'morality, society and law' depends upon human 'uniqueness', it is worth pondering what human uniqueness may mean or entail. All animals are unique in their own way; they may excel in aspects, such as speed, flight, language, physique, and so forth, that put humans to shame. In that sense, humans too are unique in possessing certain abilities and characteristics that not all animals share. But human uniqueness, no more significant than any other animal's uniqueness, does not by itself constitute an argument for using or not using other species.

6.24. When the paragraph continues – 'Humans are *therefore* morally entitled to use animals, whether in the laboratory, the farmyard or the house, for their own purposes' (our emphasis) – we are confronted by a non sequitur. It simply does not follow that because humans are unique, they have the moral right to exploit other animals. That there are differences within and between species cannot be doubted. But the issue to be confronted is whether any of these differences are morally relevant, and without demonstrating how human uniqueness is morally relevant, the attempted argument collapses.

6.25. SCHOL continues: 'And this belief is sometimes combined with a further belief that there is a moral imperative for human beings to develop medical and veterinary science for the relief of suffering, among both humans and other animals. This moral imperative permits the use in research laboratories of animals, whose suffering must be weighed against the ultimate relief of suffering towards which research is directed.' Again we are dealing with 'beliefs' rather than arguments as such. Beliefs are stated, but reasons for them are not given, let alone assessed. To make the point more emphatically, people have all kinds of beliefs about all kinds of things, but the question is which beliefs are better justified. Morality does not get settled by an opinion poll, as if we can tell the shape of the Earth by taking a poll. Precisely why human uniqueness should involve this 'moral imperative' is not at all clear, and no reasons are given for it.

6.26. The report concludes the paragraph with this: 'This moral imperative permits the use in research laboratories of animals, whose suffering must be weighed against the ultimate relief of suffering towards which research is

directed. This is encapsulated in the weighing of harms and benefits (the 'cost/benefit' assessment) in the 1986 Act.' But it does not follow – even if there is a 'moral imperative' to relieve suffering – that the deliberate infliction of pain, death, or suffering upon other sentients is justified to achieve this aim. Indeed, it is generally acknowledged that acts matter more than omissions and that 'it is worse to cause a harm than to fail to prevent one' (LaFollette, 2011, p. 814). Neither does it follow that we can meet this 'imperative' only by means of a cost-benefit assessment in which the suffering of individual sentients is weighed against whatever relief (if such there be) may come from such research. The necessary reasoning is not supplied that would enable us to consider such a position. This appears to be a conclusion without any serious attempt to analyse the ethical underpinnings of its support.

6.27. One way of grasping the arbitrariness of the judgement is to ask why human subjects should not also be included in the cost-benefit assessment. If, as we are told, there is a moral imperative to relieve suffering through research (and such research will be effective), why should humans not themselves also be subjected to experimentation, especially since the results from such experimentation would undoubtedly be greater? This is not a rhetorical question. We know that experimentation on human subjects, including prisoners of war, orphaned children, people of colour, and serving soldiers, took place during the twentieth century. Defended by arguments similar to the argument now adopted by SCHOL, all these experiments were seen as necessary to the acquisition of useful knowledge.

6.28. The reply may come that humans are unique and therefore should not be used in scientific research. But leaving aside the uniqueness of not just humans but all species, it simply does not follow that our special endowments (if such they be) justify the infliction of suffering on other sentients. Indeed, an argument could be properly run in the opposite direction – namely, that because humans are unique (especially in a moral sense), they should agree to sacrifice themselves to achieve useful knowledge, rather than inflict suffering on others who are morally blameless.

6.29. And here, of course, we reach another rub: the assumption throughout the SCHOL report is that it is a morally simple or straightforward matter to justify the infliction of suffering on animals as a means to some greater good (however hypothetical). But as we have already indicated, while humans can agree to sacrifice themselves for a putative greater good, it is impossible for animals to do so. Animals are incapable of giving or withholding consent. Recognition of this point makes the infliction of suffering on animals not easier but harder (if not impossible) to justify. As Tom Regan rightly comments, 'risks are not morally transferable to those who do not voluntarily choose to take them in the way this defense assumes' (Regan, 1983, p. 377). Animals do not sacrifice themselves; we sacrifice them.

6.30. SCHOL concludes its section on ethics in this way: 'The unanimous view of the Select Committee is that it is morally acceptable for human beings to use other animals, but that it is morally wrong to cause them "unnecessary" or "avoidable" suffering' (House of Lords, 2002). But this appeal to necessity begs questions and raises a number of problems.

6.31. The first issue is the problem of establishing necessity. Many pro–animal research documents speak freely of animal use being necessary, but they seldom offer any definition of the term. In ethical terms, showing that something is necessary requires more than a simple appeal to what is customary, desirable, or even beneficial. Human wants or pleasures do not by themselves constitute moral necessity. By definition, necessity is an urgent and unavoidable requirement; the need has to be dictated by some compulsion or coercion that makes any other act impossible. When the concept is defined in this way, we can see immediately that only the weakest possible meaning of the word can reasonably apply in the case of animal experimentation. Far from being in a situation of having no choice or having to make a direct choice, or being coerced beyond our will, when humans choose to experiment, it is a voluntary act of will.

6.32. To be fair, even those who support experiments understand this point. 'If there is a weakness in the case for animal experimentation within the terms laid down by the [1986 UK] Act, it lies in the difficulty of demonstrating necessity,' argues the APC review (2003) in a remarkably candid confession. The subsequent comments are no less so and are worth reproducing in full:

> The challenge, indeed the requirement of the Act, is to demonstrate in any given case that there is no alternative to animal experimentation of the kind proposed – that the desired and desirable objective cannot be achieved in any other way. If this were interpreted as the requirement to show that the desired result could not be achieved in any other way, then it would be very difficult indeed to demonstrate. In principle, and with enough changes assumed, any number of desirable results might be achieved. It is usually, and more plausibly however, interpreted as a requirement to show that the desired result is not likely to be achieved in any other way. But this means – 'is not likely, given present circumstances'. It is therefore open to opponents of experimentation to argue that present circumstances should be changed so as to make it more likely. (APC, 2003, p. 15; emphases in original)

6.33. The admissions here are telling. We are told that 'it would be very difficult indeed to demonstrate' any necessity for animal experiments. We are further told that the best case that can be managed is that the desired result 'is not likely to be achieved in any other way'. However one characterises these admissions, it should be clear that animal testing fails the test of necessity as understood ethically[6]. At the outset of its review, the APC argues that 'it is evident that procedures that inflict injury on animals for reasons other than their own good require robust defence' (APC, 2003, pp. 8–9). That being so, we have to conclude that the APC has simply failed to provide such a defence.

6.34. Another way of looking at this is to consider an actual experiment, which concerned diagnostic tests for tuberculosis. One hundred and sixty subjects were selected, and tuberculin was injected into their eyes, skin, and muscles. Reports of the experiments detail the moans from the subjects, who were unable to sleep because of the pain in their eyes. 'They kept their little hands pressed over their eyes, unable to sleep from the sensations they had to undergo' (Lederer, 1995, p. 80).

6.35. The subjects were not animals, however. They were human children. All were under the age of eight, and all but twenty-six were from St. Vincent's Catholic Orphanage in Philadelphia. The experiments were performed in 1908 as part of a series of clinical trials in Philadelphia, New York, and Baltimore to test the value of tuberculin as a possible cure for tuberculosis (Lederer, 1995, pp. 80–81).

6.36. The vast majority of people would regard such experiments on children as morally objectionable. In support of this view, they might point to various factors such as the innocence of the children, their defencelessness, their inability to consent, their inability to comprehend what was happening, and the obligation of the orphanage to protect orphaned children, not to mention the suffering the children had to undergo. But the question is, how can we logically oppose such tests on children without also opposing similar tests on other sentient animals? To be consistent in our moral reasoning, we must evaluate actions that harm all sentient creatures, not just human ones.

6.37. It is worth pointing out that however gruesome these tests might appear, they were performed with a high moral purpose. The aim of the experiments – to find a cure for tuberculosis (then an invariably fatal disease) – was surely laudable. And did they achieve useful results? Almost certainly the experiments yielded some scientific knowledge, even knowledge that could not have been (at the time) obtained elsewhere (indeed, more useful knowledge than from experimenting on animals of a different species). Despite that, most people would argue that it is wrong to use innocent children as means to an end, even if the results may prove beneficial. Even if there were gains, most would regard them as 'ill-gotten' (Regan, 1983, p. 393).

6.38. But consider this: the moral factors that might be deployed in defence of the children are almost identical to the moral factors that can be deployed in defence of animals also subjected to experiments. Animals too can suffer. Animals too cannot give or withhold consent. Animals too cannot represent themselves. Animals too are

[6]The point is made even more starkly in the covering letter from APC chair Professor Michael Banner to the Home Office minister commending the review. He writes, 'While we conclude that some uses of animals may yield scientific knowledge, we argue that this does not settle the question of justification' (APC, 2003, p. 1, our emphasis).

morally innocent or blameless. Animals too have difficulty comprehending what is happening to them or why. And animals are also vulnerable. Given this common set of factors, it is as difficult to justify experimentation on animals as it is on young children.

6.39. Put another way, there are differences between animals and orphans, but they are not *morally relevant* differences. Examples of morally irrelevant differences include skin colour, sexual orientation, and upbringing. No one could rationally justify differential moral treatment on the basis of such obviously morally irrelevant differences. So we must also add to the list another difference: species. That an individual is a member of another sentient species cannot by itself logically justify inferior moral treatment of that individual. The point is unassailable, and its logic is accepted even by those who support experimentation on animals. Philosopher R. G. Frey, for example, writes that 'we cannot, with the appeal to benefit, justify (painful) animal experiments without justifying (painful) human experiments'[7] (Frey, 1983, p. 115).

Your dog or your child

6.40. And yet the idea that experimentation involves us in a direct choice between human and animal welfare – the 'your dog or your child' argument – still dominates public debate and is found even in supposedly authoritative documents, including, for example, the Weatherall report. In order to provide a moral basis for defending such experiments, the report offers 'the hospital fire thought experiment' (Weatherall, 2006, p. 124). The scenario runs as follows:

> Suppose a major teaching hospital is on fire. As well as the full range of medical specialities treating patients of different ages (with differing life expectancies, quality of life and many other distinguishing features), the hospital also contains other life forms: visitors, health professionals, an animal house (including non-human primates), a maternity and assisted reproductive technology unit with stored embryos and gametes, and – inevitably – the hospital pet cat. For the very fastidious there are also live plants on many of the window ledges and live bacteria and viruses, both in vitro and in the bodies of patients and staff. How are we to prioritise rescue for all these different life forms with differing needs and capacities? And more precisely, how can we work out morally defensible priorities for rescue? (Weatherall, 2006, p. 124)

6.41. What can we learn from this 'thought experiment'? The Weatherall report thinks that all is plain sailing: 'The "hospital fire" thought experiment shows that *without knowing (or needing to know) the theoretical basis or ethical justification*, almost all humans intuitively make important distinctions about the moral importance of different living things' (Weatherall, 2006, p.124; our emphases). But this line obfuscates the issue. The issue is not how some or even most people would respond 'intuitively' to a given situation, but rather whether such responses are rationally supportable. Referring to what we may do 'without knowing (or needing to know) the theoretical basis or ethical justification' – arguing that we can know what is right without rational argument – is problematic. While moral intuitions have an important place in ethics as a starting point, they do not by themselves constitute a rational assessment or even an argument. As R. M. Hare indicates, there needs to be a second order of enquiry and scrutiny following such moral intuitions (Hare, 1981). After all, many 'intuited' that slavery was morally permissible at one time.

6.42. The Weatherall report maintains that two conclusions can be drawn from the 'intuitive' decision by the majority of people in the scenario. The first is this:

> 1. Humans generally, and almost universally, accord a lower priority to all animals than they accord to any humans (which means, inter alia, that they believe it right to save humans before animals). (Weatherall, 2006, pp. 124–125)

6.43. But this conclusion does not follow at all. All that follows from the hospital fire scenario (if the results are to be believed) is that humans will *in the given situation* respond in that way. The scenario is by definition a limited

[7]Frey also writes: 'The case for anti-vivisectionism, I think, is far stronger than most people allow' (Frey, 1983, p. 115).

crisis situation in which one has to make a direct choice. But to philosophise from that one situation, in which most people may choose to save fellow human beings, to a supposed duty to choose humans beings in a wide range of normative situations, where there is no direct choice to be made, is logically fallacious. Thus, the report fails to distinguish between normal and crisis situations. What may happen in a crisis situation, where there is absolutely no alternative but to choose between competing claims, does not settle the issue of what is normally correct. For example, most people would probably save a member of their own family before someone else's family member, but it does not follow that it is therefore justifiable to experiment on someone else's child to save one's own. Again, consider a scenario in which an animal hospital is on fire, and one has to choose between the animals one can save. A person who keeps Siamese cats may well seek to save her own cat and other Siamese cats, but the fact that the person has made that decision in that circumstance does not by itself imply that other cats are inferior or deserve inferior moral treatment[8].

6.44. The second moral conclusion, according to the Weatherall report, is as follows:

> 2. Humans think it is morally required to sacrifice the lives of animals to save human life (*consistency then requires that they should do so – other things being equal – in medical research, as well as in hospital fires*). Humans do not always make these distinctions based on species prejudice, i.e. in favour of members of our own species, but based on an analysis or theory about what justifies such distinctions, which is race, gender and species neutral. (Weatherall, 2006, p. 125; our emphasis)

6.45. Much is wrong with this paragraph as an example of moral reasoning. In the first place, the language is changed, and therefore so too is the nature of the putative argument. What was previously described as an 'intuition' has now hardened into a supposed moral requirement. While the report may see this requirement as a corollary of our intuitions about the 'fire' scenario, no moral reasoning has been adduced to make it so. Second, the use of the word 'sacrifice' – insofar as it implies (as it usually does) a voluntary act of the individual – is inappropriate. Animals do not sacrifice themselves; they are coerced, rather obviously against their will and their own best interests. Third, the parenthetical clause is deeply muddled: 'consistency then requires that they should do so – other things being equal – in medical research, as well as in hospital fires'. It does not follow that having done one thing in a crisis situation, we should do the same in another, entirely different circumstance. A variety of factors may come into play. And neither – and this is the central point – should it follow that what we do in a crisis situation should become what is known as 'normative'. The report again tries to obfuscate the issue by use of the words 'other things being equal', as if the cases of a hospital fire and medical research are identical. But they are not, precisely because things are not equal. In the case of the hospital fire, one's choices are both direct and necessarily limited. That is not the case in animal research, where one faces no such direct choice. Indeed, in all such cases, one is not weighing two direct claims, but weighing an actual harm against only a hypothetical good. There is no urgency, crisis, or direct choice involved. Moreover, in the fire situation, one is not deliberately causing harm to those one does not rescue.

6.46. This latter point is accepted even by those who endorse animal experiments. It is worth repeating the judgement of the APC report: 'in animal research we are rarely, if ever, presented with the stark situation in which we can save the life of a child by taking the life of an animal. Invariably other options and choices intervene. Hence, it is perfectly coherent to oppose animal experiments, by arguing that other options and choices are possible, but save the child if we are faced with a stark choice' (APC, 2003, p. 15).

6.47. The second line of the Weatherall report's second moral conclusion is as follows: 'Humans do not always make these distinctions based on species prejudice, i.e. in favour of members of our own species, but based on an analysis or theory about what justifies such distinctions, which is race, gender and species neutral' (Weatherall, 2006, p. 125). If such distinctions are not made simply on the basis of 'species prejudice' (despite the apparent reliance on a crisis situation in which simple 'intuitions' are appealed to) and rely on 'an analysis or theory about

[8]Not only is the conclusion flawed, but so actually is the scenario. We are reliably informed by firefighters that in such cases 'you just get whoever you can (including animals) as fast as one can'. The idea that one can rationally plan in the event of such an extreme crisis is fanciful, and indeed, thought experiments tend to be fanciful; that is why they are conducted in thought and not in reality.

what justifies such distinctions' (Weatherall, 2006, p. 125), all we can say is that we are not provided with that analysis or theory. The appeal here and throughout is to the uniqueness of humans, but without the necessary supporting argument to justify differential moral treatment of other sentient beings. Moreover, the assertion that such a theory is 'species neutral' is simply that: an assertion. Again, we are not provided with any evidence or argument that would enable us to make this conclusion. It is the special pleading, the reliance on selected crisis situations, and the lack of cogent argumentation that makes the Weatherall report unpersuasive as a moral defence of experiments on animals.

6.48. Before we move to the next section, it is worth pondering another perspective. In the reports we have been considering, much has been made of the 'uniqueness' of human beings. But it is worth asking, even if uniqueness is accepted, what this 'uniqueness' entails. Chief among the distinguishing human capacities is the capacity for moral agency, the ability to distinguish between right and wrong and be morally responsible for our actions. But if it is true that we uniquely have this capacity, the usual argument should be turned on its head. It is precisely *because* we have such a moral capacity that we could and arguably should behave in a morally sensitive way to other sentient beings: it is our very capacity to act altruistically, to be generous and unselfish, that is the most important of all human potentialities. From this, it follows that humans should extend moral solicitude not only to fellow humans but also to all other beings capable of pain and suffering. Our perception of our own well-being should not be the only criterion on which we base our relations with the animal world. We are the species uniquely capable of seeing that other sentient species have their own interests and can be harmed in similar ways.

6.49. We are struck by the narrow definition of human benefit and welfare indicated by the reports we have considered. The APC report details at length the system of cost-benefit analyses, which it would like to see engaged in a thorough licensing system. But none of the criteria includes the possibility that it may not be in humanity's own interest to inflict suffering on fellow sentients. Are humans really benefited from inflicting injury on animals? At least it is a question worth asking, and it is noticeable in the roster of proposed criteria that this question is not even on the agenda (APC, 2003, pp. 84–86). It has been shown that animal abuse can harm us through, for example, desensitisation, loss of empathy, habituation, and denial (Linzey, 2009a, pp. 6–8). The idea that there are no debit consequences for human beings should therefore be jettisoned.

7. The problem of institutionalisation

7.1. In the light of the foregoing discussion, the question might not unnaturally be asked: if the scientific and ethical case against animal experimentation is so strong, why does it continue as a legitimised social and moral practice?

7.2. This leads us to considering the phenomenon of institutionalisation. Institutionalisation may be defined as the process of entrenching or embodying approval of certain practices within organisations, social systems, and societies. By living in a society, we are automatically a member of various institutions, whether they be families, schools, colleges, trade unions, political parties, businesses, religious bodies, universities, or corporations. Such institutions can have positive benefits in terms of enabling social cohesion, providing emotional and psychological support, and not least of all, enabling employment and job security. They help regulate social and commercial life and can help individuals find fulfilment.

7.3. But there is a downside to institutions – principally the way in which they can become self-perpetuating and resistant to reform. Hence, once institutionalised, a practice is seen as the norm of the organisation, and only considerable upheaval or radical challenge will lead to fundamental change.

7.4. This focus on the institutionalisation of animal experiments reveals how values, norms, and institutions are so closely intertwined that speciesist attitudes are tolerated and developed because, ideologically, they are seen as a given in spite of their arbitrary nature. Speciesism, a term coined by Richard Ryder in 1974, may be defined

as the 'arbitrary favouring of one species' interests over the interests of others' (Linzey and Waldau, 1996, p. 788; our emphasis). Many activists and scholars have compared speciesism to racism and sexism (e.g., Nibert, 2002), but unlike racism and sexism, speciesism has been little recognised, let alone sufficiently criticised. Indeed, speciesism is institutionalised in social life.

7.5. There are five principal aspects of institutionalisation that should be noted.

Legislation

7.6. The criminal law consolidates institutionalised animal exploitation by tolerating the practices that take place in a range of institutions, such as research laboratories (Flynn, 2008). Many of the painful practices that are performed upon living animals in experiments would violate anti-cruelty laws, and such institutionalised practices account for the majority of the violence executed against animals (Beirne, 1999).

7.7. As we have seen, approximately 115.3 million animals annually are bred and used worldwide for the biomedical industry for experiments, and such experiments cover a range of painful and life-threatening procedures, including induction of tumours, strokes, brain damage, and spinal injuries, injection or force-feeding of toxic substances, and implantation of devices in the body, many of which are done with inadequate or even no pain relief. Animals are also frequently subjected to repeated stressful and even frightening behavioural tests, restriction of body movement and social interaction, and withdrawal of items essential for life such as food and water. Although most of us would define such actions as cruel, and these actions would defy existing laws if inflicted on companion animals, they are perfectly legal when conducted for the purposes of research. Along with intensive rearing regimes, these biomedical practices in conjunction with the law represent the most systematically organised abuse of animals (Benton, 1998). In this way, the criminal law can be seen as a major structural and historical mechanism consolidating institutionalised animal exploitation (Beirne, 1999).

Institutional or establishment thinking

7.8. Second, institutionalisation is also consolidated by institutional or establishment thinking. Institutionalised animal exploitation is an aspect of the established paradigm of research that sustains what the philosopher Jacques Derrida has called 'the worst kinds of violence, that is, the purely instrumental, industrial, chemico-genetic treatment of living beings' (Derrida, 2004b, p. 73; Peggs and Smart, forthcoming). This paradigm is grounded in the idea that the scientific community knows what the world is like (Kuhn, 2012) and usually accepts as a matter of course that animal subjects can be used for experimental purposes. Issues that we have previously mentioned tend to be overlooked – for example, the problems with using animals as 'models' for human beings, the harmful consequences for humans of using animal 'models', and the ethical issues associated with using animals as resources (Knight, 2012). Here the point can be understood in terms of contradictions: animals are used in scientific research because they are deemed 'similar' to human beings; ethical consideration, however, cannot be extended to them because they are 'different'. With regard to the use of animals as resources, the harmful consequences for animals should be paramount. As Paola Cavalieri points out, however, 'the view that vivisected animals did not suffer offered a good [ethical] escape route' for those who advocated the use of animals in research (Cavalieri, 2006, p. 59).

7.9. Those who sanction and carry out animal experiments view animals as tools and thus as means to an end (Midgley, 2004). Specifically, scientific developments in the field of genetics mean that we are seeing increasing numbers of GM animals from a growing range of species being used for increasingly diverse purposes in animal experiments. For example, in 2012 in the UK, the number of experiments using GM animals increased by 22 per cent from the figure for 2011 (Home Office, 2012b), and again in 2013, it increased by another 6 per cent (Home Office, 2013). There is an evident intellectual conformity to the established paradigm about animal experiments. Furthermore, there is a moral conformity to the established paradigm about the ethical issues associated with using animal subjects in experiments. This conformity is lucidly described by Dr Donald Barnes, a former principal investigator at the US Air Force School of Aerospace Medicine. Barnes was in charge of irradiation experiments with the Primate Equilibrium Platform at Brooks Air Force Base but was dismissed for raising the question of ethics. Barnes says:

> I represented a classic example of what I choose to call 'conditioned ethical blindness'. My entire life had consisted of being rewarded for using animals, treating them as sources of human improvement or amusement … During my sixteen years in the laboratory, the morality and ethics of using laboratory animals were never broached in either formal or informal meetings prior to my raising the issues during the waning days of my tenure as a vivisector. (cited in Singer, 2009, p. 71)

7.10. Animal experiments take place within the context of policies that are designed to regulate, or at least (theoretically) give guidance on how to reduce, the suffering of animals. These guidelines on animal suffering institutionalise what Robert Garner calls the 'moral orthodoxy' of utilitarianism, in which humans are viewed as being justified in choosing to sacrifice the interests of animals in the event of a conflict of interests with humans if, without the pain or death of animals, the suffering of humans would result (Garner, R., 2005). Many countries seek to regulate human-induced animal suffering by means of 'protection' legislation or Directives that are designed to reduce the suffering of some animals who are used for experimental purposes. The status of the measures vary along a spectrum of mandatory to voluntary. Animals included under the auspices of such measures vary among countries. As we have seen, the biomedical industry in the US successfully lobbied to prevent the majority of animals used in experimentation (mice, rats, fish, reptiles, and birds) from being included as animals under the Animal Welfare Act, the only national law covering the use of animals in experiments. On the other hand, in the EU, birds and fish are covered by 'protection' Directives. The measures seek to reduce pain, suffering, distress, or lasting harm to protected animals. In some parts of the world, such as the EU, such Directives are based on the principle of the 'Three Rs': replacement, reduction, and refinement. These are the guiding principles, first advanced by W. M. S. Russell and R. L. Burch in 1959, for attempts to reduce the use of animals in testing. However, 2013 was the fourth consecutive year in which the number of experiments in the UK was actually higher than when the Animals (Scientific Procedures) Act 1986 came into force. The principle of the Three Rs extends to the quality of life of those animals used in research since it lays down minimum standards for housing and care (European Parliament, 2010). Despite these measures, the institutionalisation of experiments using animal subjects remains intact because the focus is on improving the perceived welfare of animals rather than on whether animal experiments should take place at all.

7.11. Experiments that use animal subjects are deemed to be beneficial to the health and well-being of humans and to animals as well. This is in the context of the medicalisation of human conditions, where the improvement of human life through diagnosis, prevention, and treatment is a central objective. In biomedical research, partiality to human interests is obligatory (Welchman, 2003) and is institutionalised in the form of legislation that requires all new biomedical products be tested on animals, where there is no immediate alternative, before they can be trialled on humans. This is an expensive business for researchers and thus involves considerable investment.

Public and private funding

7.12. Third, animal experiments are institutionalised through public and private funding. The pharmaceutical industry is a heavy investor in such research. For example, in 2010, the pharmaceutical industry in the EU invested twenty-seven billion euros in research and development (Association of the British Pharmaceutical Industry, 2011, p. 5). Experimenting with animal subjects is big business. The supply of animal subjects for such procedures also makes a great deal of money for private firms. The total annualised sales of Charles River Laboratories (a supplier of animals and equipment for experiments) were reported to exceed US$1.2 billion in 2007 (*Online Investor*, 2008). There is a great deal of money to be made by the pharmaceutical industry. For example, in 2009 in the UK alone, the pharmaceutical industry generated £7 billion in trade surplus (Association of the British Pharmaceutical Industry, 2011, p. 5). Enormous profits are made from existing drugs, and the medicalisation of an increasing range of human conditions means that pharmaceutical companies can and do charge high prices for an increasing range of drugs (Goldacre, 2012). Large pharmaceutical companies in the US spend a lot of time and money seeking to influence federal government policy. According to the Center for Responsive Politics, pharmaceutical companies in the US spent over $49 million on lobbying in 2013 alone (Center for Responsive Politics, 2014).

7.13. Thus, one primary obstacle facing researchers who might otherwise be disinclined to use animals in research is the fact that funding and regulatory bodies expect to see certain traditionally used methodologies, rather than 'new' or emerging methodologies, or methodologies that funders have not yet seen operationalised. To receive funding, researchers might believe that they must experiment on animal 'models', for if they do not, then they risk not being funded, which can have professional and personal consequences. As such, a legitimising authority must signify acceptance of and approval for non-animal methods, so that researchers can reasonably expect to have their projects funded when their proposed methodology does not involve animals. Regulatory bodies perpetuate the cycle of animal experimentation by mandating that animals be used to test all new drug product candidates and by their tendency to hold a higher bar for accepting non-animal methods than animal experiments.

The partiality of the media

7.14. Fourth, there is the partiality of the media in reporting and covering issues relating to animals. Animal issues are often ignored, trivialised, or misrepresented. Despite the fact that there is increasing public concern about the use of animals in experiments (e.g., European Commission, 2010; Wilke and Saad, 2013), most media reporting and commentary favours the established view that using animals for human purposes is justifiable. Public understanding about animal experimentation is usually gained through media reports about breakthroughs in diagnosis and treatments of a range of feared human diseases. The reports are largely positive or uncritical (Molloy, 2011). A recent study has demonstrated that media reports tend to be overhyped and that this positive spin often originates from the researchers and their institutions (Sumner et al., 2014). In contrast, media reporting about animal advocates is often negative and critical. Steve Baker observes what he calls a 'growing hysteria' in the media about the dangers of 'animal rights activism' (Baker, 1993, p. 196). Although the more recent ecological agenda has resulted in elements of the news media wishing to portray a concern for the environment (associated with a compassion for animals and worries about abuse and, most usually, species extinction), still the news media seek to convey the message that concern for animals is an extreme position to take (Baker, 1993, p. 206). Thus, the established nature of animal experimentation remains largely unquestioned.

7.15. Allied to this is the problem of secrecy. Much of the work that is undertaken in such research is done in secret. This lack of transparency has been of public concern. The Home Office in the UK has announced a consultation on transparency designed to keep the public informed about animal experimentation (Home Office, 2014b). But the critical point remains that without adequate knowledge, the extent and nature of the use of animals in laboratories remain largely hidden (see Creamer, 2013, pp. 186–187).

The distorting power of language

7.16. Fifth, it is worth noting the power of language and the way in which it informs and consolidates our view of the use of animals in research. To put it most simply, language use constructs our understanding of the world, giving particular meanings and creating representations of reality (Jorgensen and Phillips, 2002). These depictions of reality may be described as discourses, and embedded in them are ideological understandings of the world. Fairclough describes discourse as a 'practice of not just representing the world, but of signifying the world, constituting and constructing the world in meaning' (Fairclough, 1992, p. 64), while Gee explains the importance of ideologies where 'theories ground beliefs and beliefs lead to actions …' (Gee, 1996, p. 21).

7.17. The Truth and Reconciliation Commission of South Africa indicated the power of ideologies to subvert and nullify the moral compass of individuals: 'Ideologies in these sorts of combinations provide the means and grounds for people to act violently and yet, ironically, believe they are acting in terms of worthy, noble and morally righteous principles' (Truth and Reconciliation Commission, 1998, p. 297).

7.18. However, discourses about the world, and the ideologies of these discourses, may not be apparent to their users. Dominant discourses can simply over time become 'truth' – obvious, uncontested common sense (Fairclough, 2001). As Bourdieu notes, this produces the 'recognition of legitimacy through the misrecognition of arbitrariness' (cited in Fairclough, 2001, p. 76).

7.19. All of this is to say that language plays a critical role in framing the practice of, and the debate around, animal experimentation. Not only does science, and in particular, experimentation, have its own form of language

use, but on a societal level, the discourses construct various understandings of animal research as a practice and of its concomitant justifications. Noam Chomsky has pioneered critical awareness of how 'thought control' operates within institutions, preventing us from being as critical of our own institutions as we are of others (Chomsky, 1992, pp. 11ff.; Chomsky, 2003).

7.20. The language used in animal experimentation obscures, justifies, exonerates, and minimises what actually takes place in laboratories. Living sentient beings are linguistically transformed into 'research animals', 'systems', and 'models', such as 'surgically altered models, cardiovascular disease models and preconditioned models' (Charles River Laboratories, 2014a). One company offers a 'Retinal Degeneration and Neuroprotection Model', explaining, 'We now offer a blue light exposure model that induces retinal damage and cell death …' (Charles River Laboratories, 2014b). In other words, the company offers a way of blinding captive sentient nonhumans. In another example, 'naives' is a term used by the experimenters for marmosets who will have their brains damaged at some point in the future (Bagot, 2014).

7.21. Although animals may be subjected to what humans would describe as excruciatingly painful and distressing procedures, they are rarely said to be 'hurt' or to 'suffer' (Dunayer, 2001). They are 'stressed' by such things as being given electric shocks, being put into cold water, being injected with chemicals, being placed in an oven, having day and night cycles disrupted, or being used in the 'forced swim test,' otherwise known as the 'behavioural despair test' (Dunayer, 2001). Death is obscured by descriptions such as 'culled', 'discarded', 'terminated', 'sacrificed', and 'housecleaning taking place' (Dunayer, 2001). They even use the word 'humane' to describe the treatment of the animals in their care, a practice that has been criticised as a totally inappropriate use of the word as defined (McMillan, 2012).

7.22. The words used to describe many animals in general discourse carry the underlying implication that the inherent purpose of these sentient beings' lives is serving humans (Mitchell, 2012). These 'purposes' are deeply anthropocentric, and this is seen vividly in experimentation discourse, where individuals are given such labels as 'laboratory animals', 'lab rats', 'lab monkeys', and so on, with the very term 'guinea pig' being synonymous with being used for experiments. The implication is that experiments on 'laboratory animals' simply involve using animals for their inherent purpose.

7.23. Psychological distance from events is another significant factor. Traditional scientific language is written as agentless, so nobody commits any violent act in lab testing. Electrodes are inserted, formalin is injected, arteries are tied off, holes are drilled in skulls, and mice are enucleated, all in the passive voice, with no human performing the actions. Animals are not blinded by anyone, but an ocular end point is reached. In addition, not all observations are recorded in reports of experiments, but only a selection of those deemed of interest to the experimenter and readers. This results in an edited and sanitised version of what has taken place. The struggling, cries, bleeding, repetitive behaviour, moans, agitation, anxiety, pain, fear, depression, and vomiting from animals may be deemed of no relevance to the researcher and thus be linguistically expunged from reality.

7.24. Even in cases where such events are described, they are likely to be minimised and obscured by use of linguistic strategies. Dunayer notes that if an animal cries in pain, the animal may be described as exhibiting 'vocalisation responses'; infants who are separated from their mothers may show 'cognitive and affective responses to separation' (Dunayer, 2001, p. 108). It is even at times implied that animals are willing partners in experiments, as in 'twelve sheep *donated* 45 per cent of their blood; six others *donated* at least 80 per cent'; 'crab-eating Macaques *took part* in experiments where they were deprived of water and had parts of their brains removed' (Dunayer, 2001, pp. 118, 119; emphases added).

7.25. Halliday and Matthiessen make these observations about science from a linguistic perspective:

> The language of science, though forward-looking in its origins, has become increasingly anti-democratic: its arcane grammatical metaphor sets apart those who understand it and shields them from those who do not. It is elitist also in another sense, in that its grammar constantly proclaims the uniqueness of the human species. (Halliday and Matthiessen, 2004, p. 225)

7.26. Work on moral disengagement (Bandura, 1999, 2002) recognises that people can act in ways which are totally against their own moral and ethical beliefs, if certain facilitating conditions are present. Some of these conditions are clearly present in the language of animal testing.

7.27. In popular as well as specialist texts, individuals or groups opposed to animal tests are often positioned as being opposed to 'progress', and this inhibition of progress, it is claimed, will inevitably result in the loss of many human lives. A discourse closely interwoven with this one is the claim that the only way to have reached this point in human knowledge is to have experimented on animals. These discourses construct a continuous opposition of identities between 'scientists' and 'anti-vivisectionists', with the implicit understanding that those who oppose animal tests cannot be scientists and do not understand the work and its importance. The researchers are portrayed as a knowledgeable elite with specialist understanding of what is needed in order to do the best for society. The discourses assert that it is simply a lack of understanding which leads people to oppose animal experimentation and that if they really understood what happens and why it happens, people would not oppose the practice.

7.28. These erroneous identity constructions may go even further, where those opposed to animal experimentation are portrayed, at least by association, as 'violent extremists' or 'terrorists', while those who practice and fund animal use are never portrayed as supporting or causing harm of any kind. For example, in a *Nature* editorial regarding 'animal activism' and its effects, titled 'Animal Rights and Wrongs' (*Nature*, 2011), there is much discussion of violence with phrases such as 'physical attacks', 'campaigns of harassment', 'fire bombings', 'violent activist behaviour', 'vandalism', 'lingering fear', 'corrosive animal rights extremism', 'tide of violent activity', 'bully and blackmail', 'terrorize researchers', and so on – fourteen such phrases in an editorial of only 765 words – but no mention of any harm carried out by researchers. While admitting that any violence against researchers worldwide is extremely rare and that the editorial applies only to 'extremists', the article subtly implicates those who oppose experimentation while at the same time exonerating those who practice it.

7.29. The aforementioned factors indicate how problematic it is to conduct a rational public discussion of the moral issue and why researchers are inevitably resistant to change. When established medical authorities say in unison that animal experiments are essential to human health, it is often highly problematic for researchers in institutes to raise questions that they know will cause discomfort at best and censure at worst. There is no conspiracy of silence as such. Rather, the situation is more prosaic: establishment figures do not welcome the opening of questions that they have decided are already settled.

7.30. That institutionalisation results in intellectual and moral stagnation is implicitly recognised by the APC report itself:

> Researchers and regulators, as well as others involved with the implementation of the [1986] Act, should not rest with the *status quo*, but should subject their cost-benefit judgements to an on-going and detailed critical evaluation. *This will involve engaging in creative and imaginative thinking*, so as to identify strategies and targets that can avoid or reduce animal suffering, maximise the benefits of studies in which animals are used, and so help to diminish the moral conflicts that are inherent – and, most people believe, regrettable – in the use of animals in research. (APC, 2003, p. 79; our emphases)

7.31. The point is also echoed in the *BMJ*:

> The culture within research is shifting, and animal research is no longer as immune from challenge or criticism as it once was. Nonetheless, although science is more self-critical, in practice it can be difficult to achieve change because stakeholders (governments, funders, universities, allied research industries, and researchers) may all have interests, not infrequently financial, in continuing to do things as they have always been done. (Pound et al., 2014)

7.32. But the question that must be asked is this: given the massive investment – moral, intellectual, and financial – in the practice of animal experimentation, and thus its widespread institutionalisation within research institutes, how likely, even feasible, is it that 'creative and imaginative thinking' will take place? Moreover, we should question the applicability of a 'cost-benefit' (i.e., basically consequentialist) methodology to animal experimentation. The very idea conceives of animals as commodities, as resources that exist for human use, and not as ends in themselves.

7.33. It is difficult to avoid the conclusion that animal experimentation represents the institutionalisation of a pre-ethical view of animals. In some ways, we should not be surprised at that. Animal experiments emerged at a time when the dominant ethical paradigm was itself unenlightened, representing a largely or wholly instrumentalist view of animals. Scientific practice has yet to respond fully to the emerging ethical sensitivity to animals, which has been pioneered and has gained a measure of social acceptance especially during the last fifty years.

7.34. But the recognition of the problem of institutionalisation also represents a moral opportunity. If animal experimentation represents the institutionalisation of a pre-ethical view of animals, then we have to ask whether it is possible to institutionalise research carried out in accordance with a fully ethical perspective. G. R. Dunstan writes of how the moralist, 'having seen his vision, or arrived at his position by moral reasoning, must weave his insight into the fabric of society by creating an institution in which to embody it' (Dunstan, 1974, p. 4). Institutionalisation has received comparatively little attention in ethical theory, and it is now urgent that this question be raised in relation to our treatment of animals.

7.35. What, then, would the institutionalisation of an ethical perspective on animal experimentation look like? Animal organisations have already made the first steps by founding and funding institutes dedicated to humane research. The value of these first steps should not be minimised. These organisations enable scientists to apply for grants to pursue non-animal research and also provide an opportunity for people to donate to research projects that do not harm animals. These admirable endeavours need to be supplemented by others equally pioneering and adventurous. Authoritative scientific journals dedicated to humane research need to be established, journals that refuse, as a matter of principle, to publish research that has involved the use of animals. In addition, there is a need for new academic posts, indeed new university departments, given over to the instruction of researchers in non-animal methods and the dissemination of alternatives. We need to show universities and institutes of higher education worldwide that non-animal research can also attract major funding and research grants to rival those made by pharmaceuticals and existing pro–animal research bodies.

7.36. Moreover, instead of trying to uncritically defend existing animal research, universities especially should adopt a new ethical outlook that opposes such research in principle or, at the very least, facilitates full ethical discussion about the research taking place in their institutions and enables conscientious objections by staff and students in departments where animal research is undertaken. Doubtless, these changes will happen gradually, but with sufficient resources from animal organisations, the public, and governments (who often pay lip service to the need for alternatives), they can happen.

8. The failure of control

8.1. Despite the foregoing issues, there remain many people who believe that the best, perhaps the only, way of securing the protection of animals in laboratories is through more legal controls and better regulations. While not denying that some legal restrictions – for example, the move against cosmetic testing on animals and testing for household products – are to be welcomed (Thew, 2013a, 2013b), we have to question whether many of the even well-meaning controls are effective in terms of preventing suffering. We provide five examples: inspection, licensing, supervised self-regulation, the Three Rs, and care and ethics committees. To avoid the charge of selecting the worst examples, we mainly focus on the UK, which, as we have noted, purportedly provides the most protection for animals.

Inspection

8.2. The first issue of questionable effectiveness concerns the inspection of experiments and compliance with regulations in the UK. To monitor compliance with the provisions of the Animals (Scientific Procedures) Act, (hereafter 'ASPA'), the inspectorate of the Animals in Science Regulation Unit (hereafter 'ASRU', formerly the Animals Scientific Procedures Inspectorate) is required to visit establishments to ensure compliance with the terms of the licence issued. In the event of any breach of licence conditions, the inspectorate should report to and advise the Secretary of State on the action to be taken. Since 2006, there has been a steady but noticeable decline in the number of inspections carried out and, conversely, a steady but noticeable increase in the number of infractions noted (ASRU, 2011, pp. 29–32; ASRU, 2012, pp. 35–38). This statistical anomaly aside, it might appear – when we consider the figures in isolation – that the system of inspection works fairly well: year on year, the inspectors unearth (or are informed of) around thirty violations of licence conditions, and in all cases, some form of action is taken against the licence holders (ASRU, 2011, p. 29; ASRU, 2012, p. 35)[9]. A more critical analysis of the inspectorate's own reports, on the other hand, reveals that the ASRU must institutionalise a working definition of welfare that is at odds with normal practice.

8.3. When dealing with violations, the inspectorate classifies infractions as falling between Category A (least serious) and Category D (most serious). According to the most recent available data, in 2011 and 2012, there were twenty-eight Category A infringements (fifteen in 2011 and thirteen in 2012), twenty-one Category B infringements (eleven in 2011 and ten in 2012), nine Category C infringements (six in 2011 and three in 2012) and one Category D infringement (in 2011). Insofar as Category A infringements are concerned, it is clear that these are deemed so minor as to be almost trivial: these cases, according to ASRU guidelines, are those which are characterised, inter alia, as having 'no animal welfare implications' and are typically dealt with as requiring 'no further action' beyond noting and recording the infraction (ASRU, 2011, p. 27; ASRU, 2012, p. 33). When the (albeit scant) reports of what happened in these cases of Category A infringements are compared against the Home Office's categorisation, a particularly telling picture emerges of exactly what the Home Office inspectorate's view of 'no animal welfare implications' actually means. For instance, the 'unexpected' exceeding of a severity band assessment – from moderate to substantial – did not, according to the inspectors, result in any animal welfare implications (ASRU, 2011, p. 11; ASRU, 2012, pp. 13–14) despite the fact that a moderate level of suffering was at the time deemed to include those 'protocols that have the potential to cause greater suffering but include controls which minimise severity', and a substantial level of suffering was 'a major departure from the animal's usual state of health or well-being' according to the Home Office's own classifications (Home Office, 2000, para 5.42)[10]. Nor, according to the ASRU, were there *any* animal welfare implications resulting from 'animals being left in a scanner overnight' (ASRU, 2011, p. 11) (presumably without any of the most basic and mandatory requirements of welfare, such as food, water, and bedding).

[9] Over half of all breaches of licensing conditions are incidents of 'self-reporting' by the licence holders themselves. In these circumstances, the inspectorate's role becomes one of advising the Home Secretary of appropriate action to be taken.
[10] This guidance has been superseded under the new ASPA. There is no equivalent definition.

8.4. When Category B infringements are considered along the same lines – that is, the categorisation of compromised animal well-being compared to what actually happened – a similar picture emerges. Category B violations are those which are 'not sufficiently serious for referral for prosecution, revocation of licences or withdrawal of a certificate to be considered' and are characterised as having 'animal welfare implications that do not necessarily involve avoidable or unnecessary pain, suffering, distress or lasting harm' (ASRU, 2011, p. 28; ASRU, 2012, p. 33). When there are, in the opinion of the inspectorate, 'serious animal welfare implications involving avoidable pain, suffering, distress or lasting harm', these should be classified as Category C or D. Hence, it is clear that the inspectorate did not consider that the deaths of 474 fish, over a period of twenty-four to forty-eight hours, as a result of being kept in 'water inappropriate to their needs', necessarily resulted in any 'avoidable or unnecessary pain, suffering, distress or lasting harm'. Likewise, it was not necessarily the case that lasting harm or unnecessary suffering was felt by the two rats 'inadvertently left in an unattended procedure room without access to water from Friday to Sunday' or by the eleven mice who died when the severity limit imposed by the licence was unexpectedly exceeded or by the three rats who died after being left in a 'warming box to prepare them for a procedure' but were promptly forgotten about (ASRU, 2011, pp. 11–13).

8.5. Similarly, according to Home Office classifications, no lasting harm was done to the mouse abandoned to die unattended over the course of a weekend following an ectopic heart transplant, and no avoidable suffering was felt by the five rats who, because of an 'oversight' by the project licence holder, were not given any pain relief for two weeks following spinal surgery (ASRU, 2012, pp. 14–15). In all of the afore-cited examples, the inspectorate was content that only a Category B infringement ('not necessarily involving avoidable pain, suffering, distress or lasting harm') had taken place.

8.6. The point to be made here is that in the context of scientific procedures, the regulators have their own definition of welfare, and this definition appears to rule out individual instances of suffering as relevant factors. How else would it be possible to state, as the Home Office inspectorate did, that the preceding accounts involve 'animal welfare implications that do not necessarily involve avoidable or unnecessary pain, suffering, distress or lasting harm', unless one were to ascribe a meaning to 'avoidable or unnecessary pain, suffering, distress or lasting harm' that does not include individual animal suffering?

8.7. This interpretation of 'welfare' might be understandable if there was no statutory guidance determining the manner in which animals should be cared for and housed before, during, and after a procedure. But of course, there is statutory guidance in the form of the ASPA. While ASPA underwent significant changes in January 2013 to incorporate the EU's Directive 2010/63, the incidents referred to previously should be considered under the version of the act in force at the time of these incidents.

8.8. For any project (i.e., series of individual procedures and protocols) to be authorised, a licence must be issued by the Secretary of State. In her determination of whether the project is justified, the Secretary of State must first engage in the cost-benefit analysis referred to earlier in this report. Second, she is to ensure that all establishments using animals for scientific purposes ensure that minimum levels of welfare and pre- and post-procedure care are adhered to, so as to avoid what Russell and Burch called the 'contingent inhumanity' of imperfect husbandry by which suffering is inflicted upon an animal 'as an incidental and inadvertent by-product … of the procedure, which is not necessary for its success' (Russell and Burch, 1959, p. 54).

8.9. Consequently, numerous provisions are found in ASPA regulating all aspects of the experimental 'process'. For instance, subject to the exercise of the Home Secretary's discretion (Home Office, 1986, s.6[2]), all experimentation must take place in a designated 'scientific procedure establishment' (Home Office, 1986, s.6[1]). Under the terms of any licence granted, all establishments should have 'a person to be responsible for the day-

to-day care of the protected animals' who should be specified (Home Office, 1986, s.6[5][a]), and a veterinary surgeon or 'other suitably qualified person' should be on hand (but not necessarily full-time) (Home Office, 1986, s.6[5][b]). Furthermore, a number of additional safeguards were added to the original text of the act through amendments to the Regulations of 1998. In particular, section 10 requires that persons charged with the day-to-day care of animals be suitably trained and sufficient in number (Home Office, 1986, s.10[5A], s.10[6B]), that the accommodation be fit for the purpose of satisfying the captive animals' basic health and well-being requirements, and that arrangements be in place to prevent, detect, and expeditiously eliminate avoidable pain or distress (Home Office, 1986, s.10[6B][a–e]; these provisions correlate almost exactly with those listed in article 5 of the then parent Directive, Directive 86/609/EEC, the 1986 Directive). So that the Home Secretary is informed of whether the conditions in any establishment are 'appropriate', section 10(6C) requires that regard be paid, during any licensing application, to the provisions of Annex II of the 1986 Directive (European Commission, 1986).

8.10. Although it is clear that the Home Secretary must give 'appropriate' consideration[11] to Annex II, it is not entirely clear in all cases how much weight the Home Secretary should afford to an individual establishment's ability to comply with Annex II. The Annex itself, however, clarifies: the object of the Annex is to 'help authorities, institutions and individuals in their pursuit of the aims of the Directive …' (European Commission, 1986, Annex II, introduction, para 4) but to go no further than simply acting as 'recommendations to be used with discretion, designed as guidance to the practices and standards which all concerned should conscientiously strive to achieve …' (European Commission, 1986, Annex II, introduction, para 6). While regard is paid to Annex II during the licence application stage, *The Home Office Code of Practice for the Housing and Care of Animals Used in Scientific Procedures* (Home Office, 1989), which largely replicates the principles contained within Annex II, governs the ongoing aspects of animal welfare[12]. Under section 21 of ASPA, these codes of practice are given a degree of legal force by virtue of s.21(4), which states that a breach of the code by any licensee 'shall not of itself render that person liable to criminal or civil proceedings but – (a) any such code shall be admissible in evidence in any such proceedings, and (b) if any of its provisions appears to the court conducting the proceedings to be relevant to any question arising in the proceedings it shall be taken into account in determining that question'.

8.11. As the analysis of ASRU practice has revealed, however, the 'nuts and bolts' safeguards are not, in themselves, sufficient to guarantee that individual animals do not succumb to those 'incidental and inadvertent' harms that Russell and Burch warned against back in 1959. This may be precisely the point, however. Those persons charged with the implementation and enforcement of the 1986 act (in its pre-2012 incarnation) clearly did not view harms against the individual animals referred to previously as serious enough to warrant any significant censure, and for this there are two possible reasons.

8.12. First, the individual inspectors themselves might be insensible to the issue of animal suffering. Second, and most likely, the parameters of suffering at an institutional level rule out, on the basis of some quasi-utilitarian aggregation, instances of individual suffering as constituting a violation of the rules. It is, as most ethicists are aware, fairly easy to override or undervalue the suffering of individuals when looking at the aggregation of harms. However, even taking this into consideration, we still find no justification for how the deaths of 474 fish over a period of twenty-four to forty-eight hours did not constitute avoidable harm. The question then becomes, of course, if the deaths of 474 fish over a period of twenty-four to forty-eight hours did not constitute avoidable harm, then how many fish must die in water inappropriate to their needs for the utility calculus to be offended? And if two mice left in a procedure room without access to water for three days were deemed an insufficient number to warrant a finding of unnecessary harm, how many dehydrated and starved mice does it take to tip the scales? And if the regulators thought that no actionable harm was caused to the five rats left without pain relief for two weeks following spinal surgery, would they be compelled into action by a similar fate befalling ten rats or one hundred or ten thousand? If, as we have argued, animals have moral weight beyond their utility, then their

[11] 'The conditions of a certificate issued under section 6 or 7 [those pertaining to breeding and supply establishments] shall include such conditions relating to the general care and accommodation of protected animals … as the Secretary of State considers appropriate' (Home Office, 1986, s.10[6B]).

[12] Substantial changes have been made to ASPA, effective from January 2013, to bring it in line with Directive 2010/63, which replaces Directive 86/609. It is yet unclear what benefit, if any, the new regulations will provide. But we discuss the previous Directive in order to highlight the deficiencies.

individual suffering must be taken into account when inspections occur. Clearly, the inspection process, as the first step in the enforcement of regulations in the UK, is flawed.

Licensing

8.13. We now turn to the issue of licensing. As we have seen, all experiments performed in the UK require a licence. Unfortunately, however, the level of institutional ambivalence to individual animals, as shown in the preceding discussion, is not confined only to the inspectorate. In one of the few cases brought before the courts to determine whether the actions of a laboratory constituted a breach of the licence conditions imposed by ASPA and, consequently, required remedial or punitive action to be taken by the Home Secretary, the court demonstrated that, for the judiciary, harms done to individual animals do not matter.

8.14. In *Secretary of State for the Home Department v BUAV* (2008), the plaintiff animal protection organisation made numerous complaints to the Home Secretary about, inter alia, breaches of the conditions of three project licences granted to the Cambridge University Department of Experimental Psychology. This particular laboratory was conducting experiments, as per the conditions of its licence, on marmosets for the purpose of furthering 'research into the functioning of the human brain and illnesses affecting it' (such as Parkinson's Disease, Huntington's disease, and strokes). To this end, the marmosets were subjected to numerous invasive surgical procedures designed to induce strokes or to damage the brain (*Secretary of State*, 2008, para 20). The claimants alleged – on the basis of an undercover investigation – that the laboratory had committed numerous breaches of the conditions of its licence. The claimants reported their findings to the Home Office, and an investigation was carried out by the Scientific Procedures Inspectorate. Upon receipt of the inspectorate's report, the Home Secretary decided that no action should be taken against the licence holders. The BUAV sought a judicial review of Home Office decisions.

8.15. The substance of the BUAV's complaints was twofold. First, there had been a miscalculation of the severity limits during the licence application and grant stage: none of the licensed protocols in any project would, said the university in its applications, exceed a 'moderate' severity limit. The evidence brought by the BUAV, the organisation claimed, showed that on any sensible view, certain procedures exceeded this limit and caused such foreseen adverse consequences that the only means by which this suffering could be alleviated was by killing the animals involved. Hence, said the BUAV, a severity limit of 'substantial' should have been assigned to these protocols. While the issue is an important one because severity is a key element in the cost-benefit test and, as was recognised by the Court of Appeal, is one that raises fundamental questions about the extent to which and when 'death as an endpoint' (i.e., killing) can curtail suffering, it is to the second aspect of the *BUAV* case – dismissed rather disparagingly by the court as raising 'no important point of law … nor any factual matter of enduring relevance' (*Secretary of State*, 2008, para 75) – to which we now turn.

8.16. According to the BUAV's complaint, there had been numerous breaches of the conditions imposed by the licence related to housing and aftercare provisions found under section 10(6B) of ASPA (Home Office, 1986). Specifically, said the BUAV, the facility could not evidence adequate overnight care for post-operative animals, and this absence of care caused unnecessary harm to, and the eventual deaths of, a number of marmosets (*Secretary of State*, 2008, para 77). While the Court did agree with the BUAV's submission that in order to demonstrate compliance with section 10(6B), proper records *should* have been kept, the salient aspect of this particular case was whether the inspector was entitled to reach the conclusion that the aftercare arrangements were adequate on the basis of the interviews conducted with staff (when they knew they were being investigated) and his own observations during the post-investigation inspection. On this matter the court found that the inspector was entitled to reach such a conclusion because neither ASPA nor its guidance prescribed any particular method of record-keeping; hence, the alleged system of 'positive reporting' – whereby notes are made on the record of care only when there is 'something of substance to say' (*Secretary of State*, 2008, para 76) – employed at the facility at night (but not during the day) was not inappropriate. Crucially for present purposes, however, Lord Justice May (hereafter 'May LJ') went on to say that even if the record-keeping at the facility was not a model of best practice, the inspector's general conclusion that the laboratory was well-run was 'not vitiated by reference to a relatively small number of individual animals' (*Secretary of State*, 2008, para 80). There are a number of issues stemming from May LJ's assertion in support of the inspector's conclusion that the Cambridge facility was generally well-run, despite the number of failings of individual care.

8.17. First, May LJ was clearly not concerned with individual animals because, for him, the cost-benefit analysis was an aggregative and cumulative process, and because 'animal harm' under this aggregative assessment becomes actionable and illegitimate harm only when a certain (presumably numerical) threshold is surpassed, then the 'small number of individual animals' referred to in the BUAV case was an insufficient number to warrant action. (In fact, the number of marmosets adversely affected by the absence of overnight staff cover was not small, and the legal test for care arrangements, in any event, is one of reasonable foreseeability of harm, not whether the harm actually occurred.)

8.18. Second, while it was not explicitly expressed as such in the BUAV case, it would not be unreasonable to infer from the facts that the benefit obtained by the Cambridge facility from operating a sub-optimum system of after-hours care was the avoidance of the costs and inconvenience of employing additional night-time staff. While this might not offend ASPA, on the basis that ASPA simply requires that 'sufficient staff' be employed (Home Office, 1986), the use of the word 'sufficient' in ASPA is simply an example of a qualitatively valueless definition that might permit any factors, such as economic expediency and convenience, to be taken into consideration. In this sense, ASPA – or an interpretation that allows expediency and convenience to become relevant considerations – is very much at odds with the principles underpinning the constraints imposed upon scientific procedures that use animals: as this present study has previously shown, the decision to utilise animals in scientific experimentation can be justified only when it is *necessary* to do so. Consequently, it would be a perverse situation if causing harm to animals during the experiments themselves could be justified only in the absence of an alternative, but causing harm during the pre- and post- procedure phases could be legitimised when it was financially convenient to do so.

8.19. Finally, one can reasonably assume that May LJ held the belief that if failings in care standards had occurred (and he would not be drawn into making any robust and unequivocal pronouncements on this matter), then this could be excused on the basis that 'mistakes happen'. The objection to this latter justification is that failings in care standards in institutions and establishments that are obliged, by law, to put in place procedures, systems, and safeguards to prevent these precise failings are not mistakes or unfortunate lapses: instead they are breaches of the precise duty imposed on the laboratory. As the preceding sections have demonstrated, although the precise housing and care provisions of ASPA are found in the non-binding *Code of Practice*, the bottom-line requirements – that those entities undertaking harmful scientific practices upon living animals take such measures as are required to prevent harms to the animals that are not deemed immediately relevant to and contingent upon the experiments themselves – are a precondition of the granting of any licence. To brush aside, as May LJ did, the evident failings of the Cambridge facility on the spurious grounds that ASPA does not explicitly specify that a certain process of record-keeping be established, or that a minimum number of supervised and trained staff be on duty at night, is to make a mockery of the principles that underpin the act. Ultimately, it is unsustainable to argue that, to comply with the law, research establishments do not have to provide staff out-of-hours when it is both foreseeable and foreseen (by licences) that an animal may require attention at that time to minimise suffering (including by euthanasia). It is inconceivable that human patients would not have access to such care, bearing in mind that patients are usually able to call for assistance.

8.20. A further simple but vital point about licensing systems needs to be made. Although licensing may give the appearance of control, almost the reverse is the case. Licensing by its very nature authorises, empowers, and legitimates licensees. Perhaps the best example of this is the attempt by the UK government to introduce a licensing system for hunting with dogs. In the context of trying to secure some middle way between self-regulation and abolition that might appease anti-hunting MPs, the government proposed a licensing scheme (not wholly dissimilar to that utilised for animal experiments) that would allow hunting to continue. The licensing system was to operate according to two principles – one of 'cruelty' and the other of 'utility' (again not wholly dissimilar to the cost-benefit analysis utilised for animal experiments). We now know that the then Prime Minister, Tony Blair, most reluctantly agreed to abolitionist legislation when it became clear that Labour MPs saw through this contrivance and voted against it (Blair, 2010, pp. 304ff.).

8.21. As one commentator made clear,

> registration and licensing would have given hunting a legal authority, which it never had before. Licensing, by definition, empowers or authorises what was not previously authorised. It would have legitimised, institutionalised, and, therefore, helped to perpetuate hunting. Registered hunting is worse than a fudge; the bill would have provided hunting with full legal protection and helped to make it immune from fundamental criticism. (Linzey, 2009b, p. 92)

8.22. Licensing, then, creates a false sense of legitimacy and in effect reduces control over those carrying out animal experiments. It empowers and authorises licensees by institutionalising the practice itself.

8.23. It should also be noted that the people regulating animal research are not impartial, since they are often former animal researchers. According to the annual Home Office inspectorate reports, 'all inspectors are registered veterinary or medical practitioners who have first-hand experience of biomedical research and possess higher scientific or clinical postgraduate qualifications' (Home Office, 2014a). In practice this means that the vast majority are previous animal researchers or veterinarians who have been responsible for laboratories using animals and indeed that this is the Home Office's preference.

Supervised self-regulation

8.24. In 2013, the EU Cosmetics Regulation prohibited both the testing of cosmetics on animals and the marketing of any products in the EU that had been tested on animals. While this legislative move is certainly encouraging, animal testing in other contexts unfortunately continues. The method of 'supervised self-regulation' places the onus on industry to identify and manage risks, resulting in conflicts of interest, and once again illustrates the failure to control animal experimentation. Placing trust in an industry that is necessarily driven and guided by self-interest will create more barriers to monitoring compliance and will fail to increase alternatives to animal testing.

8.25. Any EU company wanting to manufacture, import, or sell products containing chemicals (paint, furniture, and clothing, to name a few) must demonstrate that the products will not harm human health or the environment. The EU regulation REACH ('Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals') governs the use and safety of chemicals in the EU, and in assessing the hazardous nature of any proposed substance, the regulation aims to reduce the use of animals in tests.

8.26. When large quantities of chemical substances are manufactured and imported in the EU, companies must submit proof to the European Chemicals Agency (ECHA) that they have managed risks associated with those substances. In effect, this means that the companies must submit dossiers detailing the substances they propose to use, the possible risks that may be involved, and the different ways that the company plans to deal with those risks. This may involve, for example, a proposal to test the toxicity of the chemical on animals. The legislation itself states that duplicate animal tests must be avoided and testing on vertebrate animals can be undertaken only as a last resort. For some animal tests, if there is no other prior data in relation to the chemical, then the manufacturer puts forward a testing proposal (for substances marketed at one hundred tonnes or above) which is assessed by ECHA and Member State authorities 'to check that the proposed test is likely to produce reliable and adequate data' (ECHA, no date).

8.27. In an effort to demonstrate transparency and promote information sharing, ECHA publishes testing proposals involving vertebrate animals on its website. Members of the public and organisations are then encouraged to provide 'scientifically valid' data on the proposed chemical or substance.

8.28. The REACH framework basically shifts the responsibility for testing new chemicals – and therefore public safety – to the manufacturer or importer. This method of regulation whereby risk management processes are mandated can be described as 'supervised self-regulation'. This form of regulation places considerable trust in the industry to honestly identify and manage risks. One major disadvantage of this form of regulation is that if the company being regulated knows more about the risks than the regulator, it is difficult for the regulator to monitor compliance. This in turn poses a significant threat to the public interest (Freiberg, 2010, p. 36).

8.29. In its publication 'Guidance in a Nutshell on Registration', ECHA states:

> REACH … is based on the principle that it is for manufacturers, importers and downstream users to ensure that they manufacture, place on the market or use such substances that do not adversely affect human health or the environment. The responsibility for the management of the risks of substances lies therefore with the natural or legal persons that manufacture, import, place on the market or use these substances in the context of their professional activities. (ECHA, 2013, p. 4)

8.30. In practice, this means that the decisions about which risks may be present and how these risks should be managed are left to the manufacturers. Therefore, if a manufacturer identifies a potential public health risk, and an animal experiment is proposed, the proposal is unlikely to be denied because the trust is placed in the regulated company to decide the appropriate risk management measure. Similarly misguided is the onus placed on other organisations and the public to volunteer information in relation to the substance. Information being voluntarily submitted by other organisations is highly unlikely, as these manufacturers may be in competition with one another. It is also unlikely that members of the public will have the means, or the necessary incentive, to produce 'scientifically valid' information to ECHA. In fact, a recent review of the process confirmed these assertions (Taylor et al., 2014).

8.31. Not only is this supervised self-regulatory model unsafe for consumers and the environment, since it relies on manufacturers to be accurate and honest about potential risks; it also does not align with REACH's aim to increase alternatives to testing on animals. Therefore, while there is a complex apparatus of control at work in the EU in relation to the introduction of new chemicals, in practice the regulatory framework falls short of achieving its goals.

8.32. The inevitable place of self-regulation, even within a formal regulatory framework, is emphasised by the APC report to which we referred earlier. It argues that 'it is important to realise that researchers themselves bear the responsibility for carrying out cost-benefit assessments of their work, including critical evaluation of the need for animal studies at all' (APC, 2003, p. 65).

8.33. The APC report also emphasises the issue of comprehensibility:

> It is important that the information provided by the researchers really addresses costs and benefits in an accessible and meaningful manner, and clearly communicates the researchers' own assessments of the balance of likely benefit over harm … we recommend that the project licence application form be designed so as to encourage more adequate, easy-to-understand and pertinent descriptions of costs and benefits and the relations between the two. (APC, 2003, pp. 65–66)

8.34. Two things are notable here. First, if it is the responsibility of researchers to critically evaluate the need for animal studies and to carry out cost-benefit assessments of their own work, this gives rise to a conflict of interest. While the regulators have the final say and should carry out their own evaluation, it is all too easy for researchers to assign weights to costs and benefits that are in their own favour. Second, and related, is the extraordinary way in which researchers are themselves envisaged to be both scientists and ethicists – even though they may have little or no training for the latter role. Of course, we may hope that scientists will be conscientious and diligent in keeping abreast of ethics literature, but that is separate from possessing ethical expertise in the form of assessing moral harms and benefits and being aware of challenges to performing utilitarian calculations, for example. Also, ethicists are knowledgeable of other ethical views that may be critically relevant to the assessment of animal studies. What is particularly disconcerting is that in the light of what is subsequently approved (by local ethical review committees and the Home Office itself) – that is, the subsequent lack of rejection of projects by the Home Office – it seems clear that the initial assessment by the researcher pretty much holds sway.

8.35. We shall address the issues of ethical committees shortly, but the point that needs to be made here is that it is very difficult even for scientists in one field to adequately judge the value of work in another – hence the right, but also revealing, emphasis on comprehensibility: making such project licences 'easy-to-understand'. What happens, one wonders, when they are not easy to understand? Are the licences simply waved through on the basis of trusting the researcher involved? Authorities in one field often rely on authorities in another, and so scientists should work closely with ethicists to ensure moral accountability and more effective control at the level of self-regulation.

The Three Rs

8.36. Within the Member States of the EU, these guiding principles underpinning the use of animals in scientific research are found in Directive 2010/63. Having entered into force across all Member States in January 2013, Directive 2010/63 does not simply replace and update the technical provisions of how and when animals can be used for scientific purposes enunciated in Directive 86/609. Instead, Directive 2010/63 represents – at its idealistic best – a move by the European Commission to fundamentally readdress the issue of animals and scientific procedures.

8.37. The previous regime was, at its heart, a tool by which scientific procedure establishments were subject to regulation simply to avoid a race to the bottom of standards; without a common set of minimum standards imposed across all European laboratories, unscrupulous undertakings would simply opt for the state with the least draconian legislative regime, creating a significant (and uncompetitive) distortion of the market. Hence, Directive 86/609 strove to compel some form of minimum standards, not because these standards had any direct bearing on any pain and suffering felt by the animal subjects of scientific procedures, but because poor standards in one particular country could have the effect of creating an uneven playing field across the EU.

8.38. Directive 2010/63 does, of course, maintain the need to ensure that the competition within the EU remains healthy and viable across all Member States, but its purpose has gone beyond this limited goal to ensure that some form of animal protection is a central tenet of the legislation, rather than a fortuitous by-product of avoiding the race to the bottom. This much is clear from both the language of the preamble (which sets out the operating principles, context, and justification for the legislation but has no binding legal effect in and of itself) and the articles of the Directive itself (which set out the manner in which these principles should be put into effect by the Member States).

8.39. In terms of the former, two highly significant points deserve attention here. First, there is the declaratory statement in the preamble that Directive 2010/63 represents 'an important step towards achieving the final goal of full replacement of procedures on live animals for scientific and educational purposes as soon as it is scientifically possible to do so' (European Parliament, 2010, p. 34). Clearly, the significance of this statement should not be overplayed: it neither pledges to end the use of animals in scientific procedures within any particular time frame nor binds any particular Member States to any obligations to bring about an end to the use of animals. What this statement does do, however, is explicitly acknowledge that the use of animals in scientific experiments cannot and must not remain the norm for scientific advancement.

8.40. Second, of further significance regarding the aspiration of 'full replacement' is the basis for this assertion: Directive 2010/63 recognises that animals are sentient creatures with intrinsic – and not simply instrumental – value and that the use of animals for human purposes is a matter of serious public concern.

8.41. Quasi-prohibition (or rather the rhetoric of it) is at the heart of Directive 2010/63, and the first R of the Three Rs – replacement – is the first principle to be applied by the competent authorities of all Member States: 'Member States shall ensure that, wherever possible, a scientifically satisfactory method or testing strategy, not entailing the use of live animals, shall be used instead of a procedure' (European Parliament, 2010, p. 39). While this remains only a quasi-prohibition because of the use of the phrase 'wherever possible', with its infinite possibilities for creative avoidance, the fact remains that the first thing that the first enjoining article of the Directive specifies is that there is a prohibition on animal testing unless a case can be made to justify the use of animal test subjects.

When a case can be made for the granting of a licence to conduct regulated procedures on animals, then – as one might naturally expect – the hierarchy of the Three Rs is to be strictly implemented: experimenters must seek to use the least number of animals as possible (reduction) and use techniques involving the least degree of pain and harm (refinement). But it is not clear whether reduction or refinement wins when they clash.

8.42. Obviously, Directive 2010/63 is a highly detailed document, and because of its very nature (a Directive of the EU, not a directly applicable regulation), it requires transposition into the laws of each Member State by means of domestic legislation. Hence, it would be impossible to offer any detailed description of how each and every one of the principles found in the Directive is applied in the twenty-eight Member States of the EU. Directive 2010/63, therefore, when reduced to its simplest possible form, represents a significant regulation that underpins the direction of the laws of twenty-eight States, representing the collective values of over 500 million people: a statement that scientific procedures involving the use of animals are implicitly undesirable and should be curtailed.

8.43. But the failure of this rhetoric to be actualised once again emphasises the problem of failure to control because in practice there are few measurable ways in which this Directive is being implemented. In order to adhere to the spirit and purpose of the Directive, resources and expertise should be directed towards ensuring replacements for the use of animals in experiments – with non-animal alternatives becoming the norm – but this is clearly not the case. Alternatives are more often than not the Cinderella of the scientific world: underfunded and under-regarded, often with much tougher standards for acceptance than the equivalent animal tests. Unless and until a proportion of the huge amount of funding that is devoted to animal research is made available to pioneering non-animal research, there can be little hope of meeting the Directive's rhetoric with reality.

Care and ethics committees

8.44. Many research institutes in the UK and the US have care committees or local ethical review processes (hereafter 'ERPs'). Important questions are raised in relation to these committees: Are they reliable and trustworthy? And are they effective in policing animal experiments? As we have previously noted, there is often a significant conflict of interest for committee members in their advisory roles.

8.45. In the US, the FDA is a federal regulatory agency within the US Department of Health and Human Services. The FDA is responsible for protecting the public health and regulates the use and safety of human and veterinary drugs, biological products, medical devices, food supply, cosmetics, and products that emit radiation.

8.46. As such, the FDA has wide scope in setting the animal testing agenda in the US. In relation to cosmetics, for example, the FDA does not specifically require manufacturers to test on animals. Instead, it advises companies to 'employ whatever testing is appropriate and effective for substantiating the safety of their products' (US FDA, 2006). Therefore, while the FDA does not specifically require testing to be undertaken on animals in relation to cosmetics, in effect its stance does nothing to discourage companies from testing cosmetics on animals.

8.47. An Institutional Animal Care and Use Committee (hereafter 'IACUC') is required by US law to be established by institutions that use animals in research, to oversee the care and use of animals in those institutions. The IACUCs have broad responsibilities, and not all IACUC members have expertise in animal care. More troublesome is the fact that members might have conflicts of interest or bias. For example, some IACUCs are composed of a majority of researchers who use animals in research versus researchers who do not. Also, IACUCs oversee work of colleagues, and members of those committees might be hesitant to professionally criticise the work undertaken by professional peers whom they have to see day in and day out.

8.48. Since their conception in 1985, IACUCs have overseen animal use at institutions receiving federal grants. Although brought in as a response to public concerns about the treatment of animals in research, IACUCs were not specifically instructed to perform even elementary cost-benefit analyses of animal research protocols. Instead IACUCs have, by and large, limited themselves to advisory or technical roles.

8.49. This disinclination to adopt a broader ethical approach to the role of IACUCs may be a result of the composition of the IACUCs (Hansen, 2013). A recent study found that at twenty-one of the top twenty-five research institutions funded by the National Institutes for Health, an average of 67 per cent of IACUC members were animal researchers, and 15 per cent were veterinarians, many of whom conducted animal research. The study also found that 93 per cent of IACUC chairpersons were animal researchers (Hansen et al., 2012). The disinclination to evaluate the ethical dimension of using animals in research is evident in a comprehensive study which found that 98 per cent of in-house protocols were approved by IACUCs (Plous and Herzog, 2001).

8.50. Obviously, IACUCs would benefit from greater diversity on their committees to avoid groupthink (Hansen, 2013). Psychological studies have demonstrated that bias is prevalent in everyone and that we are twice as likely to seek information that fits our current worldview as we are to consider opposing views (Pronin et al., 2004; Heffernan, 2011; Hart W. et al., 2009; Pyszcynski et al., 1985). This is especially relevant when we consider that around 80 per cent of members of IACUCs are engaged in animal experiments and that like-minded groups of people are more likely to reinforce their own biases than challenge them (Tesser and Rosen, 1972; Sunstein, 2009).

8.51. Similar issues arise with the establishment and functioning of ERPs in the UK. Although the APC advises that ERPs comprise a range of persons, including 'lay people and people outside the establishment – all of whom can bring a "fresh eye" to the issues raised by the work' (APC, 2003, p. 69), it does not mandate that professional ethicists be counted among their number. This has to be a serious omission. Having one or two token ethicists would not by itself meet the ethical seriousness of the projects being considered, but when the majority of members are scientists (with no required expertise in moral deliberation) and no ethicists are involved, ERPs can hardly be judged to be *ethical* reviews in the first place. Yes, they may be scientific reviews (depending upon the range and expertise of the members), but they can hardly be called ethical ones.

8.52. Moreover, the APC itself notes that a Home Office review of ERPs commented that 'some [scientists] still seem unwilling to allow their science to be challenged within the ERP, and are sometimes reluctant to offer a sustainable justification of proposed work' (APC, 2003, pp. 69–70).

8.53. This means that even within the existing system in which some independency may be allowed, there is clearly a resistance to engage ethically with challenge or criticism. This is likely due to conflicts of interest and the problems with 'supervised self-regulation', as discussed previously. It could also be due, in part, to lingering beliefs that science and ethics are to be kept separate as much as possible, from a mistaken perception of ethics as 'subjective' and in opposition to science as 'objective'. Requiring animal ethicists to be members of such committees would not only make the reviews more objective in terms of reducing conflicts of interest, but would also do much to overcome misconceptions about the relationship between science and morality.

8.54. A recent journal article by a previous chair of an animal care committee in South Africa provides a thoroughgoing critique of the operations of such committees and how they undervalue animal life. In particular she argues:

> Another way in which harms suffered by animals used for experiments are undervalued is illustrated by the fact that researchers who violate experimental protocols are not usually seriously reprimanded; there is great reluctance on the part of AECs – on which animal researchers and technicians serve – to take experimenters to task. (Galgut, 2015, p. 9)

8.55. It seems abundantly clear that care committees do not normally provide a rigorous evaluation of proposals from an ethical perspective, nor do they feel obliged to utilise the services of animal ethicists on their committees. Care and ERP committees are fundamentally flawed in not addressing the ethical issue at stake in animal research. We do not currently have figures for the number of projects rejected by such committees or for what reasons. The danger is that such committees provide camouflage for unethical practices while creating an illusion of control over them.

Conclusion

8.56. We have discussed the principal forms of control, where controls exist, and have found them wanting. The IACUCs in the US are so utterly lacking in independency that they do not provide a rigorous evaluation of proposals from an ethical point of view. Even within the UK system (frequently held up as a best practice model), we find the inspection process flawed, the licensing system insufficient to prevent (and act upon) serious breaches, and ERPs insufficiently independent and reluctant to change. The Three Rs principles, which are endorsed by the EU and to which lip service is paid by governments (and which might have provided some impetus to change), are in practice massively underfunded and undervalued, so that alternatives are the Cinderella of scientific research.

9. Undercover investigations

9.1. At the beginning of our report, we indicated the limited nature of legislation (or even absence of law) regulating experimentation worldwide (see 2.5–2.11). In our last section, we showed the lack of control, or failure of control, exercised in practice. In this section, we examine the issue of non-compliance. It is important to note that at least three things are required for improvement through regulation. First, there need to be laws and statutory guidelines to supplement those laws. Second, there needs to be adequate enforcement (including adequate and independent inspection). And third, there has to be compliance.

9.2. The issue of compliance is as important as the other two factors. Without compliance, regulations can have no impact at all. It is, therefore, especially serious that animal organisations have uncovered significant evidence of non-compliance over the past twenty years or so. In this section, we examine six such examples – one relating to international trade and five others in UK laboratories. Various animal organisations have employed undercover investigations, but here we focus on those conducted by the BUAV. We are grateful to the BUAV for providing the results of their investigations.

International trade in primates (1991)

9.3. In 1991, the BUAV followed the chain of supply for NHPs from Asia, Mauritius, and the Caribbean to research laboratories in the UK, Europe, and the US (BUAV, 1992). An undercover worker was placed at Shamrock, a major UK facility for importing and holding NHPs, and Hazleton, a UK contract testing laboratory, while other investigators travelled to the main exporting countries to infiltrate the trapping network. Footage revealed the extensive suffering inflicted on monkeys during their capture, caging, transportation, holding at Shamrock, and eventual death in the laboratory.

9.4. Shamrock Ltd was established in 1954 to supply free-living (otherwise known as 'wild-caught') rhesus monkeys for research. Since that time Shamrock had become one of the largest suppliers of NHPs for research within Europe, supplying many species of NHPs, including the most popular for research: rhesus macaques, long-tailed macaques, vervets, and baboons. Demands from laboratories for a continuous cheap supply of NHPs meant that the majority of NHPs, those traded internationally as well as those imported into the UK, were taken from their natural environment, since captive-bred macaques cost three times more.

9.5. The findings of this BUAV (1992) investigation included the following:

- The suffering endured by monkeys during trapping and transportation often resulted in high mortality rates. As many as eight out of every ten monkeys captured died before reaching the laboratory.

• There were appalling conditions at holding centres in source countries – for example, monkeys kept in cramped and overcrowded cages.

• Suffering and losses were inflicted on monkeys travelling as cargo on passenger airlines to destinations around the world.

• As many as 20 per cent further deaths followed the arrival of the monkeys in the UK, due to illnesses such as enteritis and pneumonia. Others were killed due to their poor condition or deformity.

• Between 1988 and 1991, 3,220 macaques were imported into the UK by Shamrock; 611 of these subsequently died. In some cases the mortality rates were higher. For example, out of a shipment of fifty monkeys who were imported from one country, seventeen were dead within three months, and twenty-seven were dead within six months.

• At Shamrock, NHPs were kept in inadequate conditions (in barren cages and individually housed with no stimulation or exercise), resulting in abnormal behaviour including circling, rocking, and self-mutilation.

• The suffering and distress experienced by the NHPs were increased by the general attitude and behaviour of staff at Shamrock, including rough handling. NHPs were captured by nets and hauled to the ground, causing distress and injury, including cuts, bruises, and even loss of teeth.

• Experiments at Hazleton involved NHPs held in restraint 'chairs' while forced to inhale toxic substances via a mask secured to their head. The monkeys would often scream and struggle while placed in these 'chairs'.

• At Hazleton, monkeys were slapped about the body by staff and were shaken and prodded while restrained. One monkey was called 'Rape' because she screamed frequently.

9.6. These findings led to the following outcomes:

• There was a subsequent international move away from the trapping of monkeys for research. In the UK alone, following BUAV's 'Paradise Lost' investigation, only 5 per cent of monkeys imported during 1993 were taken from their natural environment. In 1990, it had been 77 per cent.

• In 1995, the UK government announced a ban on the use of trapped monkeys in research unless there was 'exceptional and specific justification'. It also introduced a system whereby overseas suppliers of NHPs had to be inspected and approved before being given permission to import monkeys for research (this system has recently been abandoned).

• In 1994, Indonesia and the Philippines announced restrictions on the NHP trade and a ban on the export of trapped monkeys, although monkeys could continue to be trapped in the 'wild' to establish or replenish breeding programmes.

• A Home Office inquiry into Shamrock accepted the main criticisms made by the BUAV – namely, that management had failed to care for the NHPs; that staff were incompetent in care and handled animals inappropriately and insensitively; and that the conditions in which the animals were kept were inadequate. In 1993, Shamrock announced a ban on the import of free-living monkeys. A few years later, in 2000, the facility closed down.

Wickham research laboratory (1992)

9.7. In 1992, the BUAV carried out an investigation at Wickham Laboratories in the UK (BUAV, 1993). At this facility, rabbits, mice, and guinea pigs were subjected to a range of tests, including skin irritancy, toxicity (poisoning), and pyrogenicity studies for 'quality control' (the routine batch testing of established drugs, medical devices, and solutions used in intravenous infusions). Products tested at Wickham were for a variety of UK and foreign chemical and pharmaceutical firms. Wickham also carried out batch testing on mice using the LD50 (Lethal Dose 50 per cent) test for a product containing botulinum toxin (commonly known as botox).

9.8. During this investigation it was found that animal tests were being carried out at Wickham (for which the Home Office had granted licences) despite these tests no longer being required by UK or European regulations.

9.9. Unprofessional scientific practice was also uncovered. Laboratory staff were told to weigh bags of mouse food rather than actual mice, to save time. This was a clear breach of the Home Office licence conditions and could lead to distorted test results. Other findings which breached the Home Office's *Code of Practice for the Housing and Care of Animals Used in Scientific Procedures* included rabbit cages poorly maintained – many had bars missing – and no bedding provided for the animals. As a result, many rabbits suffered from sore feet and abscesses, and others were found dead in their cages. Many animals were gassed in a CO2 chamber that had a broken dial, making it impossible to assess the right dose of CO2 to ensure rapid and humane killing. At one point the cylinder ran out and was not replaced for weeks, which meant that staff were left to break the necks of hundreds of mice at a time.

9.10. The BUAV called on the Home Office to withdraw Wickham's licence to carry out experiments. The BUAV also believed an independent review of the whole operation of the 1986 Animals (Scientific Procedures) Act was needed.

9.11. These findings led to the following outcomes:
The Home Office conducted its own investigation, and on 22 June 1993, it released a statement announcing weaknesses that were discovered and the actions Wickham Laboratories would need to take. It found Wickham to have poor local management, resulting in lax attitudes, and poor practices among staff. These included a readiness to falsify data on occasions. The investigation claimed to have found one case of unnecessary animal use. It was found that some aspects of the technical training were unsatisfactory, and the initial training was poorly structured. It was also found that the system lacked formal assessment of competence before unsupervised tasks were allocated to new employees.

9.12. The following actions were taken or directed:

- Wickham had to replace the person who had day-to-day responsibility for running the animal house, and that person's licence to use animals was revoked.

- A former licence holder was warned that any future application for a personal licence would be subjected to close scrutiny.

- A number of other members of staff were sent letters warning them about their future conduct.

- Wickham was ordered to make acceptable improvements to training arrangements and operational procedures. It was directed that Wickham have a formal training scheme for all animal unit staff.

- Wickham's standard operating procedures relating to the care, husbandry, and euthanasia of animals were to be revised to the satisfaction of the inspectorate.

Harlan UK (1998–1999)

9.13. In 1998–1999, a ten-month undercover investigation was carried out by the BUAV at the Harlan UK Leicestershire site (BUAV, 1999). This site bred dogs (and other animals) for the research industry and was also contracted to look after animals in use by other institutions. The investigation revealed a lack of care for the dogs, as well as numerous breaches of government guidelines.

9.14. Harlan was founded in 1931 and is a major international company with locations all over the world. The Harlan UK Group consists of breeding establishments that sell to laboratories across the world. Harlan UK breeds a number of species of animals (including beagles, rabbits, guinea pigs, gerbils, hamsters, rats, and mice) and more than 225 stock and strains of animals, including hybrid, mutant, transgenic, and surgically altered animals. Some facilities require only blood serum, plasma products, or organs; Harlan bleeds and kills these animals (including dogs) to the facility's requirements.

9.15. During the investigation, breaches were found in the minimum standards of housing and care as stated in the Home Office *Code of Practice for the Housing and Care of Animals in Designated Breeding and Supplying Establishments*, and the BUAV called for Harlan UK's certificate of designation to be withdrawn. The Animals (Scientific Procedures) Act 1986 (in force at the time) stated that 'a certificate of designation is granted only to those establishments which meet the required standards of husbandry and care'.

9.16. Key breaches uncovered by the BUAV included the following:

- Harlan failed to fully recognise the special requirements of breeding animals.

- The breeding females and stud dogs received little human contact or stimulation and no exercise.

- All dogs, including whelping females, were kept in bare pens, with no bedding other than a handful of sawdust as substrate.

- Other breaches included failure to adhere to minimum space requirements; failure to provide adequate staff training; failure to provide sufficient staff; failure to check the well-being of animals at least once daily; poor hygiene; mouldy food-hoppers; mice in the units; and temperatures outside the recommended range.

9.17. The investigation also discovered loopholes in the government regulation of animal experimentation. Dogs at Harlan were overbred, causing the production of animals 'surplus to requirements'. These healthy 'surplus' dogs were regularly killed, including some who were only a few months old. Between January 1998 and April 1999, the BUAV estimated that at least 250 dogs were killed who were considered 'surplus to requirements'. The government does not require breeding establishments to provide statistics to show how many 'surplus' or breeding dogs are killed. Therefore, the public is not provided with accurate information as to how many dogs are held by the research industry each year. A second loophole in the government's regulations highlighted by the BUAV was that dogs at Harlan UK were often killed for blood serum and plasma. Yet again, the government does not require breeders to supply statistics on the number of animals killed for tissue, blood, or organs.

9.18. The BUAV was dissatisfied with the Home Office's response to the investigation and stated that the Home Office had failed to enforce legislation against animal cruelty and to properly investigate once breaches of legislation had been made.

9.19. The resulting report by the Home Office inspectorate generally praised the welfare conditions within the facility and rejected several of the BUAV's allegations. However, the BUAV argued that a closer reading of the report showed that many of the allegations had actually been accepted. The BUAV also accused the Home Office inspectorate of seeking to denigrate the BUAV investigator at every opportunity.

9.20. The APC, the government's advisory body, stated: 'Many members felt that the report sought to exonerate Harlan-Hillcrest, with the risk of creating the impression that the conditions which prevailed there were deemed acceptable by the Inspectorate' (APC, 2004, p. 47).

Cambridge University (2002)

9.21. The BUAV carried out an investigation into the use of marmosets in neurological research at Cambridge University (BUAV, 2002). The NHPs were used for a mixture of basic research (including research to find out more about the brain) and applied research which was aimed at trying to develop a marmoset 'model' for human illnesses such as stroke and Parkinson's disease. Hundreds of monkeys spent their entire lives in barren cages and were deliberately brain-damaged.

9.22. The research included the following:

- The monkeys were 'trained' to carry out behavioural and cognitive tasks, before undergoing major surgery to have brain damage inflicted. Following the brain damage, they were then forced to repeat the tasks.

- Water deprivation and/or food restrictions were used to force the monkeys to carry out the tasks required of them (they were deprived of water for twenty-two out of every twenty-four hours, with intermittent respite, for months on end).

- In tests where monkeys were used as 'models' for Parkinson's disease, they were shut into tiny Perspex boxes for up to one hour at a time, to see how often they would rotate (an effect of the brain damage). They were also given injections of amphetamine or apomorphine, which made them rotate faster or in the opposite direction.

9.23. All the experiments included the deliberate infliction of brain damage by cutting or sucking out parts of the brain or by injecting toxins. The post-operative effects of the brain surgery included pain, distress, bleeding from head wounds, fits, vomiting, tremors, swelling and bruising, loss in body temperature, failure to eat or drink, abnormal body movements such as head twisting and body rotation, the loss of use of one arm or the whole side of their body, loss of balance, and visual disturbances. The long-term effects of the brain damage included physical disabilities, learning and memory impairment, weight loss, and lack of self-care.

9.24. Further concerns raised by the BUAV included the following:

- Hundreds of marmosets were kept in small, barren cages with little stimulation or enrichment.

- Just one technician had the responsibility to care for approximately 500 marmosets.

- Hand-rearing was not part of the husbandry routine, which meant that some 'excess' newborn monkeys were left to die or were killed if they were not thriving.

- Monkeys who were experiencing the effects of significant brain damage were left unattended overnight for up to sixteen hours immediately following surgery.

- Several monkeys were killed on 'welfare grounds' or were found dead after the brain surgery.

9.25. Yet despite this level of suffering inflicted on the marmosets, the Home Office had categorised the experiments as 'moderate' rather than 'substantial'. If the experiments had been classed as causing 'substantial' suffering, they would have had to be scrutinised by the APC before any licences were granted, if they were granted at all[13].

9.26. These findings led to the following outcomes:

9.27. The BUAV called for an inquiry that was independent of the Home Office. However, in the face of a promise made to Parliament by a Home Office minister after the criticism by the APC following the Harlan investigation, the Home Office inspectorate carried out its own investigation. The Home Office report dismissed, misrepresented, or completely ignored the BUAV's allegations; levels of animal suffering were also seriously downplayed. Even clear breaches of project licences which involved additional animal suffering beyond that allowed in the licences were dismissed as 'a few minor infringements of a technical nature …'

9.28. With the information obtained during their investigation and in the light of the subsequent review, the BUAV applied to the UK's High Court for permission to seek a judicial review of the legality of the Home Office's application of the law in the Cambridge case and of the wider implementation of animal experiments legislation. The BUAV was successful on the assessment of Cambridge severity limits (overruled in the Court of Appeal) and lost on the care arrangements issue. The courts acknowledged that the Home Office had been unlawful in approaching its own guidance about how to assess severity. A legal discussion of the findings is provided in section 8 (8.14–8.19).

Wickham research laboratory (2009)

9.29. A second BUAV investigation took place at Wickham Laboratories in Hampshire in 2009 (BUAV, 2009). The BUAV found yet again that the laboratory was testing substances on animals for which no test was required or where there was a valid alternative. Some of these tests were pyrogenicity tests during which rabbits were injected with a substance and forcibly restrained by their necks in stocks for hours at a time. Individual rabbits were then routinely reused in the test. They also uncovered more details of the LD50 tests being conducted on a massive scale to check batches of the highly toxic botulinum toxin product.

9.30. The key findings included the following:

- Animals were kept in small, virtually barren cages that failed to meet their behavioural and social needs.

- Some animals were being used in tests that were no longer required by national and international regulations.

- The LD50 test for botulinum toxin product, also seen during the 1992 investigation, was still being conducted. However, since that time, a valid test-tube alternative to the test (the SNAP-25 assay) had been developed. The BUAV argued that under UK law, this test should be used because it had been validated by no less than an official UK government laboratory and had been used by them since 1999 for the same purpose. Inexplicably, the UK Home Office was not insisting on this test ten years later.

- Despite a UK and EU ban on the use of animals for cosmetic testing, there appeared to be a loophole in the law which allowed animals to continue to be used in tests for the botulinum toxin product that, although licensed for medical use, could very well end up being used – quite legally – for cosmetic purposes (as botox).

[13] The findings of the BUAV investigation were launched with an in-depth political news item on BBC Two's Newsnight. The focus of Newsnight was the BUAV's concerns about the Home Office licensing system – that the Home Office had been misleading the public about the reality of animal suffering in laboratories, downplaying it by labelling such invasive research as 'moderate' rather than 'substantial'. The Newsnight reporter said: 'Under the present licensing system, it seems that the true extent of suffering endured by laboratory animals is being systematically obscured.' Hours before Newsnight, former Prime Minister Tony Blair had defended the university and the NHP research in what he called his 'Science Matters' speech. He said that 'the response of the government must be to encourage openness, transparency and honesty', and he claimed that Britain has 'one of the world's strictest, most regulated regimes for animal experimentation'. Blair went on to say, 'Cambridge University intends to build a new centre for neurological research. Part of this would involve using primates to test potential cures for diseases like Alzheimer's and Parkinson's. But there is a chance the centre will not be built because of concerns about public safety dangers and unlawful protests. We cannot have vital work stifled simply because it is controversial' (BBC Two, 2002).

9.31. The BUAV was particularly concerned with the suffering and death of what amounted to hundreds of mice every week in the LD50 test. Researchers injected botulinum toxin into the abdomen of the mice and then periodically observed the animals to see how many died. The mice would become increasingly paralysed, eventually gasping for breath and suffocating to death; no pain relief was provided for the mice.

9.32. As a token consideration with respect to animal welfare, staff were supposed to observe the mice and identify those who were judged unlikely to survive until the next check. This was a completely inadequate way of controlling suffering, but in any event, using the company's own data, the BUAV discovered that this so-called humane endpoint was a sham because far more of the mice in question died an agonising death than were killed.

9.33 Most mice in the higher-dose categories died during the test. Those considered unlikely to survive until the next check were taken out into the corridor and crudely killed on the floor by staff, who broke their necks with a ballpoint pen. New members of the staff who had never killed mice before were expected to practice breaking necks with a ballpoint pen on live mice. However, during this training, staff sometimes broke the backs of mice rather than their necks. Even experienced staff had problems and caused back injuries.

9.34. These findings led to the following outcomes:
The Home Office set up a semi-independent inquiry and in 2010 released its report on Wickham Laboratories, which found breaches in animal testing licences issued to the company. The report substantiated many of the BUAV's findings.

9.35. The key findings of the Home Office report included the following (Animals Scientific Procedures Inspectorate, 2010):

- Too many mice in the LD50 tests were being 'found dead' rather than being 'humanely' killed by staff – in breach of the institution's licence to monitor the animals regularly.

- Staff incompetence in the way mice were killed led to their suffering, including the practice of neck-breaking with a pen on the corridor floor.

- Key staff did not carry out their legal responsibilities under the ASPA, including the named veterinary surgeon (hereafter 'NVS'), who did not ensure the welfare of rabbits.

- Staff training in the monitoring and killing of animals was poor.

9.36. One of the companies commissioning tests on rabbits at Wickham moved to non-animal alternatives, and the UK Veterinary Medicines Directorate launched a review into the use of rabbits for pyrogenicity testing. This review found that twenty-six veterinary drugs were still being tested on animals when there was no longer any scientific need. The review prompted a change in the licences for these drugs, sparing an estimated 38,000 animals (cited in BUAV, 2011).

9.37. The following actions were taken or directed:

- The Home Office immediately ordered the staff to stop killing the mice on the floor.

- A number of other staff members received letters warning them about their future conduct.

- Wickham Laboratories was ordered to make acceptable improvements to its formal training arrangements and operational procedures.

- Improvements had to be made to the monitoring during the LD50 tests. The Home Office investigation following on from the BUAV's investigation found that 80 to 100 per cent of mice in the relevant groups were in fact dying from the botox.

• The Home Office report acknowledged that there was a potential conflict of interest with the NVS responsible for animal welfare, who was also a major company shareholder. The NVS subsequently stood down, and the Home Office introduced new guidance aimed at preventing such conflicts.

9.38. Despite the preceding findings, the BUAV was disappointed that the Home Office had failed to properly investigate whether the drugs tested at Wickham Laboratories necessitated animal tests, in particular whether such tests were required by national and international regulators. Following a judicial review brought by the BUAV after this investigation, the Home Office agreed that, with quality control testing, it had to make sure before an animal test for a particular substance took place that there were no available alternatives. New guidance was issued to inspectors.

9.39. The Home Office initially strongly denied that it had any responsibility to ensure that the botox was not actually used for cosmetics. However, following the judicial review, the Home Secretary, Theresa May, conceded that she did have the responsibility to make sure that the end use of the botox was not for cosmetic purposes. However, all the signs indicate that the Home Office has done nothing to enforce the condition, with the result that the tests appear to be continuing at Wickham.

Imperial College, London (2012)
9.40. During an undercover investigation in 2012 (BUAV, 2013), the BUAV documented a catalogue of shortcomings and wrongdoing by Imperial College staff and researchers that caused more distress and suffering to the animals (rats and mice) in their care than was allowed in the experiments. Findings included breaches in and lack of knowledge of UK Home Office project licences, a failure to provide adequate anaesthesia and pain relief, incompetence and neglect, and disturbing methods used to kill animals.

9.41. The key concerns raised by the BUAV investigation include the following:

• Underestimation of the degree of suffering in project licences. Experimental protocols were given a 'moderate' limit even when the anticipated adverse effects clearly called for a 'substantial' classification of the research. One research project involved kidney transplantation, a major procedure by any standard. Some rats had both their kidneys removed via abdominal surgery and were left with just one (transplanted) kidney. The subsequent Home Office review said that senior inspectors not involved in original classifications were asked to review them. There was 'agreement that some procedures may not have been classified as of sufficiently high severity' (Home Office, 2014c).

• Poor monitoring of animals resulting in suffering and breaches of humane 'endpoints' (the point at which further suffering must not take place). In one case, where mice were found to be in a distressed state on a Monday morning, a senior technician stated: 'I am so disgusted. Those poor mice' and 'If the Home Office was in we would have been screwed if they saw those mice'.

• Researchers lacking knowledge of the severity limits of their project licences and the humane 'endpoints' they were supposed to apply. When asked about the severity limits on their licences, many researchers did not know. One said: 'So do I get to call a friend?' Not knowing the severity levels and 'endpoints' could result in animals being subjected to even more pain and suffering than permitted.

• Poor application of the methods used for killing animals, leading to unnecessary suffering, and the controversial use of a guillotine to carry out live decapitation.

• Poor surgical and other procedures, resulting in animal deaths and suffering. One researcher, for example, raised concerns about the competence of a colleague: 'I think you should keep an eye on [name withheld] because he makes many mistakes.'

• Unsupervised researchers, with little experience, anaesthetising and carrying out surgery on animals. One researcher who was anaesthetising a rat to re-staple a surgery wound admitted: 'I've never done this before' and 'I only came down here for the first time yesterday so I haven't even seen these rats before'.

• Failure to provide adequate anaesthesia and analgesics. There were several occasions when animals appeared to be inadequately anaesthetised, as a consequence of inadequate monitoring, use of inappropriate anaesthesia, or deliberately due to fears about losses of animals during surgery. One researcher who did not want to wait for hours for a rat to recover from anaesthesia on a Friday afternoon stated: 'But I won't give it a full dose. As long as there is enough for it to be not fully under but you know not feeling too much pain.'

• Pop music was played at high levels throughout the facility, adding to animals' distress. The music was even played during surgery itself, while animals were recovering, and during killing.

9.42. These findings led to the following outcomes:

The Home Office announced it would carry out an investigation, and Imperial College immediately commissioned its own inquiry. A report was then published in December 2013. The inquiry subsequently known as 'The Brown Report' was carried out by Professor Steve Brown, director of the Medical Research Council's Mammalian Genetics Unit (Brown Report, 2013). The report concluded that Imperial College 'did not have in place adequate operational, leadership, management, training, supervisory and ethical review systems …' (Brown Report, 2013, p. 7). Other findings from the review included the following:

> … in terms of operational structures and standards, communication and working practices, as well as the mechanisms for reporting animal welfare concerns, we found that there was considerable room for improvement and the introduction of significant changes. These would have a substantive impact upon animal welfare …
>
> We recommend an increase in staffing levels that will allow the increased involvement of animal care staff with in vivo research programmes … and ensure greater independent overview of animal welfare out of hours and at weekends …
>
> We found that the provision of training, supervision and competency assessment was ad hoc, and that there was little evidence of effective mechanisms for sharing information and best practice across staff … We recommend a significant increase in resource for training and competency assessment … (Brown Report, 2013, pp. 8–9; emphasis in original)

9.43. The university's Animal Welfare and Ethical Review Body – which is responsible for reviewing animal use – was found to be 'not fit for purpose' (Brown Report, 2013, p. 14) and in need of 'wholesale reform' (Brown Report, 2013, p. 8). Additionally, Professor Brown commented in the press release of the report, 'While our focus has been on Imperial College, the committee's recommendations should serve as a useful framework for other institutions to review their policies and practices' (Brown press release, 2013).

9.44. The Animals in Science Committee (ASC), the government advisory body, published its own report in July 2014 based on the findings of the Home Office investigation at Imperial College (hereafter 'HOI') and the Brown Report. This report found that Imperial College had breached its establishment licence and concluded that there was 'a systematic pattern of infringements, of which the ASC notes that at least two involved tangible welfare costs …' (ASC, 2014, p. 2). The ASC report recommended that 'the Minister should consider whether he can continue to have confidence in the current ELH [Establishment Licence Holder] at IPC [Imperial College, London] retaining this role' (ASC, 2014, p. 5).

9.45. The ASC report concluded that

> the regime at ICL clearly fell short of the standard required by the Animals (Scientific Procedures) Act 1986 (ASPA). The HOI investigation identified a pattern of infringements that reflected underlying systematic failings … In particular, failings of culture and communications impeded the promotion of best practice and the 3Rs, whilst NACWOs [Named Animal Care and Welfare Officers] and biomedical staff were insufficiently involved in procedures and post-procedure recovery. This was symptomatic of a deeper failure of leadership, giving rise to, and in turn compounded by, an inadequately resourced Biomedical Services senior management team. (ASC, 2014, p. 4)

9.46. In 2014, the current establishment licence holder at Imperial College stepped down from holding that responsibility with immediate effect at the insistence of the minister.

Conclusion

9.47. Some may argue that because some of the egregious practices that were brought to light were, to some degree, subsequently rectified, this shows how the system of regulation is effective. We cannot share that view. The point to grasp is that these abuses were brought to light only by undercover investigations. Without those investigations, the abuses almost certainly never would have been discovered, nor would remedial measures have been taken. And this is the even more pertinent point: these abuses happened despite the panoply of regulation in the UK, including detailed laws, the licensing system, the inspectorate, the ERPs, and the national advisory committee (APC/ASC). What these examples demonstrate is that even despite all these regulations, animals are not protected against egregious suffering in the UK, even in leading academic institutions that have a reputation for scientific excellence.

9.48. Another consideration also gives us pause. Often we are told that animals in laboratories are treated with scrupulous care and that every attempt is made by researchers and technicians to avoid animal suffering. For example, we are assured of the following:

> There is a consensus in the scientific community that accepts a moral imperative to fulfil the principle of humane experimental technique expounded upon by Russell and Burch, the 3Rs. In practice, conscientious researchers make every effort to observe the spirit of legislation … (Darling and Dolan, 2007)

But in the light of these undercover revelations, another interpretation presents itself – namely, that while some researchers may be conscientious in the discharge of their responsibilities, the prevailing institutional ethos is such that harm to 'laboratory animals' is counted as a small thing in comparison with the research work undertaken. Without accusing any researchers of callousness, we suggest that the predominant ethos – where animals are used for human ends – in laboratories works against the highest possible standards. As such, standards can only, at best, mitigate the suffering which can lawfully be inflicted on animals.

9.49. The ineluctable conclusion is not just that there were failures in the many examples cited, but that such failures are endemic in a system in which animals are seen and used as 'laboratory tools'. Animal experimentation is not adequately policed even by the supposedly highest standards of care and the greatest degree of regulation.

10. Consideration of counter-arguments

10.1. We now turn to a range of counter-arguments used to defend animal research and respond to them.

10.2. *Surely the answer to the lapses in control is better, more effective control.*
We have already detailed the many practical considerations that should make us wary of relying on putative controls. Indeed, the whole notion of control is grounded in a systemic mischaracterisation of the moral status of animals.

10.3. *Isn't it better to leave these matters to scientists who know more than we do?*
Scientists are often best equipped to answer factual questions about what sorts of experimentation are most likely to be effective. However, they are not best equipped to address the moral question of animal experimentation. Scientists are not experts on morality, and so on the topic of moral status, they have no particular expertise. Besides, there is a legitimate public interest in how animals are treated, not least of all because, inter alia, public money is used to fund scientific research.

10.4. *Humans have been given 'dominion' over animals, which means we can use them as we want.*
Dominion in its original context in Genesis chapter one certainly did not mean despotism or that humans could do as they please to animals. The biblical theology of the first creation saga in Genesis is that God created the world and all its plants and animals, who were blessed and given their own living space, and then humans were made in the image of God and given dominion. The ideas of imago dei and dominion need to be read together. God created a world, fashioned humans in the divine image, and then gave them responsibility to care for the world as God intended. Humans were the species commissioned to look after the earth and render an account to God. This is made explicit in Genesis 1.29, when having been made in the image and given dominion, humans are given a vegetarian diet. Herb-eating dominion can hardly be a licence for tyranny. The attempt, therefore, to interpret dominion as meaning that 'might is right' is a misreading of the first Genesis narrative. Not only is this the view of the original narrative; it is now the established view of biblical scholars (Jónsson, 1988, cited and discussed in Linzey, 2009b, pp. 28–29).

10.5. *How can we consistently oppose animal experiments in a society that accepts the killing of animals for food?*
We accept that the new ethical paradigm we have outlined will involve major changes to the way we treat animals, including those reared and killed for food. But we aver that there is still a distinction to be made between the two practices. Almost everyone who eats meat believes that animals may be killed but that this must be done 'humanely'. Whether it is possible to 'humanely' raise and kill billions of animals for food, especially in intensive conditions, is, of course, disputable, but at least in theory such a distinction is maintained.

10.6. In animal experiments, however, suffering is endemic. In most cases, it is a question of deliberately and intentionally causing harm. This is not some accidental or incidental feature of experimentation; it is rather inherent in the practice. Even when procedures do not deliberately involve suffering, suffering nevertheless is entailed in the practices of capture, trade, transport, confinement, and manipulation that animal experimentation involves. Even if, therefore, our sole concern is for the suffering of animals rather than their death, it follows that animal experimentation warrants particular censure and requires special justification, if any is possible.

10.7. *Are not those who oppose animal experiments guilty of intimidation, if not violence?*
We do not support violence, arson, intimidation, or illegality. We believe that the tiny number of activists who are involved in such activities are engaged in morally self-contradictory behaviour – self-contradictory because people who seek to justify such actions invariably appeal to the ends justifying the means, which is precisely the consequentialist rationale of researchers who use animals. Moreover, such tactics rob animal advocates of the moral high ground and are attempts (in democratic countries at least) to shortcut the system. But it should not be overlooked that research on animals regularly inflicts violence and suffering on millions of animals. While there can be no consequentialist justification for violent protests, by the same standard we should also reject consequentialist justifications for inflicting violence on animals in research.

10.8. *Cannot animal research be justified retrospectively in virtue of the advances in science during the last century?*
No, and for many reasons. It is difficult to assess how much of the progress has been due to animal research, and it is even more difficult to claim that we could not have had at least as much progress if all the time, money, and resources had been put into different kinds of research. Most fundamentally, this assumes a certain conception of justification that we should reject – that is, consequentialist justification. Should we torture innocent humans and place such scenes on TV if we know that this will drastically reduce the crime rate? Many would not be sanguine about this idea.

10.9. *Is it not better that these experiments take place in Britain where there are some controls rather than in other countries where there are few, if any, controls in place?*
Well, maybe it is 'better' (though some of us are not confident about that), but that hardly addresses the main point against invasive animal research. It is a bit like saying we should torture the innocent human only in Britain because there the torture will last only one hour, whereas in some other country the torture will last two hours. Just as we ought not to torture innocent humans, we ought not to conduct invasive research on animals. If we abolished such testing, there would be no issue of 'controls'.

10.10. *Did not the Nazi government ban experiments on animals?*
Heinrich Himmler, in his notorious Posen Speech of 1943, made a direct connection between the Final Solution and the Third Reich's supposedly enlightened laws regarding animal welfare:

> We shall never be rough or heartless where it is not necessary; that is clear. We Germans, who are the only people in the world who have a decent attitude to animals, will also adopt a decent attitude to these human animals, but it is a crime against our own blood to worry about them … (Himmler, 1943; Longerich, 2013)

10.11. In practice, the various animal welfare laws that were enacted under Nazi rule were not as comprehensive in their application as they were in their drafting. Experimentation on animals (as well as humans) continued, especially for military purposes. Despite his rhetoric, Himmler explicitly authorised experiments on animals (Delarue, 1964, p. 262). It is also the case, as just shown, that the Nazi protection of animals was a tool to justify a rather different approach to human beings (Sax, 2000). The simple claim, then, that the Nazis banned experiments on animals is untrue. More importantly, it is irrelevant. Just because someone espousing an evil ideology agrees with you on one issue does not mean you are wrong on that issue. It is always possible to find dubious fellow travellers on any issue.

10.12. *Animals lack the cognitive sophistication to have a sense of self or of time, and thus they cannot experience the higher-order suffering that humans can experience. Animals can experience pain, but humans – because of their higher-level cognitive capacities – experience suffering on top of that, so humans have more overall experience of pain. It follows that experimenting on animals is not morally comparable to experimenting on humans: we do not harm animals to the extent that we would harm humans subjected to the same treatment.*
The problem with this argument is that having higher-level cognitive capacities often serves to mitigate rather than increase one's overall experience of pain. Humans can, for instance, understand why they are experiencing pain and when it will cease in ways that beings without higher-level cognitive capacities cannot. Thus, in fact, pain may sometimes be worse for animals than for us. Sahar Akhtar writes,

> Beings with only a rudimentary sense of time and of self may be at the greatest disadvantage from pain. They may possess enough self- and time-awareness to suffer from the anticipation and memory of pain, but not enough to be able to discount pain, choose to refrain from focusing on pain, form expectations about the cessation of pain, or to consider other interests or times without pain. (Akhtar, 2011, p. 510)

10.13. *Are not people who oppose animal experiments obligated to forgo any benefits that might come from such experimentation or any products that have been tested on animals?*
There is certainly a strong case for avoiding cosmetics and other consumer products that have been tested on animals (within a specified time frame) as a means of supporting cruelty-free products or as a way of registering a protest. The same may be said of some other products that may help jolt pharmaceutical companies into rethinking current testing regimes. Many animal organisations have sponsored and organised such boycotts. But it would be impossible to stop using each and every product that has, at some time or another, been tested on animals for the simple reason that every commercial (and not even only commercial) product has been tested, at some time or another, on animals. The range of usage of animals is so extensive – including, but not limited to, fire-extinguisher substances, dyes, paints, hair sprays, weaponry, poisons, radiation, plastics, agrichemicals, and even vegetable and herbal products – that no one can live entirely free of products once tested on animals. The notorious LD50 poisoning test – designed to ascertain the dose at which 50 per cent of the animals to whom a substance is given die – has been carried out using water, the very stuff of life.

10.14. It should also be mentioned that experiments on human subjects have also resulted in some gains. These human subjects have ranged from children to people of colour, soldiers, prisoners of war, and the mentally challenged (Pappworth, 1969). For example, after the Second World War, the US government granted immunity to Japanese scientists who had performed grisly experiments on foreigners and prisoners of war in exchange for their research data on human adaptability to the environment (Whymant, 1982). It is more than likely that, directly or indirectly, such experiments on a variety of subjects have contributed to an increase in scientific knowledge of which most of us are the beneficiaries.

10.15. It does not follow, of course, then that even if these gains are ill-gotten, we should not make use of them. Even Nazi experiments on Jewish people (allegedly) produced some useful results. It is pusillanimous, therefore, to suggest, as have some scientists, that those who oppose animal experiments should forswear all its conceivably useful results. Since we live in a society where almost all usable substances – from soya beans to plain water – have been tested on animals, any attempt to do this would be impossible.

10.16. *Lord Winston has proposed that medical products should be labelled as 'tested on animals'. Do you agree?*
We welcome attempts at transparency and full disclosure. But if this is not just a publicity ploy or a back-door attempt to gain public acquiescence of animal experiments, then there needs to be *full* disclosure. People should be informed not only as to whether animals were used, but also as to what kinds of animals, how much suffering they had to undergo, what conditions they were kept in, and whether such experiments actually helped or hindered progress. By definition, one could not include all those animals – the vast majority – whose use has not led to a therapeutic product.

10.17. Moreover, why stop at 'medical' products? The whole gamut of commercially produced items, including household products, cosmetics, chemicals, weaponry, poisons, plastics, and the rest, should also be labelled. What logical grounds can there be for insisting that only some products be labelled and not others – unless, of course, the real purpose of the proposal is to co-opt unsuspecting (and largely unaware) patients into a moral acquiescence of the virtues of animal testing in the absence of proper evidence and discussion? (Winston, 2011, column 623, cited and discussed in Linzey and Cohn, 2012).

11. Summary and conclusions

11.1. *The deliberate and routine abuse of innocent, sentient animals involving harm, pain, suffering, stressful confinement, manipulation, trade, and death should be unthinkable. Yet animal experimentation is just that: the 'normalisation of the unthinkable'* (Peattie, 1984). It is estimated that 115.3 million animals are used in experiments worldwide per annum (2.5–2.8). In terms of harm, pain, suffering, and death, this constitutes one of the major moral issues of our time.

11.2. *This normalisation flies in the face of what is now known about the extent and range of how animals can be harmed.* The issue of the complexity of animal awareness, especially animal sentience (defined as the capacity to experience pain and pleasure), cannot be ignored. Unlike our forebears, we now know, as reasonably as we can know of humans, that animals (notably, mammals, birds, and reptiles) experience not only pain but also shock, fear, foreboding, trauma, anxiety, stress, distress, anticipation, and terror to a greater or lesser extent than humans do. This is the conclusion of many scientific books and scientific papers in peer-reviewed scientific journals (3.5–3.7).

11.3. *This normalisation is buttressed by an overconfidence in animal experiments as a scientific technique.* The current debate has been given new impetus by the new scientific critiques, especially in relation to the unreliability of animal experiments (4.2–4.7); the unpredictability of laboratory environments (4.8–4.10); the discordance between human diseases and 'animal models' of disease (4.11–4.13); interspecies differences in physiology and genetic function (4.14–4.22); and the development of more predictive human-based testing (4.23–4.28). The upshot is that it is no longer accurate or reasonable (if it ever was) to say that the only moral choice is between experimenting on animals and giving up on scientific progress (4.29).

11.4. *This normalisation is based on the discredited idea that animals are just tools for human use, means to human ends, fungible items, and commodities that can be treated and dispensed with as humans think fit.* During the last forty years, there has been considerable growth in intellectual work on the ethical status of animals. This new work has challenged the ideas that (i) humans should always have absolute priority in our moral thinking (moral anthropocentrism) (5.4–5.10); (ii) animals exist for human beings, to serve their interests and wants (instrumentalism) (5.11–5.20); and (iii) humans should be distinguished and separated from other animals in terms of a binary 'them' and 'us' (dualism), in which animals are inevitably denigrated (5.21–5.28).

11.5. *This normalisation is challenged by new moral thinking which centres around three positions*: (i) individual animals have worth in themselves. Sentient beings (beings capable of pleasure and pain) are not just things, objects, machines, or tools; they have their own interior life that deserves respect. This view extends to sentients as individuals not just as collectivities or as part of a community. (ii) Given the conceding of sentience, there can be no rational grounds for not taking animals' sentience into account or for excluding individual animals from the same basic moral consideration that we extend to individual human beings. And (iii) it follows that causing harm to individual sentient beings (except when it is for their own good – for example, in a veterinary operation), if not absolutely wrong, minimally requires strong moral justification. Indeed, some would argue that such acts of harming innocent (i.e., morally blameless) sentients is absolutely wrong (5.29).

11.6. *This normalisation is belied by rational factors that should commend animals as subjects of special moral solicitude:*

i. Animals cannot give or withhold their consent (5.31–5.45).
ii. They cannot represent or vocalise their own interests (5.46–5.47).
iii. They cannot understand or rationalise their suffering (5.48–5.52).
iv. They are morally innocent or blameless (5.53–5.54).
v. They are vulnerable and relatively defenceless (5.55–5.57).

These considerations make justifying harm to animals (like harm to human infants) especially difficult.

11.7. *This normalisation is based on flawed moral arguments*. We have examined three authoritative reports:

i. The UK government's Animal Procedures Committee (APC) (2003) argues that even if inflicting suffering is an 'intrinsic' wrong, it may not be an 'absolute' wrong if it can 'be shown to be the lesser of two wrongs that we have to choose between' (6.3–6.15). But that argument supposes what is in need of justification – namely, that there is a direct or immediate choice to be made, which is what the APC (elsewhere) acknowledges is extremely rare: 'in animal research we

are rarely, if ever, presented with the stark situation in which we can save the life of a child by taking the life of an animal' (6.9).

ii. The House of Lords Select Committee (2002) argues, inter alia, that humans are 'unique' and that 'therefore' they can utilise animals in experiments. But this is a non sequitur. What has to be shown is how humans are unique and how that justifies inferior moral treatment of animals (6.17–6.39).

iii. The Weatherall Committee (2006) argues, inter alia, that we are justified in experimenting on animals because, in the case of a hospital fire, we would 'intuitively' choose to save the human patients. But the conclusion does not follow. All that follows (if the results are to be believed) is that humans will in the given situation respond in that way. The scenario is by definition a limited crisis situation in which one has to make a direct choice. But to philosophise from that one situation, in which most people may choose to save fellow human beings, to a supposed duty to choose human beings in a wide range of normative situations, where there is no direct choice to be made, is logically fallacious (6.40–6.49).

11.8. *This normalisation is reinforced by the massive institutionalisation of animal experiments through (i) legislation (7.6–7.7); (ii) institutional and establishment thinking (7.8–7.11); (iii) public and private funding (7.12–7.13); (iv) the partiality of the media (7.14–7.15); and (iv) the language of experimentation, which obscures, justifies, exonerates, and minimises what actually takes place in laboratories (7.16–7.35).* The result of these factors is, inter alia, moral stagnation and resistance to change. We cannot avoid the conclusion that animal experimentation represents the institutionalisation of a pre-ethical view of animals.

11.9. *This normalisation is augmented by a range of regulations and controls, which in reality do very little to protect animals and indeed often do the reverse.* We have shown how inspection is flawed (8.2–8.12), how licensing creates a false sense of legitimacy (8.13–8.23), how supervised self-regulation in the EU is inadequate (8.24–8.35), how the Three Rs are not enforced (8.36–8.43), and how care and ethics committees do not provide a rigorous evaluation of proposals from an ethical perspective and are fundamentally flawed in not addressing the basic ethical issue (8.44–8.55). The Three Rs, which are endorsed by the EU and to which lip service is paid by governments (and which might have provided some impetus to change), are in practice massively underfunded, so that alternatives are the Cinderella of scientific research. Even where controls exist, we find them wanting (8.56). This is confirmed by disturbing evidence provided by undercover investigations (9.1–9.46).

11.10. *This normalisation is justified by the oft-repeated assertion that human interest requires such experiments, but it has to be questioned whether humans are ever benefited by the abuse of animals.* Humans can be harmed, for example, by desensitisation, loss of empathy, habituation, and denial. We now know that there is a strong link between animal abuse and violence to human beings (3.7–3.9). Also, the new scientific evidence must make us challenge the claim of utility, since we now know that many experiments have provided misleading or erroneous results (4.1–4.29). In addition, the very logic that would justify experiments on animals also justifies the practice in relation to humans, and of course, inter alia, prisoners of war, people of colour, Jewish people, and children have been made subject to experimentation (5.34–5.45; 6.27–6.29; 6.34–6.39).

11.11 This normalising of the unthinkable needs to be de-normalised and de-institutionalised. Ethical research techniques need to be fully institutionalised, and there should be a massive switch of funding to non-animal replacement techniques as a matter of urgency.

References and bibliography

Adam, C. L. Findlay, P. Aitken, R. Milne, J. and Wallace, J. 2012. In vivo changes in central and peripheral insulin sensitivity in a large animal model of obesity. *Journal of Endocrinology* 153(7), pp. 3147–3157.

Akhtar, A. 2012. *Animals and public health: Why treating animals better is critical to human welfare*. Basingstoke, UK: Palgrave Macmillan.

Akhtar, A. 2013. The need to include animal protection in public health policies. *Journal of Public Health Policy* 34(4), pp. 549–559.

Akhtar, A. Pippin, J. J. and Sandusky, C. B. 2008. Animal models in spinal cord injury: A review. *Reviews in the Neurosciences* 19(1), pp. 47–60.

Akhtar, S. 2011. Animal pain and welfare: Can pain sometimes be worse for them than for us? In: Beauchamp, T. L. and Frey, R. G. eds. *The Oxford handbook of animal ethics.* Oxford, UK: Oxford University Press, pp. 494–518.

Allen, A. 2006. Of mice and men: The problems with animal testing. *Slate* [Online] 1 June 2006. Available at: http://www.slate.com/articles/health_and_science/medical_examiner/2006/06/of_mice_or_men.html [Accessed: 13 May 2014].

Alzheimer's Research UK. [No date]. *Why research using animals can help defeat dementia* [Online]. Available at: http://www.alzheimersresearchuk.org/siteFiles/resources/documents/ALZ_Animalbooklet_FINALSINGLEST.pdf [Accessed: 3 January 2015].

Animal Procedures Committee (APC). 2003. *Review of cost-benefit assessment in the use of animals in research* [Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/119027/cost-benefit-assessment.pdf [Accessed: 29 September 2014].

Animal Procedures Committee (APC). 2004. *Report of the Animal Procedures Committee for 2003*. Home Office, UK.

Animals in Science Committee (ASC). 2014. L*essons to be learnt, for duty holders and the regulator, from reviews and investigations into non-compliance*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/326003/ASClessonsToBeLearnt2Jul14.pdf [Accessed: 4 January 2015].

Animals in Science Regulation Unit (ASRU). 2011. *Annual report.* The Home Office, UK.

Animals in Science Regulation Unit (ASRU). 2012. *Annual report.* The Home Office, UK.

Animals Scientific Procedures Inspectorate. 2010. *A review on the issues and concerns raised in the report, "The Ugly Truth – a BUAV investigation at Wickham Laboratories"*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/116820/wickham-laboratories.pdf [Accessed: 1 March 2015].

Aquinas, T. 1918. *Summa theologiae.* The English Dominican Fathers eds. New York, NY: Benzinger Brothers.

Aquinas, T. 1945. Summa contra gentiles. In: *Basic writings of Saint Thomas Aquinas.* Pegis, A. C. trans. New York, NY: Random House, Vol. 2.

Archibald, K. and Coleman, R. 2012. How human biology can prevent drug deaths. *New Scientist* [Online] 2895. Available at: http://www.newscientist.com/article/mg21628950.200-how-human-biology-can-prevent-drug-deaths.html#.VHcTvzGsWSp [Accessed: 27 November 2014].

Aristotle. 1915. Nicomachean ethics. In: *The works of Aristotle*. Ross, W. D. trans. London, UK: Oxford University Press.

Aristotle. 1985. *The politics*. Sinclair, T. A. trans. London, UK: Penguin.

Ascione, F. R. and Arkow, P. eds. 1999. *Child abuse, domestic violence, and animal abuse*. West Lafayette, IN: Purdue University Press.

Association of the British Pharmaceutical Industry. 2011. *Animals and medicines research: Animal research for the discovery and development of new medicines* [Online]. London, UK. Available at: http://www.abpi.org.uk/our-work/library/medical-disease/Documents/animals-medicines-research.pdf [Accessed: 9 May 2014].

Attarwala, H. 2010. TGN1412: From discovery to disaster. *Journal of Young Pharmacists* 2(3), pp. 332–336.

Badawy, A. B. A. Bano, S. and Steptoe, A. 2011. Trytophan in alcoholism treatment I: Kynurenine metabolites inhibit the rat liver mitochondrial low Km aldehyde dehydrogenase activity, elevate blood acetaldehyde concentration and induce aversion to alcohol. *Alcohol and Alcoholism* 46(6), pp. 651–660.

Bagot, M. 2014. Inside monkey testing centre where marmosets are given brain damage to help treat Parkinson's. *Daily Mirror* [Online]. Available at: http://www.mirror.co.uk/news/uk-news/see-inside-monkey-testing-centre-3618664#ixzz34DnWrccv [Accessed: 28 May 2014].

Bailey, J. 2008. An assessment of the role of chimpanzees in AIDS vaccine research. *Alternatives to Laboratory Animals* 36(4), pp. 381–428.

Bailey, J. Thew, M. and Balls, M. 2013. An analysis of the use of dogs in predicting human toxicology and drug safety. *Alternatives to Laboratory Animals* 41(5), pp. 335–350.

Bailey, J. Thew, M. and Balls, M. 2014. An analysis of the use of animal models in predicting human toxicology and drug safety. *Alternatives to Laboratory Animals* 42(3), pp. 181–199.

Baker, S. 1993. *Picturing the beast: Animals, identity and representation.* Chicago: University of Illinois Press.

Balcombe, J. P. Barnard, N. D. and Sandusky, C. 2004. Laboratory routines cause animal stress. *Contemporary Topics in Laboratory Animal Science* 43, pp. 42–51.

Baldwin, A. and Bekoff, M. 2007. Too stressed to work. *New Scientist* 194, p. 24.

Bandura, A. 1999. Moral disengagement in the perpetration of inhumanities. *Personality & Social Psychology Review* 3, pp. 193–209. Available at: http://www.uky.edu/~eushe2/Bandura/Bandura1999PSPR.pdf [Accessed: 27 November 2014].

Bandura, A. 2002. Selective moral disengagement in the exercise of moral agency. *Journal of Moral Education* 31(2), pp. 101–119. Available at: https://historicalunderbelly.files.wordpress.com/2009/11/bandura_moraldisengagement1.pdf [Accessed: 27 November 2014].

Banner, M. 1998. Ethics, society and policy: A way forward. In: Holland, A. and Johnson, A. eds. *Animal biotechnology and ethics.* London, UK: Chapman and Hall, pp. 325–329.

BBC Two. 2002. *Newsnight* 23 May 2002. Available at: http://news.bbc.co.uk/1/hi/programmes/newsnight/2005130.stm [Accessed: 10 February 2015].

Beirne, P. 1999. For a nonspeciesist criminology: Animal abuse as an object of study. *Criminology* 37(1), pp. 117–147.

Benton, T. 1998. Rights and justice on a shared planet: More rights or new relations? *Theoretical Criminology* 2(2), pp. 149–175.

Bernstein, M. 1998. *On moral considerability: An essay on who morally matters.* Oxford, UK: Oxford University Press.

Bernstein, M. 2004. *Without a tear: Our tragic relationship with animals.* Chicago: University of Illinois Press.

Blair, T. 2010. *A journey.* London, UK: Hutchinson.

British Heart Foundation. 2010. *Animals and heart research*. Leaflet.

British Pharmacological Society. 2013. *Why do we use animals in scientific research?* Available at: http://www.bps.ac.uk/details/pageContent/855663/Why_do_we_use_animals_in_research.html?cat=bps12aae254a00 [Accessed: 3 January 2015].

British Union for the Abolition of Vivisection (BUAV). 1992. *Briefing paper on the primate trade, role of Shamrock (Great Britain) Ltd and Hazleton UK.*

British Union for the Abolition of Vivisection (BUAV). 1993. A BUAV investigation at Wickham research laboratories. Unpublished report.

British Union for the Abolition of Vivisection (BUAV). 1999. A BUAV investigation at Harlan UK. Unpublished report.

British Union for the Abolition of Vivisection (BUAV). 2002. A BUAV investigation into marmoset neuroscience research at Cambridge University. Unpublished report.

British Union for the Abolition of Vivisection (BUAV). 2009. A BUAV investigation at Wickham research laboratories. Unpublished report.

British Union for the Abolition of Vivisection (BUAV). 2011. BUAV congratulates UK veterinary agency for removing obsolete batch animal tests. *Politics.co.uk.* Available at: http://www.politics.co.uk/opinion-formers/buav-british-union-for-the-abolition-of-vivisection/article/buav-congratulates-uk-veterinary-agency-for-removing-obsolet [Accessed: 1 March 2015].

British Union for the Abolition of Vivisection (BUAV). 2013. BUAV report to the Home Office: Animal experiments at Imperial College London. Unpublished report.

Brown press release. 2013. *Independent investigation into animal research at Imperial College published.* Available at: http://brownreport.info/wp-content/uploads/2014/02/Brownreportpressrelease.pdf [Accessed: 4 January 2015].

Brown Report. 2013. Independent investigation into animal research at Imperial College London. Available at: http://brownreport.info/wp-content/uploads/2014/02/The-Brown-Report.pdf [Accessed: 4 January 2015].

Bruins, M. J. Vente-Spreeuwenberg, M. A. M. Smits, C. H. and Frenken, L. G. J. 2011. Black tea reduces diarrhoea prevalence but decreases growth performance in enterotoxigenic Escherichia coli-infected post-weaning piglets. *Journal of Animal Physiology and Animal Nutrition* 95(3), pp. 388–398.

Brydges, N. M. Hall, L. Nicolson, R. Holmes, M. C. and Hall, J. 2012. The effects of juvenile stress on anxiety, cognitive bias and decision making in adulthood: A rat model. *PLoS One 7*(10), e48143.

Carruthers, P. 1989. Brute experience. *Journal of Philosophy* 86(5), pp. 258–269.

Carruthers, P. 2011. Animal mentality: Its character, extent, and moral significance. In: Beauchamp, T. L. and Frey, R. G. eds. *The Oxford handbook of animal ethics.* Oxford, UK: Oxford University Press, pp. 373–406.

Cavalieri, P. 2006. The animal debate: A reexamination. In: Singer, P. ed. *In defence of animals: The second wave.* Malden, MA: Blackwell Publishing, 2006, pp. 54–68.

Center for Responsive Politics. 2014. *Pharmaceuticals/health products: Long-term contribution trends* [Online]. Available at: http://www.opensecrets.org/industries/totals.php?cycle=2014&ind=H04 [Accessed: 9 May 2014].

Charles River Laboratories. 2014a. *Basic research* [Online]. Available at: http://www.criver.com/products-services/basic-research [Accessed: 23 June 2014].

Charles River Laboratories. 2014b. *Ocular toxicology* [Online]. Available at: http://www.criver.com/products-services/safety-assessment/toxicology/ocular-toxicology [Accessed: 23 June 2014].

Cherednichenko, G. Zhang, R. Bannister, R. A. Timofeyev, V. Li, N. Fritsch, E. B. Feng, W. Barrientos, G. C. Schebb, N.

H. Hammock, B. D. Beam, K. G. Chiamvimonvat, N. and Pessah, I. N. 2012. Triclosan impairs excitation-contraction coupling and Ca2+ dynamics in striated muscle. *Proceedings of the National Academy of Sciences* 109(35), pp. 14158–14163.

Chomsky, N. 1992. *Chronicles of dissent: Interviews with David Barsamian.* Monroe, ME: Common Courage.

Chomsky, N. 2003. *Understanding power: The indispensable Chomsky.* Mitchell, P. R. and Schoeffel, J. eds. London, UK: Vintage.

Clemedson, C. McFarlane-Abdulla, E. Andersson, M. Barile, F. A. Calleja, M. C. Chesné, C. Clothier, R. Cottin, M. Curren, R. Dierickx, P. Ferro, M. Fiskesjö, G. Garza-Ocanas, L. Gómez-Lechón, M. J. Gülden, M. Isomaa, B. Janus, J. Judge, P. Kahru, A. Kemp, R. B. Kerszman, G. Kristen, U. Kunimoto, M. Kärenlampi, S. Lavrijsen, K. Lewan L. Lilius, H. Malmsten, A. Ohno, T. Persoone, G. Pettersson, R. Roguet, R. Romert, L. Sandberg, M. Sawyer, T. Seibert, H. Shrivastava, R. Sjöström, M. Stammati, A. Tanaka, N. Torres Alanis, O. Voss, J-U. Wakuri, S. Walum, E. Wang, X. Zucco, F. and Ekwall, B. 1996. MEIC evaluation of acute systemic toxicity. Part II. In vitro results from 68 toxicity assays used to test the first 30 reference chemicals and a comparative cytotoxicity analysis. *Alternatives to Laboratory Animals* 24(Suppl. 1), pp. 273–311.

Clemedson, C. E. Barile, F. A. Chesne, C. Cottin, M. Curren, R. Eckwall, B. Ferro, M. Gomez-Lechon, M. J. Imai, K. Janus, J. Kemp, R. B. Kerszman, G. Kjellstrand, P. Lavrijsen, K. Logemann, P. McFarlane-Abdulla, E. Roguet, R. Segner, H. Thuvander, A. Walum, E. and Ekwall, B. 2000. MEIC evaluation of acute systemic toxicity. Part VII. Prediction of human toxicity by results from testing of the first 30 reference chemicals with 27 further in vitro assay. *Alternatives to Laboratory Animals* 28, pp. 161–200.

Coates, P. J. Appleyard, M. V. Murray, K. Ackland, C. Gardner, J. Brown, D. C. Adamson, D. J. Jordan, L. B. Purdie, C. A. Munro, A. J. Wright, E. G. Dewar, J. A. and Thompson, A. M. 2010. Differential contextual responses of normal human breast epithelium to ionizing radiation in a mouse xenograft model. *Cancer Research* 70(23), pp. 9808–9815.

Cohen, B. J. and Loew, F. M. 1984. Laboratory animal medicine: Historical perspectives. In: Fox, J. G. Cohen, B. J. and Loew, F. M. eds. *Laboratory animal medicine.* New York, NY: Academic Press, pp. 1–18.

Creamer, J. 2013. Freedom of information. In: Linzey, A. ed. 2013. *The global guide to animal protection.* Chicago: University of Illinois Press.

Curry, S. H. 2003. Why have so many drugs with stellar results in laboratory stroke models failed in clinical trials? A theory based on allometric relationships. *Annals of the New York Academy of Sciences* 993, pp. 69–74.

Darling, F. and Dolan, K. P. 2007. Animals in cancer research. *AnimalResearch.Info* [Online]. Available at: http://www.animalresearch.info/en/medical-advances/articles-lectures/animals-cancer-research/ [Accessed: 3 January 2015].

Darwin, C. 1872. *The expression of the emotions in man and animals.* London, UK: John Murray. Available at: http://darwin-online.org.uk/content/frameset?itemID=F1142&viewtype=side&pageseq=1 [Accessed: 11 August 2014].

DeGrazia, D. 1996. *Taking animals seriously: Mental life and moral status.* Cambridge, UK: Cambridge University Press.

Delarue, J. 1964. *The history of the Gestapo.* Savill, M. trans. London, UK: Macdonald and Co.

Derrida, J. 2004a. The animal that therefore I am (more to follow). In: Atterton, P. and Calarco, M. eds. A*nimal philosophy: Essential readings in continental thought.* London, UK: Continuum, pp. 113–128.

Derrida, J. 2004b. Violence against animals. In: Derrida, J. and Roudinesco, E. *For what tomorrow … A dialogue.* Fort, J. trans. Stanford, CA: Stanford University Press, pp. 62–76.

Dirnagl, U. 2006. Bench to bedside: The quest for quality in experimental stroke research. *Journal of Cerebral Blood Flow and Metabolism* 26, pp. 1465–1478.

Dolan, S. Gunn, M. D. Crossan, C. and Nolan, A. M. 2011. Activation of metabotropic glutamate receptor 7 in spinal cord

inhibits pain and hyperalgesia in a novel formalin model in sheep. *Behavioural Pharmacology* 22, pp. 582–588.

Dorri, M. Shahrabi, S. and Navabazam, A. 2010. Comparing the effects of chlorhexidine and persica on alveolar bone healing following tooth extraction in rats, a randomised controlled trial. *Clinical Oral Investigation* 16(1), pp. 25–31.

Dunayer, J. 2001. *Animal equality: Language and liberation.* Derwood, MD: Ryce Publishing.

Duncker, S. C. Philippe, D. Martin-Paschoud, C. Moser, M. Mercenier, A. and Nutten, S. 2012. *Nigella sativa* (black cumin) seed extract alleviates symptoms of allergic diarrhoea in mice, involving opioid receptors. *PLoS One* 7(6), e39841.

Dunstan, G. R. 1974. *The artifice of ethics.* London, UK: SCM.

European Chemicals Agency (ECHA). 2013. *Guidance in a nutshell: Registration* [Online]. Available at: http://echa.europa.eu/documents/10162/13632/nutshell_guidance_registration_en.pdf [Accessed: 3 January 2015].

European Chemicals Agency (ECHA). [No date]. *What about animal testing?* [Online]. Available at: http://echa.europa.eu/chemicals-in-our-life/animal-testing-under-reach [Accessed: 9 May 2014].

European Commission. 1986. *Council Directive 86/609/EEC of 24 November 1986 on the approximation of laws, regulations and administrative provisions of the Member States regarding the protection of animals used for experimental and other scientific purposes.*

European Commission. 1997. *Glossary of terms and guidelines for statistical tables by Member States.* XI/411/97.

European Commission. 2010. *Eurobarometer science and technology report* [Online]. Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_340_en.pdf [Accessed: 9 May 2014].

European Parliament. 2010. *Directive 2010/63/EU of the European Parliament and of the council of 22 September 2010 on the protection of animals used for scientific purposes.* Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0063&from=EN [Accessed 3 January 2015].

Fairclough, N. 1992. *Discourse and social change.* Cambridge, UK: Polity Press.

Fairclough, N. 2001. *Language and power.* 2nd ed. Harlow, UK: Pearson Education.

Flynn, C. P. 2008. A sociological analysis of animal abuse. In Ascione, F. R. ed. *The international handbook on animal abuse and cruelty: Theory, research and application.* West Lafayette, IN: Purdue University Press, pp. 155–174.

Flynn, C. P. 2011. Examining the links between animal abuse and human violence. *Crime, Law, and Social Change* (Special issue: Animal Abuse and Criminology) 55, pp. 453–468.

Freiberg, A. 2010. *The tools of regulation.* New South Wales, Australia: The Federation Press.

Frey, R. G. 1983. *Rights, killing and suffering.* Oxford, UK: Basil Blackwell.

Gaffney, J. 1986. The relevance of animal experimentation to Roman Catholic methodology. In: Regan, T. ed. *Animal sacrifices: Religious perspectives on the use of animals in science.* Philadelphia, PA: Temple University Press.

Galgut, E. 2015. Raising the bar in the justification of animal research. J*ournal of Animal Ethics* 5(1), pp. 5–19.

Garner, J. Watts, S. Parry, C. Bird, J. Cooper, G. and Kirkman, E. 2010. Prolonged permissive hypotensive resuscitation is associated with poor outcome in primary blast injury with controlled haemorrhage. *Annals of Surgery* 251(6), pp. 1131–1139.

Garner, J. P. 2005. Stereotypies and other abnormal repetitive behaviors: potential impact on validity, reliability, and replicability of scientific outcomes. *Institute for Laboratory Animal Research Journal* 46(2), pp. 106–117.

Garner, R. 2005. *Animal ethics.* Cambridge, UK: Polity.

Garrett, J. R. 2012. *The ethics of animal research: An overview of the debate.* In: Garrett, J. R. ed. The ethics of animal research: Exploring the controversy. Cambridge, MA: MIT Press.

Gee, J. P. 1996. *Social linguistics and literacies: Ideologies in discourses.* 2nd ed. London, UK: Routledge.

Ghooi, R. B. 2011. The Nuremberg Code – A critique. *Perspectives on Clinical Research* 2(2), pp. 72–76.

Godlee, F. 2014. How predictive and productive is animal research? *British Medical Journal* 348(3719).

Goldacre, B. 2012. *Bad pharma: How medicine is broken, and how we can fix it.* London, UK: Fourth Estate.

Gombay, A. 2007. *Descartes.* Oxford, UK: Blackwell.

Goodman, J. R. Casey, B. A. and Cherry, E. 2012. Mounting opposition to vivisection. *Contexts* 11(2), pp. 68–69.

Grodin, M. A. and Glantz, L. H. 1994. *Children as research subjects: Science, ethics and law.* Oxford, UK: Oxford University Press.

Gross, D, M. 2010. Defending the humanities with Charles Darwin's *The expression of the emotions in man and animals* (1872). *Critical Inquiry* 37, pp. 34–59. Available at: http://iicas.ucsd.edu/_files/conferences/science-emotions/abstracts/Gross_abstract.pdf [Accessed: 11 August 2014].

Guerrini, A. 2007. Natural history, natural philosophy and animals, 1600–1800. In: Senior, M. ed. *A cultural history of animals in the age of enlightenment.* Oxford, UK: Berg, pp. 121–144.

Gullone, E. 2012. *Animal cruelty, antisocial behaviour, and aggression: More than a link.* Basingstoke, UK: Palgrave Macmillan.

Haldane, E. S. and Ross, G. R. T. eds. 1950. *Discourse on method in philosophical works of Descartes.* London, UK: Cambridge University Press.

Halliday, M. A. K. and Matthiessen, C. 2004. *An introduction to functional grammar.* 3rd ed. London, UK: Hodder Arnold.

Hampton T. 2006. Targeted cancer therapies lagging. Better trial design could boost success rate. *Journal of the American Medical Association* 296(16), pp. 1951–1952.

Hanke T. 2006. Lessons from TGN1412. *Lancet* 368(9547), pp. 1569–1570.

Hansen, L. A. 2013. Institution animal care and use committees need greater ethical diversity. *Journal of Medical Ethics* 39(3), pp. 188–190.

Hansen, L. A. Goodman, J. R. and Chanda, A. 2012. Analysis of animal research ethics committee membership at American institutions. *Animals* 2(1), pp. 68–75.

Hare, R. M. 1981. *Moral thinking: Its levels, method, and point.* Oxford, UK: Oxford University Press.

Hart, P. C. Bergner, C. L. Dufour, B. D. Smolinsky, A. N. Egan, R. J. LaPorte, J. L. and Kalueff, A. V. 2009. Analysis of abnormal repetitive behaviors in experimental animal models. In: Warnik, J. E. and Kauleff, A. V. eds. *Translational neuroscience in animal research: Advancement, challenges, and research ethics.* New York, NY: Nova Science Publishers, pp. 71–82.

Hart, W. Albarracín, D. Eagly, A. H. Brechan, I. Lindberg, M. Lee, K. and Merrill, L. 2009. Feeling validated versus being correct: A meta-analysis of selective exposure to information. *Psychological Bulletin* 135, pp. 555–588.

Health Research Extension Act of 1985. Public law 99-158. Available at: http://grants.nih.gov/grants/olaw/references/hrea1985.htm [Accessed: 9 May 2014].

Heffernan, M. 2011. *Willful blindness: Why we ignore the obvious at our peril.* New York, NY: Walker and Company.

Himmler, H. 1943. Audio excerpts from the speech given by Heinrich Himmler to SS group leaders in Posen, occupied Poland. Holocaust Timeline. *The History Place* [Online]. Available at: http://www.historyplace.com/worldwar2/holocaust/h-posen.htm [Accessed: 29 September 2014].

Hobbes, T. 1841. De Cive [1642]. In: Molesworth, W. ed. *The English works of Thomas Hobbes of Malmesbury.* London, UK: John Bohn, Vol. 2.

Hoggan, G. 1875. Letter. *Morning Post* 2 February 1875.

Home Office. 1986. *Animals (Scientific Procedures) Act 1986.* London, UK. Available at: http://www.legislation.gov.uk/ukpga/1986/14/contents [Accessed: 26 September 2014].

Home Office. 1989. *The Home Office code of practice for the housing and care of animals used in scientific procedures.* London, UK.

Home Office. 2000. *Guidance on the operation of the Animals (Scientific Procedures) Act 1986.* 23 March 2000. London, UK: The Stationery Office. HC321. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228542/0321.pdf [Accessed: 26 September 2014].

Home Office. 2012a. *Animals (Scientific Procedures) Act 1986 amendment regulations 2012.* London, UK. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265691/Animals__Scientific_Procedures__Act_1986.pdf [Accessed: 6 February 2015].

Home Office. 2012b. *Annual statistics of scientific procedures on living animals Great Britain 2012.* London, UK.

Home Office. 2013. *Annual statistics of scientific procedures on living animals Great Britain 2013.* London, UK.

Home Office. 2014a. *Animals in Science Regulation Unit: Annual report 2013.* London, UK.

Home Office. 2014b. *Consultation on the review of section 24 of the Animals (Scientific Procedures) Act 1986.* London, UK.

Home Office. 2014c. *Report of ASRU investigation into compliance.* Ref: A8(1). London, UK.

Horrobin, D. F. 2003. Modern biomedical research: An internally self-consistent universe with little contact with medical reality? *Nature Reviews Drug Discovery* 2, pp. 151–154.

House of Lords. 2002. Select committee on animals in scientific procedures. London, UK. Available at: http://www.publications.parliament.uk/pa/ld200102/ldselect/ldanimal/150/150.pdf [Accessed: 29 September 2014].

Hume, D. 1902. *Enquiry concerning the principles of morals* [1751]. Selby-Brigge, L. A. ed. Oxford, UK: Clarendon Press.

Hunt, P. A. Lawson, C. Gieske, M. Murdoch, B. Smith, H. Marre, A. Hassold, T. and VandeVoort, C. A. 2012. Bisphenol A alters early oogenesis and follicle formation in the fetal ovary of the rhesus monkey. *Proceedings of the National Academy of Sciences* 109(43), pp. 17525–17530.

Hursthouse, R. 2011. Virtue ethics and the treatment of animals. In: Beauchamp, T. L. and Frey, R. G. eds. *The Oxford handbook of animal ethics.* Oxford, UK: Oxford University Press, pp. 119–143.

Hussain, W. Patel, P. M. Chowdury, R. Cabo, C. Ciaccio, E. J. Lab, M. J. Duffy, H. S. Wit, A. L. and Peters, N. S. 2010. The renin-angiotensin system mediates the effects of stretch on conduction velocity, connexin43 expression, and redistribution in intact ventricle. *Journal of Cardiovascular Electrophysiology* 21(11), pp. 1276–1283.

Irving, D. N. 2013. Need to know: Nuremberg Code, Declaration of Helsinki, Belmont Report, OHRP. *Life Issues* [Online].

Available at: http://www.lifeissues.net/writers/irv/irv_214needtoknow.html [Accessed: 27 November 2014].

John Paul II. 1993. *Veritatis splendor. Encyclical letter.* London, UK: Catholic Truth Society.

Jónsson, G. A. 1988. *The image of God: Genesis 1:26–28 in a century of Old Testament research.* Lund, Sweden: Almqvist and Wiksell International.

Jorgensen, M. and Phillips, L. 2002. *Discourse analysis as theory and method.* London, UK: Sage.

Kamberov, Y. G. Wang, S. Tan, J. Gerbault, P. Wark, A. Tan, L. Yang, Y. Li, S. Tang, K. Chen, H. Powell, A. Itan, Y. Fuller, D. Lohmueller, J. Mao, J. Schachar, A. Paymer, M. Hostetter, E. Byrne, E. Burnett, M. McMahon, A. P. Thomas, M. G. Lieberman, D. E. Jin, L. Tabin, C. J. Morgan, B. A. and Sabeti, P. C. 2013. Modelling recent human evolution in mice by expression of a selected EDAR variant. *Cell* 152, pp. 691–702.

Kant, I. 1963. *Lectures on ethics: Duties towards animals and other spirits.* Infield, L. trans. New York, NY: Harper and Row.

Kant, I. 1965. *Metaphysics of morals.* Ladd, J. trans. New York, NY: Bobbs-Merrill.

Kean, H. 1998. *Animal rights: Political and social change in Britain since 1800.* London, UK: Reaktion Books.

Knight, A. 2011. *The costs and benefits of animal experiments.* Basingstoke, UK: Palgrave Macmillan.

Knight, A. 2012. Weighing the costs and benefits of animal experiments. *Altex Proceedings* 1/12, Proceedings of WC8: 289–294.

Korsgaard, C. 2011. Interacting with animals: A Kantian account. In: Beauchamp, T. L. and Frey, R. G. eds. *The Oxford handbook of animal ethics.* Oxford, UK: Oxford University Press, pp. 91–118.

Kuhn, T. S. 2012. *The structure of scientific revolutions.* 15th anniversary ed. Chicago, IL: University of Chicago Press.

Kurth, T. B. Dell'Accio, F. Crouch, V. Augello, A. Sharpe, P. T. and De Bari, C. 2011. Functional mesenchymal stem cell niches in adult mouse knee joint synovium in vivo. *Arthritis & Rheumatology* 63(5), pp. 1289–1300.

LaFollette, H. 2011. Animal experimentation in biomedical research. In: Beauchamp, T. L. and Frey, R. G. eds. *The Oxford handbook of animal ethics.* Oxford, UK: Oxford University Press, pp. 796–825.

LaFollette, H., and Shanks, N. 1993. Animal models in biomedical research: Some epistemological worries. *Public Affairs Quarterly* 7, pp. 113–130.

LaFollette, H. and Shanks, N. 1996. *Brute science: Dilemmas of animal experimentation.* London, UK: Routledge.

Lansbury, C. 1985. *The old brown dog: Women, workers, and vivisection in Edwardian England.* Madison: University of Wisconsin Press.

Lederer, S. 1995. *Subjected to science: Human experimentation in America before the Second World War.* Baltimore, MD: Johns Hopkins University Press.

Ledford, H. 2009. Flaws found in mouse model of diabetes. *Nature* [Online]. Available at: http://www.nature.com/news/2009/090528/full/news.2009.523.html [Accessed: 13 May 2014].

Lenz, W. 1962. Thalidomide and congenital anomalies. *The Lancet* 279 (7219), pp. 45–46.

Lewis, C. S. 1947. *Vivisection.* Boston, MA: New England Anti-Vivisection Society.

Lewis, D. Y. and Brett, R. R. 2010. Activity-based anorexia in C57/BL6 mice: Effects of the phytocannaboid, delta-9-tetrahydrocannabinol (THC) and the anandamide analogue, OMDM-2. *European Neuropsychopharmacology* 20, pp.

622–631.

Linzey, A. 1994. *Animal theology.* London, UK: SCM Press.

Linzey, A. 2007. *Creatures of the same God: Explorations in animal theology.* Winchester, UK: Winchester University Press.

Linzey, A. ed. 2009a. *The link between animal abuse and human violence.* Brighton, UK: Sussex Academic Press.

Linzey, A. 2009b. *Why animal suffering matters: Philosophy, theology, and practical ethics.* Oxford, UK: Oxford University Press.

Linzey, A. ed. 2013. *The global guide to animal protection.* Chicago: University of Illinois Press.

Linzey, A. and Clarke, P. B. 2004. *Animal rights: A historical anthology.* New York, NY: Columbia University Press.

Linzey, A. and Cohn, P. N. 2012. Wanted: Full disclosure. Editorial. *Journal of Animal Ethics* 2(2), pp. v–vii.

Linzey, A. and Waldau, P. 1996. Speciesism. In: Clarke, P. B. and Linzey, A. eds. 1996. *Dictionary of ethics, theology and society.* London, UK: Routledge, pp. 788–792.

Linzey, A. and Yamamoto, D. 1998. *Animals on the agenda: Questions about animals for theology and ethics.* London, UK: SCM Press.

Linzey, C. 2014. Animals in Catholic thought: A new sensitivity? In: Wróbel, S. ed. *The animals in us: We in animals.* Frankfurt, Germany: Peter Lang, pp. 187–202.

Lockwood, R. and Church, A. W. 2009. An FBI perspective on animal cruelty: Alan C. Brantley interviewed by Randall Lockwood and Ann W. Church. In: Linzey, A. ed. 2009. *The link between animal abuse and human violence.* Brighton, UK: Sussex Academic Press, pp. 223–227.

Longerich, P. 2013. *Heinrich Himmler.* Oxford, UK: Oxford University Press.

Lutz, C. Well, A. and Novak, M. 2003. Stereotypic and self-injurious behavior in rhesus macaques: A survey and retrospective analysis of environment and early experience. *American Journal of Primatology* 60(1), pp. 1–15.

MacKenzie, C. 2014. The importance of relational autonomy and capabilities for an ethics of vulnerability. In: MacKenzie, C. Rogers, W. and Dodds, S. eds. *Vulnerability: New essays in ethics and feminist philosophy.* Oxford, UK: Oxford University Press, pp. 33–59.

Mahaffy, J. P. 1901. *Descartes.* London, UK: Blackwood.

Mason, P. 1997. *The brown dog affair: The story of a monument that divided the nation.* London, UK: Two Sevens Publishing.

MatTek Corporation. 2008. Reports presented at the annual Society of Toxicology meeting in Seattle, March 16–20, 2008 [Online]. Available at: www.mattek.com [Accessed: 20 July 2008].

Mayor, S. 2008. Researchers refine in vitro test that will reduce risk of 'first in humans' drug trial. *British Medical Journal* 337(a), p. 3016.

McBride, W. G. 1961. Thalidomide and congenital abnormalities. Letter. *Lancet* 278(7216), p. 1358.

McMillan, F. D. 2012. What dictionary are animal researchers using? *Journal of Animal Ethics* 2(1), pp. 1–5.

Midgley, M. 2004. *The myths we live by.* London, UK: Routledge.

Mitchell, L. R. 2012. Nonhumans and the ideology of purpose. *Anthrozoos* 25(4), pp. 491–502.

Mogil, J. S. Wilson, S. G. Bon, K. Lee, S. E. Chung, K. Raber, P. Pieper, J. O. Hain, H. S. Belknap, J. K. Hubert, L. Elmer, G. I. Chung, J. M. and Devor, M. 1999. Heritability of nociception I: Responses of 11 inbred mouse strains on 12 measures of nociception. *Pain* 80(1–2), pp. 67–82.

Molloy, C. 2011. *Popular media and animals.* Basingstoke, UK: Palgrave Macmillan.

Morgan, K. N. and Tromborg, C. T. 2007. Sources of stress in captivity. *Applied Animal Behaviour Science* 102(3–4), pp. 262–302.

Moss, S. 2011. *Birds Britannia: Why the British fell in love with birds.* London, UK: Collins.

Mumford, H. Docx, C. J. Price, M. E. Green, A. C. Tattersall, J. E. H. and Armstrong, S. J. 2013. Human plasma-derived BuChE as a stoichiometric bioscavenger for treatment of nerve agent poisoning. *Chemico-Biological Interactions* 203(1), pp. 160–166.

National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research. 1979. *The Belmont Report: Ethical principles and guidelines for the protection of human subjects of research* [Online]. US Department of Health and Human Services. Available at: http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html [Accessed: 27 November 2014].

Nature. 2011. Animal rights and wrongs. Editorial. *Nature* 470, p. 435. Available at: http://www.nature.com/nature/journal/v470/n7335/full/470435a.html [Accessed: 24 February 2011].

Nelson, S. L. 2011. The connection between animal abuse and family violence: A selected annotated bibliography. *Animal Law Review* 17(2), pp. 369–414.

Nibert, D. 2002. *Animal rights/human rights: Entanglement of oppression and liberation.* Plymouth, UK: Rowman and Littlefield.

Niu, Y. Shen, B. Cui, Y. Chen, Y. Wang, J. Wang, L. Kang, Y. Zhao, X. Si, W. Li, W. Xiang, A. P. Zhou, J. Guo, X. Bi, Y. Si, C. Hu, B. Dong, G. Wang, H. Zhou, Z. Li, T. Tan, T. Pu, X. Wang, F. Ji, S. Zhou, Q. Huang, X. Ji, W. and Sha, J. 2014. Generation of gene-modified cynomolgus monkey via Cas9/RNA-mediated gene targeting in one-cell embryos. *Cell* 156(4), pp. 836–843.

Nuffield Council on Bioethics. 2005. *The ethics of research involving animals* [Online]. Available at: http://nuffieldbioethics.org/wp-content/uploads/The-ethics-of-research-involving-animals-full-report.pdf [Accessed: 13 May 2014].

Nuremberg Code. 1949. *Trials of war criminals before the Nuremberg military tribunals under Control Council Law No. 10.* Washington, DC: US Government Printing Office, Vol. 2, pp. 181–182. Available at: http://www.hhs.gov/ohrp/archive/nurcode.html [Accessed 2 January 2015].

Omoe, H. 2006. Recent trends in animal experimentation in Japan: On the revision and implementation of the law for the humane treatment and management of animals. *Quarterly Review* 21, pp. 13–31.

Online Investor. 2008. *Company spotlight – Charles River Laboratories (NYSE: CRL)* [Online]. Available at: http://www.theonlineinvestor.com/orphans/articles/charles_river_laboratories.html [Accessed: 9 May 2014].

Oram, M. W. 2011. Visual stimulation decorrelates neuronal activity. *Journal of Neurophysiology* 105, pp. 942–957.

Palazzini, P. ed. 1962. *Dictionary of moral theology.* London, UK: Burns and Oates.

Palfreyman, M. G. Charles, V. and Blander, J. 2002. The importance of using human-based models in gene and drug discovery. *Drug Discovery World* [Online]. Available at: http://www.ddw-online.com/fall-2002/p148472-the-importance-of-using-human-based-models-in-gene-and-drug-discovery.html [Accessed: 13 May 2014].

Pappworth, M. H. 1969. *Human guinea pigs: Experimentation on man.* London, UK: Penguin.

Passingham, R. E. 2006. The need for research on non-human primates in cognitive neuroscience. *AnimalResearch.Info* [Online]. Available at: http://www.animalresearch.info/en/medical-advances/articles-lectures/the-need-research-non-human-primates-cognitive-neuroscience/ [Accessed: 3 January 2015].

Peattie, L. 1984. Normalizing the unthinkable. *Bulletin of Atomic Scientists*, pp. 32–36.

Peggs, K. Forthcoming. *Experiments, animal bodies and human values.* Farnham, UK: Ashgate.

Peggs, K. and Smart, B. Forthcoming. Nonhuman animal suffering: Critical pedagogy and practical animal ethics. *Society and Animals.*

Perel, P. Roberts, I. Sena, E. Wheble, P. Briscoe, C. Sandercock, P. Macleod, M. Mignini, L. E. Jayaram, P. and Khan, K. S. 2007. Comparison of treatment effects between animal experiments and clinical trials: Systematic review. *British Medical Journal* 334(7586), p. 197.

Pippin, J. 2013. Animal research in medical sciences: Seeking a convergence of science, medicine, and animal law. *South Texas Law Review* 54, pp. 469–511.

Plous, S. and Herzog, H. 2001. Reliability of protocol reviews for animal research. *Science* 293, pp. 608–609.

Pope, A. 1950. Of cruelty to animals. In: Vallance, R. ed. *A hundred English essays.* London, UK: Thomas Nelson.

Pound, P. Bracken M. B. and Bliss, S. D. 2014. Is animal research sufficiently evidence based to be a cornerstone of biomedical research? *British Medical Journal* 348(3387).

Preece, R. 2002. *Awe for the tiger, love for the lamb: A chronicle of sensibility to animals.* Vancouver, Canada: University of British Columbia Press.

Pronin, E. Gilovich, T. and Ross, L. 2004. Objectivity in the eye of the beholder: Divergent perceptions of bias in self versus others. *Psychological Review* 111(3), pp. 781–799.

Pyszcynski, T. Greenberg, J. and Holt, K. 1985. Maintaining consistency between self-serving beliefs and available data: A bias in information evaluation. *Personality and Social Psychology Bulletin* 11, pp. 179–190.

Raven, C. 1927. *The creator spirit.* London, UK: Longmans.

Rawls, J. 1972. *A theory of justice.* Oxford, UK: Oxford University Press.

Regan, T. 1983. *The case for animal rights.* London, UK: Routledge and Kegan Paul.

Rollin, B. E. 1990. *The unheeded cry: Animal consciousness, animal pain and science.* Oxford, UK: Oxford University Press.

Rowlands, M. 1998. *Animal rights: A philosophical defence.* 2nd rev. ed. Basingstoke, UK: Palgrave Macmillan.

Rowlands, M. 2002. *Animals like us.* London, UK: Verso.

Rowlands, M. 2009. *Animal rights: Moral theory and practice.* Basingstoke, UK: Palgrave Macmillan.

Rowlands, M. 2012. *Can animals be moral?* Oxford, UK: Oxford University Press.

Royal Society. 2001. *Use of genetically modified animals.* London, UK. Available at: https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2001/10026.pdf [Accessed: 29 September 2014].

Russell, W. M. S. and Burch, R. L. 1959. *The principles of humane experimental technique.* London, UK: Methuen and Co.

Ryder, R. D. 1983. *Victims of science: The use of animals in research.* Rev. ed. London, UK: National Anti-Vivisection Society.

Sax, B. 2000. *Animals in the Third Reich: Pets, scapegoats, and the Holocaust.* New York, NY: Continuum.

Scerri, C. Stewart, C. A. Balfour, D. J. K. and Breen, K. C. 2012. Nicotine modifies in vivo and in vitro rat hippocampal amyloid precursor protein processing in young but not old rats. *Neuroscience Letters* 514(1), pp. 22–26.

Schofield, P. Pease-Watkin, C. and Blamires, C. 2002. *The collected works of Jeremy Bentham: Rights, representation, and reform: Nonsense upon stilts and other writings on the French Revolution.* Oxford, UK: Oxford University Press.

Schweitzer, A. 1923. *Civilisation and ethics.* Campion, C. T. trans. London, UK: Allen and Unwin.

Secretary of State for the Home Department v The Queen on the application of campaign to end all animal experiments (trading as The British Union for the Abolition of Vivisection). Court of Appeal (Civil Division). 23 April 2008. EWCA Civ 417.

Sena, E. S. van der Worp, B. Howells, D. and Macleod, M. 2007. How can we improve the pre-clinical development of drugs for stroke? *Trends in Neurosciences* 30, pp. 433–439.

Séralini, G. E. Clair, E. Mesnage, R. Gress, S. Defarge, N. Malatesta, M. Hennequin, D. and Spiroux de Vendômois, J. 2012. Long term toxicity of a Roundup herbicide and a Rounder-tolerant genetically modified maize. *Food and Chemical Toxicology* 50(11), pp. 4221–4231.

Shao, A. Broadmeadow, A. Goddard, G. Bejar, E. and Frankos, V. 2013. Safety of purified decolorized (low anthraquinone) whole leaf Aloe vera (L) Burm. f. juice in a 3-month drinking water toxicity study in F344 rats. Food and Chemical Toxicology 57, pp. 21–31.

Singer, P. 1979. *Practical ethics.* Cambridge, UK: Cambridge University Press.

Singer, P. 2009. *Animal liberation: A new ethics for our treatment of animals.* Toronto, Canada: Harper Perennial Modern Classics.

Smith, J. A. and Boyd, K. M. 1991. *Lives in the balance: The ethics of using animals in biomedical research.* Oxford, UK: Oxford University Press.

Spencer, C. M. Alekseyenko, O. Hamilton, S. M. Thomas, A. M. Serysheva, E. Yuva-Paylor, L. A. and Paylor, R. 2011. Modifying behavioral phenotypes in Fmr1KO mice: Genetic background differences reveal autistic-like responses. *Autism Research* 4(1), pp. 40–56.

Sumner, P. Vivian-Griffiths, S. Boivin, J. Williams, A. Venetis, C. A. Davies, A. Ogden, J. Whelan, L. Hughes, B. Dalton, B. Boy, F. and Chambers, C. D. 2014. The association between exaggeration in health related science news and academic press releases: Retrospective observational study. *British Medical Journal* 349, g7015.

Sunstein, C. R. 2009. *Going to extremes: How like minds unite and divide.* Oxford, UK: Oxford University Press.

Taylor, K. Gordon, N. Langley G. and Higgins W. 2008. Estimates for worldwide laboratory animal use in 2005. *Alternatives to Laboratory Animals* 36, pp. 327–342.

Taylor, K. Stengel, W. Casalegno, C. and Andrew, D. 2014. Food for thought: Experiences of the REACH testing proposals system to reduce animal testing. *Altex* 31(2), pp. 107–128.

Tesser, A. and Rosen, S. 1972. Similarity of objective fate as a determinant of the reluctance to transmit unpleasant information: The MUM effect. *Journal of Personality and Social Psychology* 23, pp. 46–53.

Thew, M. 2013a. Cruelty-free labelling. In: Linzey, A. ed. 2013. *The global guide to animal protection.* Chicago: University of Illinois Press.

Thew, M. 2013b. Product testing. In: Linzey, A. ed. 2013. *The global guide to animal protection.* Chicago: University of Illinois Press.

Truth and Reconciliation Commission. 1998. *Final report of the truth and reconciliation committee.* Vol. 5. Available at: http://www.doj.gov.za/trc/report/finalreport/TRC%20VOLUME%205.pdf [Accessed: 6 November 2007].

Understanding Animal Research. [No date]. *Human health* [Online]. Available at: http://www.understandinganimalresearch.org.uk/why/human-health/ [Accessed: 3 January 2015].

US Food and Drug Administration. 2004. *Innovation or stagnation: Challenge and opportunity on the critical path to new medical products* [Online]. Available at: http://www.fda.gov/ScienceResearch/SpecialTopics/CriticalPathInitiative/CriticalPathOpportunitiesReports/ucm077262.htm [Accessed: 2 January 2015].

US Food and Drug Administration. 2006. *Animal testing and cosmetics* [Online]. Available at: http://www.fda.gov/cosmetics/scienceresearch/producttesting/ucm072268.htm [Accessed: 3 January 2015].

van der Worp, H. B. Howells, D. W. Sena, E. S. Porritt, M. J. Rewell, S. O'Collins, V. and Macleod, M. R. 2010. Can animal models of disease reliably inform human studies? *PLoS Medicine* 7(3), e1000245.

Vane, J. 1996. Animal research and medical progress. *AnimalResearch.Info* [Online]. Available at: http://www.animalresearch.info/en/medical-advances/articles-lectures/animal-research-and-medical-progress/ [Accessed: 3 January 2015].

Vorobyov, V. Kwok, J. C. F. Fawcett, J. W. and Sengpiel, F. 2013. Effects of digesting chondroitin sulphate proteoglycans on plasticity in cat primary visual cortex. *Journal of Neuroscience* 33(1), pp. 234–243.

Voskoglou-Nomikos, T. Pater, J. L. and Seymour, L. 2003. Clinical predictive value of the in vitro cell line, human xenograft, and mouse allograft preclinical cancer models. *Clinical Cancer Research* 9(11), pp. 4227–4239.

Waite, T. 1993. *Taken on trust.* London, UK: Hodder and Stoughton.

Weatherall, D. 2006. *The use of non-human primates in research.* Available at: https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2006/Weatherall-Report.pdf [Accessed: 29 September 2014].

Welchman, J. 2003. Xenografting, species loyalty, and human solidarity. *Journal of Social Philosophy* 4(2), pp. 244–255.

Westacott, E. 1949. *A century of vivisection and anti-vivisection: A study of their effect upon science, medicine and human life during the past hundred years.* Ashingdon, UK: C. W. Daniel.

Whymant, R. 1982. The brutal truth about Japan. *Guardian* 14 August 1982.

Wiebers, D. O. Adams, H. P. and Whisnant, J. P. 1990. Animal models of stroke: Are they relevant to human disease? *Stroke* 21, pp. 1–3.

Wilke, J. and Saad, L. 2013. Older Americans' moral attitudes changing. *Gallop Politics* [Online]. Available at: http://www.gallup.com/poll/162881/older-americans-moral-attitudes-changing.aspx [Accessed: 11 August 2014].

Winston, R. 2011. *Hansard*. House of Lords. Column 623. Available at: http://www.publications.parliament.uk/pa/ld201011/ldhansrd/text/111024-0002.htm#11102443000399 [Accessed: 2 January 2015].

World Medical Association. 2013. *Declaration of Helsinki – Ethical principles for medical research involving human subjects* [Online]. Available at: http://www.wma.net/en/30publications/10policies/b3/ [Accessed: 27 November 2014].

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