Animals are being used in science in New Zealand for various reasons, categorised into RTT (research, teaching and testing) which includes improving human health (e.g. testing vaccines for humans on animals), improving the welfare of animals (e.g. investigating the special diets of animals during pregnancy) and protecting native wildlife (e.g. learning the characteristics of native animals) (ANZCCART(NZ) & Mellor, 2019). This use of animals has largely contributed to the development of medicines, animal husbandry and environmental conservation (NAEAC, 2002).

Due to New Zealand's focus on agriculture, over 40% of animals used are farm animals, from which many are returned to farms after research work is completed (ANZCCART NZ, 2013). However, approximately 1/3 of animals used in research die or are destroyed (NAEAC, 2002).

The use of animals in New Zealand is strictly controlled under the Animal Welfare Act 1999 (Ministry for Primary Industries, 2020). The Animal Welfare Act 1999 makes it compulsory for every institution conducting animal research to act under a Code of Ethical Conduct, and have access to an Animal Ethics Committee, which accepts, rejects or suggests changes to research proposals considering the balance between harm to the animals and the benefits of the work, analyses non-animal alternatives and stops unnecessary duplication of previous experiments (ANZCCART(NZ) & Mellor, 2019). In addition to being bound by law, scientists also care for animals because unhealthy animals would produce flawed results (ANZCCART(NZ) & Mellor, 2019).

According to NAEAC (2002), the three Rs (replacement, reduction and refinement) are used to improve animal welfare in research. Replacement ensures that sentients animals are used only when necessary (e.g. using less-sentient organisms or non-animal alternatives such as cell/tissue cultures, mathematical modelling and computer simulations). Reduction decreases the number of animals used by eliminating unnecessary duplication of experiments by using literature and peer-reviews. Refinement reduces the pain and suffering to a minimal amount through careful handling, improving the animal's environment and using anaesthetics. *A Culture of Care* is an informative guide by NAEAC, which provides advice to the minister responsible for animal welfare. Both NAEAC and the Ministry for Primary Industries are operated under the NZ Government (whose purpose is informing the public) which ensures that all information is valid and unbiased.

An ethical issue is raised when using animals in science. Animal research opposers argue that animals cannot give consent to an experiment, so the pain/suffering is unjust, and believe that animals should only be tested for veterinary research because animals should not be burdened with others' problems (Nobis, 2016). Animal research supporters base their arguments on the necessity of animal research for the advancement of the medical sector, and the fact that it has helped both humans and animals by various means including finding cures for diseases (Festing & Wilkinson, 2007). However, since societal ethics are based on personal ethics, which are formed using individual knowledge and personal experience, it is hard for all parties to agree

on one answer in an ethical issue, and these discussions will continue to grow as scientific research, and ethical analysis methodologies continue to advance (Reid, 2015). The piece by Dr Katherine Reid (2015) is an unbiased essay that analysed communication in science, and being presented to ANZCCART's conference and in ANZCCART's website ensured its validity. The piece by Dr Simon Festing and Robin Wilkinson is biased toward supporting animal testing due to their involvement in the Research Defence Society but is valid because it was peer-reviewed and was published in an accepted science journal (EMBO). Professor Nathan Nobis's piece is slightly biased due to it being compiled for the Humane Society University but was valid because it is a published book that went through vigorous scrutiny and was taught at a university.

ANZCCART (Australian and New Zealand Council for the Care of Animals in Research and Teaching) NZ supports the idea that animals should be used in science, given that they are respected and cared for properly. The main argument they make is that "direct animal studies led to many of the biomedical developments," including insulin, penicillin, drugs for high blood pressure and leukaemia, vaccination for polio, leprosy and cervical cancer (ANZCCART(NZ) & Mellor, 2019). According to ANZCCART (2013), animal research has also contributed to the development of coronary by-pass operations, blood transfusions, cardiac pacemakers, and some surgeries including cataract surgery and hip replacement surgery, and "vaccines developed using laboratory animals are used to protect infants, children and adults from diseases such as polio, diphtheria, and whooping cough. Medicines and surgical techniques perfected on animals have saved the lives of countless people." Animals have largely benefitted from animal research as well, including medicines developed for diseases infecting animals such as pets (e.g. vaccines for feline enteritis and snuffles) and farm animals (e.g. vaccines for tetanus, yersiniosis, pulpy kidney and leptospirosis). As an example, it quotes cattle plague, a disease which killed millions of animals, to which a vaccine was developed using animal research, and was eradicated in 2010. While ANZCCART acknowledges that animal research cannot guarantee the safety of medicines for humans, it says that animal testing reduces the risk of it being unsafe. ANZCCART NZ is a committee of Royal Society Te Apārangi. Due to its purpose of promoting responsible animal research, *Animal Research Saves Lives* showed considerable bias toward supporting animal research and *Using Animals in Science* showed slight bias toward the same, but since I wanted to consider its viewpoint, I included these sources. Its board comprises of a range of professionals from the field of science including bioethics, animal welfare, agriculture and physiology from some of NZ's leading science institutes and resources by them are considerably new (2013 and 2019), which ensures validity.

NZAVS (New Zealand Anti-Vivisection Society) opposes the use of animals in research where animals are used in processes that cause "pain, injury or death", and are "not meant to benefit the individual animal involved" (NZAVS, n.d.). In opposition to ANZCCART's view, NZAVS (n.d.) says that animals do not accurately serve as models for human body systems, since every species differs from one another. As an

example, it states that penicillin is “fatal for guinea pigs, effective in mice, metabolised too quickly in rabbits, teratogenic in rats and effective in humans,” and shows HIV, stroke, spinal cord injury and sepsis where cures effective against animals were ineffective against humans. According to NZAVS, approximately 9/10 of drugs that are successful in animals do not pass human trials, and a 2003 study found out that only 0.004% of basic research gets transferred into clinical treatments. Disadvantages of using animal research include using medicines that have passed animal testing but are ineffective against humans (2003 trials of an Alzheimer’s vaccine caused human brain inflammation), ruling out medicines that are effective against humans because they did not pass animal testing (Tamoxifen, a drug against breast cancer that caused liver tumours in rats) and wasting of time and resources during unsuccessful animal research (mice not getting cancer through smoking formulated the belief that smoking does not cause cancer). NZAVS is one of New Zealand’s main societies against animal research which means their information is biased toward abolishing animal research, but since I wanted to include its opinion, I included information from their website. Its members include a range of scientist from the fields of animal welfare and zoology, and its website was updated in 2020, ensuring its validity.

My position on this issue, based on the comparison of biological and social/ethical implications of animal research in New Zealand, is that animals should only be used for developing cures for diseases and veterinary research, given that all non-animals alternatives have been investigated and cannot be used, and the 3Rs are followed throughout the process. This is based on the fact that while there are instances where the development of medicines may have been hindered by using animals, as in finding that smoking is a cause of cancer, there are also many examples in which animals have been useful. When weighing the two sides, the numerous medicines that have been introduced using animal research and successfully cured both human and animal diseases, potentially saving the world from mass infections and pandemics and deadly diseases, outweigh the hindering of medical developments through animal research. Additionally, animal research has contributed to increasing the quality of life of animals themselves and in conserving native wildlife. Based on the ethical arguments presented, I believe it is wrong to manipulate animals in anything other than investigating cures for human and animal diseases considering that animals are choiceless and they are subjected to pain and suffering (but finding cures to diseases is necessary and would benefit a large part of animal or human populations at the cost of several animals). However, exploration of non-animal alternatives, restriction of duplication of experiments and maintenance of the 3Rs to the maximum possible level should always be performed. This would ensure that animals are treated to the best extent possible while making medical developments, including new medicines achieved through animal research, possible and protecting moral rights of animals.

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