The Medical Necessity of Animal Research

On April 22, 2009, Dr. David Jentsch and a group of UCLA students and faculty stood up for scientific animal research. Jentsch, a researcher who is studying drug addiction in humans through testing in monkeys, had never planned to lead a demonstration, but changed his mind after a radical group of animal rights activists firebombed his car (Conder). Now, he has pledged to continue his research with animals and to stand up for it despite this attempt at intimidation. Why is Jentsch so dedicated to animal research? Perhaps because he, like so many other scientists, knows that, though animal rights activists claim otherwise, the use of animals in scientific research is essential to the acquisition of new medical knowledge. Animal testing has played a critical role in the development of lifesaving vaccinations, treatments, and surgical procedures, and because a complete alternative for it does not currently exist, its removal from the scientific process would be disastrous, impeding all medical progress.

Animal research has been essential to almost every major medical discovery in the past one hundred years. In fact, 70% of the Nobel prizes for medicine or physiology have been awarded to discoveries dependent on research with animals (*Medical Advances and Animal Research*). The list of medical breakthroughs achieved through animal research goes on and on:

> Research with animals has led to vaccinations against small pox, measles, mumps, diphtheria, and tetanus; development of anesthesia, antibiotics, and insulin; use of cardiac pacemakers and heart bypass surgery; surgical advancements for organ transplants, hip replacements, and cataract surgery; and treatments for a host of diseases, including diabetes, multiple sclerosis, AIDS, and children's leukemia ("Animal Research: How it Benefits Both Humans and Animals").

But still, some animal rights activists claim that animals cannot possibly be useful for gaining knowledge about human health, that it doesn't make sense to use animals to learn about humans.

Contrary to these claims, animal research is extremely successful at modeling human health. How is this possible? Humans are actually very similar to animals and share like structures, with the same organs, organ systems, and basic set up, meaning that many medicines and techniques have effects on animals that are similar to their effects on humans. In fact, "nearly 90% of the veterinary medicines that are used to treat animals are the same as, or very similar to, those developed to treat human patients" (*Speaking of Research*). The most understandable explanation for animal models is the example of primates used in medical research. As Professor Aziz, a professor of neurosurgery at the University of Oxford and Imperial College London, explains, "Man is bipedal, and so are the higher primates. Our brains are wired the same way. We develop similar disorders. By learning how to treat one, we learn how to treat the other," ("Can Doctors Safely Talk About Testing?"). The inherent similarities in the structure and behavior of humans and primates mean that research in animals can uncover information that is critical to both human and primate health.

Yet primates are not the only animals used to successfully model humans. In fact, non-human primates make up only 0.24% of the animals used in research (*Speaking of Research*). The majority of animal research, 96.1%, is done on rats and mice. Though these animals seem much farther removed from humans, the same principals Professor Aziz refers to when discussing primate research are involved in research with rats and mice. Mice and humans share about 99% of their DNA and this great degree of similarity means that they can serve as successful models for humans in medical research (*Speaking of Research*). History proves it.

Take, for example, the vaccine for meningitis, whose discovery rested entirely on experiments with mice and rabbits. Meningitis, an inflammation of the membranes that cover the brain and spinal cord, can be caused by a number of viruses and bacteria, though it is most commonly caused by Haemophilus influenzae type b (*Medical Advances and Animal Research*). Initially, scientists found it very difficult to develop a vaccine for these bacteria because the human response to the Hib antigen was extremely short-lived. However, experiments in mice and rabbits showed that, by coupling the Hib antigen with a protein, a technique shown to protect mice from pneumonia, a more powerful antibody response was elicited (Parry). From this animal research, scientists were able to create the Hib vaccine, saving many lives. Before the vaccine was released in 1992, there were 800 cases of meningitis in the United Kingdom every year, leaving about 80 children per year with brain-damage, deafness, and other severe disabilities and killing another 30 (*Medical Advances and Animal Research*). After the release of the vaccine, the number of reported cases of meningitis in the United Kingdom dropped by 96% (*Medical Advances and Animal Research*).

In addition to the development of the Hib vaccine, research with animals was also vital to the development of a vaccine for Human papillomavirus (HPV), a virus that has been shown to cause cervical cancer. This vaccine is critical to women's health because cervical cancer is the second most deadly cancer in women, killing roughly 40 women every day in Europe and 230,000 women every year worldwide (*Medical Advances and Animal Research*). Research has indicated that, while over one hundred strains of HPV exist, 70% of cervical cancer is caused by types 16 and 18. Therefore, by creating a vaccine to protect the female body from common strains of HPV, scientists aimed to prevent much of the cervical cancer caused by HPV. Yet scientists were not fully aware of the connection between HPV and cervical cancer until animal

research illustrated this connection. Animal strains of the papillomavirus, such as cottontail rabbit papillomavirus (CRPV), canine oral papillomavirus, and bovine papillomavirus (BPV), are extremely similar to HPV and were used to model HPV in research which showed that, by preventing infection by papillomaviruses, the development of cancer could be prevented. The findings of this animal research directly led to the development of an HPV vaccination and, currently, the Centers for Disease Control and Prevention recommend Gardasil, an approved HPV vaccine, for all females ages 11 to 26 ("HPV Vaccine Information For Young Women").

Yet animal research has not only been important to the development of vaccinations. Treatments have also been discovered through animal testing. For example, the discovery that penicillin could treat bacterial infections is due entirely to an experiment on mice. In the beginning of World War II, Howard Florey and Ernst Chain, who were working at Oxford to develop antibiotics, injected eight mice with streptococci bacteria, injecting four of them with penicillin an hour later. While the mice injected with penicillin survived, the other four, which were not given penicillin, died (*Medical Advances and Animal Research*). The discovery that penicillin could fight against bacterial infections, not only saved many lives, but completely changed the medical approach to treating bacterial infections.

A similar experiment in guinea pigs revealed the treatment for tuberculosis (TB). In 1943, Albert Schatz and Professor Selman Waksman of Rutgers University injected streptomycin into guinea pigs that were already infected with TB. They discovered that streptomycin completely suppressed the mycobacterium tuberculosis that causes TB (Parry). This was a vital discovery because streptomycin was the first antibiotic that was effective against TB, which is estimated to have killed about one billion people from 1700 to 1900 (*Medical Advances and*

Animal Research). Now, because of the animal research performed by Schatz and Waksman, we are able to prevent even more deaths from TB. Animal research has proven to be lifesaving.

However, this is not just because many vaccines and treatments have been developed through animal testing, but also because animal testing has greatly contributed to the development of lifesaving surgical procedures, often taking the place of human experimentation. The development of transplant surgery, especially, relied on animal testing far before human trials. In the 1950s, surgical techniques necessary for kidney transplantation were practiced on dogs and pigs (Parry). Such research showed that dogs with transplanted organs that had been injected with cyclosporine and steroids had an increased survival time. These animal tests allowed doctors to perfect the transplantation process before they attempted transplants in humans. Currently, about 2,000 people benefit from kidney transplants each year, and this number is restricted by the availability of kidneys to transplant. In the 1970s, scientists moved on to attempt heart valve transplants by transplanting heart valves from pigs, sheep, calves, and goats into dogs. Today, roughly 6,500 patients benefit from heart valve transplants in the United Kingdom alone (*Medical Advances and Animal Research*).

But it is not just surgical procedures that have been developed through animal testing. Even the anesthesia used in transplant surgeries was developed by means of animal research. "Fifty years before an anesthetic was first used in patients, Humphry Davy, a surgeon's apprentice, demonstrated that nitrous oxide or 'laughing gas' could produce a state of reversible unconsciousness in animals" (*Medical Advances and Animal Research*). In the 1950s, scientists used experiments on rodents, rabbits, cats, dogs, and monkeys to show that liquid halothane was a safe, effective, and easy to use method of anesthesia. Later, spinal analgesia was discovered when Leonard Corning, who was doing an experiment about cocaine on dogs, accidentally

pierced a dog's spinal cord (*Medical Advances and Animal Research*). This accident, and the research that came from it, led to the development of the epidural and localized anesthetic, both of which have greatly contributed to patient comfort during medical procedures.

All of these examples illustrate only a small number of the important medical discoveries that have come from animal testing. In fact, the development of the majority of vaccinations, treatments, and surgical procedures has relied on knowledge gained from animal research. Yet many believe that the same knowledge we have gained from animal research could have been attained in other ways. Opponents of animal testing cite four main "alternative" methods: MRI scanning, in-vitro testing, micro-dosing, and computer modeling (*Speaking of Research*). However, contrary to popular belief, there are no absolute alternatives to animal testing, though these alternate methods can decrease the number of animals required for research studies.

MRI scanning, specifically, can be used to reduce the number of animals dissected in studies of the brain. Professor Chris Higgins, director of the Medical Research Council Clinical Sciences Centre, explains, "One area we are looking at is what controls appetite and satiety. To do this in the traditional way, we would have to dissect the animal brain, but to avoid this we use in vivo imaging to look at the areas on the brain related to hunger and satiety," (*Speaking of Research*). Yet, even though Higgins is putting this alternative to use, animals are still being used in his research. This is because, though MRI scanning can be used to learn about the structural elements of the brain, there are still genetic and molecular components that need to be explored, and that MRI scanning cannot assist with. "Although this 'alternative' can fulfill a useful role and help reduce the number of animals used, it cannot replace animal research altogether. Watching how the brain works can help us understand part of the problem, but it also occurs on

the genetic and molecular level, which MRI scans cannot show us," (*Speaking of Research*). Though MRI scanning is helpful, it is not a replacement of animal testing.

In-vitro testing, testing in a test tube instead of in a live animal, is another research method that is often cited as an alternative to animal testing. However, though in-vitro testing can replace animals in the early stages of medical research, it simply is not a complex enough model to accurately illustrate all of the variables of the human body:

> In-vitro testing cannot replace animal testing altogether…a drug might work fine on a cell in a test tube, but how will it work in a body? A test tube has no blood circulatory system, no liver, no brain, and no nervous system at all. A test tube cannot feel pain or get pregnant. We just don't know whether it would work for sure until we try it on a living creature. And again, it's either animals, or us, that we have to trial the drugs on next (*Speaking of Research*).

For ethical reasons, scientists choose animals, at least in the early stages of a drug or technique's development.

In pharmaceutical development, more and more often, opponents of animal testing bring up micro-dosing as an alternative, claiming that, finally, we have a replacement for animal research. This is not the case. Micro-dosing is a new technique that is used to study how extremely small doses of new, developing medicines travel through the body. This technique, too, can decrease animal research; however, because micro-dosing is specifically designed to monitor the effects of small doses of medicine, it cannot predict the effects or toxicity of larger prescription size doses. Even the Fund for the Replacement of Animals in Medical Experiments has stated that, in instances where micro-dosing is used, "animal studies will still be required," (*Speaking of Research*). The fact that an organization which dedicates itself to replacing animal

testing with alternatives has admitted that animal studies will still be required in pharmaceutical development, despite the development of new research techniques, is evidence that there is no complete alternative to animal testing.

However, some still argue that there is a complete alternative, that scientists can use computer modeling instead of animal testing. This is simply not true. Not only is computer modeling extremely expensive, but it is also very limited. "A recent simulation of just half a mouse's brain required the use of the world's fastest supercomputer…the vast complexity of the situation meant that it was only run for…the equivalent of one second in a real mouse brain," (*Speaking of Research*). In addition, scientists say that the computer model lacked many of the structures, like nerves and connections, seen in real mice brains. More importantly, these computer models are mainly based on knowledge gained through animal research: "Before one can program a computer model to reflect an aspect of our physiology, an understanding of the physiology being modeled is needed. This knowledge tends to come through research using animals. So animals are needed even before we get to the computer," (*Speaking of Research*). Therefore, computer modeling is in no way a replacement for animal testing. As of now, there is no replacement for animal testing.

Yet despite the documented medical benefits of animal research and the clear lack of alternatives, animal rights groups still dispute the necessity of animal testing, claiming it is excessive and unethical. This is not the case. Animal testing is not used excessively. Very few animals, proportionally, are used for research. In the United States, scientists use approximately 26 million animals for research, of which only around 1 million are not rodents, birds, or fish (*Speaking of Research*). Though this may seem like a very large number, in actuality, "we use fewer animals in research than the number of ducks eaten per year in this country…we eat over

340 chickens for each animal used in a research facility…[and], for every animal used in research, it is estimated that 14 more are killed on our roads," (*Speaking of Research*). If animal rights activists are concerned about the deaths of animals, they should be focusing on those due to increased traffic congestion and the high rate of animal consumption rather than those with a medical purpose, of which there are far fewer.

The relatively low number of animals used in research is largely because scientists use alternatives to animal testing whenever possible, if not for ethical reasons, for financial ones. It is extremely expensive to perform research on animals. "Animals must be housed, fed, and cared for by trained animal welfare technicians and veterinarians. By comparison, replacement methods tend to be much cheaper and thus academic researchers (who compete for limited available funds) and pharmaceutical companies (who are profit-seeking) will prefer to use these cheaper replacements whenever possible," (*Speaking of Research*). The fact that scientists still use animals in research is evidence that there is no complete alternative to it. According to Professor Aziz, "A monkey costs £15,000 [roughly $20,528] to buy and £100 [about $137] a week to keep, and I would jump at the chance of an alternative. But there simply isn't one in my field of research," ("Can doctors safely talk about testing?"). Scientists use as few animals as possible in their research, using alternatives whenever they can, but the use of animals cannot be eliminated. Some animal testing is absolutely necessary and has no alternative.

As for the ethics of animal testing, the process is much more humane than is commonly known. The Animal Welfare Act has strict regulations for any lab performing animal testing. Each research facility is required to have an Institutional Animal Care and Use Committee (IACUC) made up of at least three members, one of whom must be a veterinarian familiar with laboratory medicine and one who is not affiliated with the research facility (Animal and Plant

Health Inspection Service). This committee oversees all animal testing, reviewing the facility's research protocols and ensuring that researchers follow the three R's: replace, reduce, and refine. This means that before scientists can perform any research on animals they must consider alternative methods. If there is no alternative, they must reduce the number of animals so that they are using the fewest number of animals that can still produce valid results. Finally, researchers must refine their experiments to minimize the pain and stress of the research animals. Random inspections and reviews are used to enforce these policies set into law by the Animal Welfare Act (Animal and Plant Health Inspection Service).

In addition to these legal requirements, it is scientifically in a researcher's best interest to treat his animals well. "Conditions in the laboratory must be good, if only because sick, frightened, or maltreated animals simply will not do most of the things in which behavioral biologists are interested, such as court each other, play, explore, and solve difficult problems," (Bateson). Not only that, but the scientific community has its own form of regulation on animal welfare. "Articles are rejected when the ethical committee judges them to be unacceptable. Rejection of papers is an important form of control, since publication in a front-ranking journal is the major way in which a scientist establishes a reputation and obtains funds for further research," (Bateson). Thus, scientists have strong legal, scientific, and financial incentives to treat their research animals well, and though there will always be an outlier or an extraordinary case, most animal research is conducted as humanely as possible.

In the end, we will always be forced to pick between the lives of animals and the lives of humans. Vaccines, treatments, and procedures developed through animal testing continue to save thousands of lives every year, yet their production also costs animal lives. Because animal testing is essential to the acquisition of new medical knowledge and because there are no absolute

alternatives to it, to save the lives of these animals, we would have to abandon all animal research. We would have to abandon our search for treatments, and eventually cures, for AIDS, cancer, cystic fibrosis, and other deadly human diseases. Yet we must make a choice. Though steps have been taken, and should continue to be taken, to reduce the number of animals used in research, to refine experiments to minimize the discomfort of animals involved, and to replace animal testing when possible, animal testing cannot be eliminated from the scientific process. The cost, thousands of human lives that could be otherwise improved or potentially saved, would be far too great.

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