From Curiosity to a Cure: The Role of Animal-Based Research In Treating Alzheimer’s Disease

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Introduction

Have you ever wondered how scientists determine what drugs to use to treat certain diseases? By using animals in biomedical research, scientists have been able to come up with effective treatments to some of the world’s most deadly diseases. Using animals in research is looked upon negatively by some people, while others see it as a necessary investment to improve the lives of humans. Scientists have used animals to do everything from understanding the cardio cycle to understanding how to treat a wide range of illnesses. For example, around 129-200 A.D, the famous physician Galen, used animals to prove that arteries are filled with blood and not air. This information helped to start the voyage into the clues of the heart. Without advances in medical science, the human race will suffer. I believe that animal based research is necessary and should continue. I am, however, not for the inhumane treatment of the animals involved in the research.

Major Advances in Medicine Due to Animal Based Research

Throughout history, animal research has played a vital role in the development of life saving drugs. It has also helped researchers find the cause of some of the world’s most deadly diseases and viruses.
Below is a historical list of the benefits animal research has provided to the medical field.

<table>
<thead>
<tr>
<th>Period</th>
<th>Medical Advancement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800s</td>
<td>medicines revealed to build immunity</td>
</tr>
<tr>
<td>1920s</td>
<td>vitamins and insulin are discovered</td>
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<tr>
<td>1930s</td>
<td>tumor viruses are revealed</td>
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<tr>
<td>1940s</td>
<td>the keys of embryonic development are unlocked</td>
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<tr>
<td>1950s</td>
<td>scientists begin to understand muscle activity</td>
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<tr>
<td>1960s</td>
<td>the biochemical abilities of the liver are discovered</td>
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<tr>
<td>1970s</td>
<td>understanding how the brain works</td>
</tr>
<tr>
<td>1980s</td>
<td>the basics of memory are revealed</td>
</tr>
<tr>
<td>1990s</td>
<td>scientists learn more about auto immune disorders</td>
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</tbody>
</table>

The large-scale benefit to the use of animals is that lives are saved. The problem with using animals to support biomedical research is primarily due to the poor treatment of animals by scientists that did not follow any moral or ethical code of conduct. It is true that in some research situations, animals have been brutally killed or have suffered miserable deaths. According to the American Anti-Vivisection Society, it is estimated that over 100 million animals are used in scientific research each year in the United States. Over ninety-five (95) percent of the creatures used in medical research include birds, mice, rats, rabbits, pigs, non-human primates, and fish.

To support the ethical use of animals in research activities, rules and regulations have been set in place to ensure that animals that are used for medical research purposes are treated humanely. For example, the Animal Welfare Act, Public Law 89-544 contains guidelines regarding the proper and ethical care of animals used in medical research. Additionally, the National Institute of Health/Office of Laboratory Animal Welfare (NIH/OLAW) develops, monitors, and exercises compliance oversight related to Public Health Service (PHS) policy.
Research Fields That Use Live Animal Specimens

Three science research fields that are heavily dependent on animal based research include drug discovery, cosmetic product manufacturing, and genetic engineering. These areas of science are directly linked to human health and wellness. The process of drug discovery involves the identification of candidates, synthesis, characterization, screening, and assays for therapeutic efficacy. Once a product has shown its value in these tests, it will begin the process of drug development prior to clinical trials. Drug discovery is a long process and requires an investment of millions of dollars over a period of years. Mice are the most commonly used animal in drug discovery. This is because they are cheap to obtain, easy to handle, and can reproduce rapidly. Also their anatomy closely resembles that of a human, making disease modeling easier. In the US, it is estimated that twenty million rats and mice are used each year.

Product testing in the cosmetic field is commonly performed on animals to measure the levels of skin irritancy, eye tissue damage, and toxicity caused by various substances used to manufacture a variety of cosmetics products (e.g. bentonite, clogs pores, suffocates the skin, and prevents normal oxygen transport). Pigs and rabbits are often used in cosmetic research. Rabbits are used to perform the Draize Test. This test assesses drug toxicity and involves a substance being placed on the rabbit's eyes or skin, which is then observed for redness, irritation or any other damage. Genetic engineering is the process of manipulating the genes of an organism. Worms, fruit flies, mice, and rats are used in this particular type of research. These species are used because their genes function in similar ways as a human. According to the American Vivisection Society, nearly 40 million animals (worldwide) are used in genetic engineering research.
Alzheimer’s Disease and Biomedical Research

Of the major illnesses facing people in the 21st century, none is more devastating than Alzheimer’s disease (AD). It does not only lead to death, it robs a person of their memory. Think about it, how it would feel to not only die a slow death, but also lose all sense of memory of the life you have lived. Today, scientists are studying different ways to curb the negative impact of Alzheimer’s disease. Eradicating this disease is personal to me because my great-grandmother died from it. Alzheimer’s disease is a type of dementia that occurs when the neurotransmitter, acetylcholine, loses its connections with other nerve cells. Beta amyloid is a protein that builds up in surrounding cells. This disease causes people to not have the ability of memory, and simple tasks. Theses tasks include brushing your teeth, and how to dress yourself. In 1906, the scientist, Alois Alzheimer, discovered this condition in a 51-year-old woman. This mostly occurs in people ages 35-85 years old.

According to the Alzheimer’s Foundation, 5.1 million Americans are diagnosed with this disease. It’s the 6th cause of death in the United States. Some of the risk factors of this disease are family history, genetic structure, and age. The chromosomes 1, 14, and 21 are found to trigger this disease. There is no cure for Alzheimer’s disease, but there are treatments. Donepezil Hydrochlorine is one of the treatments used for AD. Other treatments include galantamine and rivastigmine [7]. Recently, ANAVEX 2-73, a new class of drugs that target mitochondrial dysfunction thought to be caused by oxidative stress to modify Alzheimer's disease, was created by Anavex Life Sciences Corp (8). These treatments were developed through research on dogs, mice and rats. This work helped scientists to learn the various parts and functions of the neurological system and how this
can be applied to a cure. For example, researchers have found that Donepezil and ENA-713 improved the cognitive abilities and daily functioning of patients with Alzheimer's disease (AD) [9].

Limitations to Alternatives for Animal Research

There are a number of things that can be done to investigate and solve biomedical questions; however, these solutions tend to be incomplete. Three major non-animal based techniques that are used in biomedical research include computer modeling, micro dosing, and in vitro testing.

Computer modeling is a good alternative to animal based research; however it’s dependent on quality data which has to be collected first via animal trials. In studying Alzheimer’s disease, a computer model can not simulate all of the features and functions of the brain. Thus, limiting the effectiveness of the research.

Micro-dosing is a new technique for measuring how very small doses of potential new medicines move around the body. It should be possible to use micro-dosing in humans to reduce the numbers of animals needed to study the effectiveness of new compounds. However, micro-dosing has limitations because it does not predict toxicity or side effects that occur at higher therapeutic doses.

In vitro testing means testing things in a test tube on the micro level. In vitro tests are not going to replace the animal models because 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 brain, and no nervous system at all. The test will need to be run on a living creature to be validated.
Conclusion

Animal based research has its pros and cons in biomedical research. Other forms of research modeling, such as computer modeling and micro dosing, are useful, but they are only simulations, not the real thing. Including animals in the research process is necessary in order for scientists to be able to clearly understand the effectiveness or outcomes of drugs and medical procedures, which is the true meaning of the ‘curiosity to a cure’ concept.

References


8. “Anavex Reports Animal Study Results as Lead Alzheimers Compound Approaches Phase 1 Clinical Trials.”, Clinical Trials Week. May 2010.