The Importance of Animal Research to Medical Discovery

"VIRTUALLY EVERY MAJOR MEDICAL ADVANCE FOR BOTH HUMANS AND ANIMALS HAS BEEN ACHIEVED THROUGH BIOMEDICAL RESEARCH USING ANIMAL MODELS TO STUDY AND FIND A CURE FOR DISEASE, AND THROUGH ANIMAL TESTING, TO PROVE THE SAFETY AND EFFICACY OF A NEW TREATMENT."

—Former U.S. Surgeon General Dr. C. Everett Koop

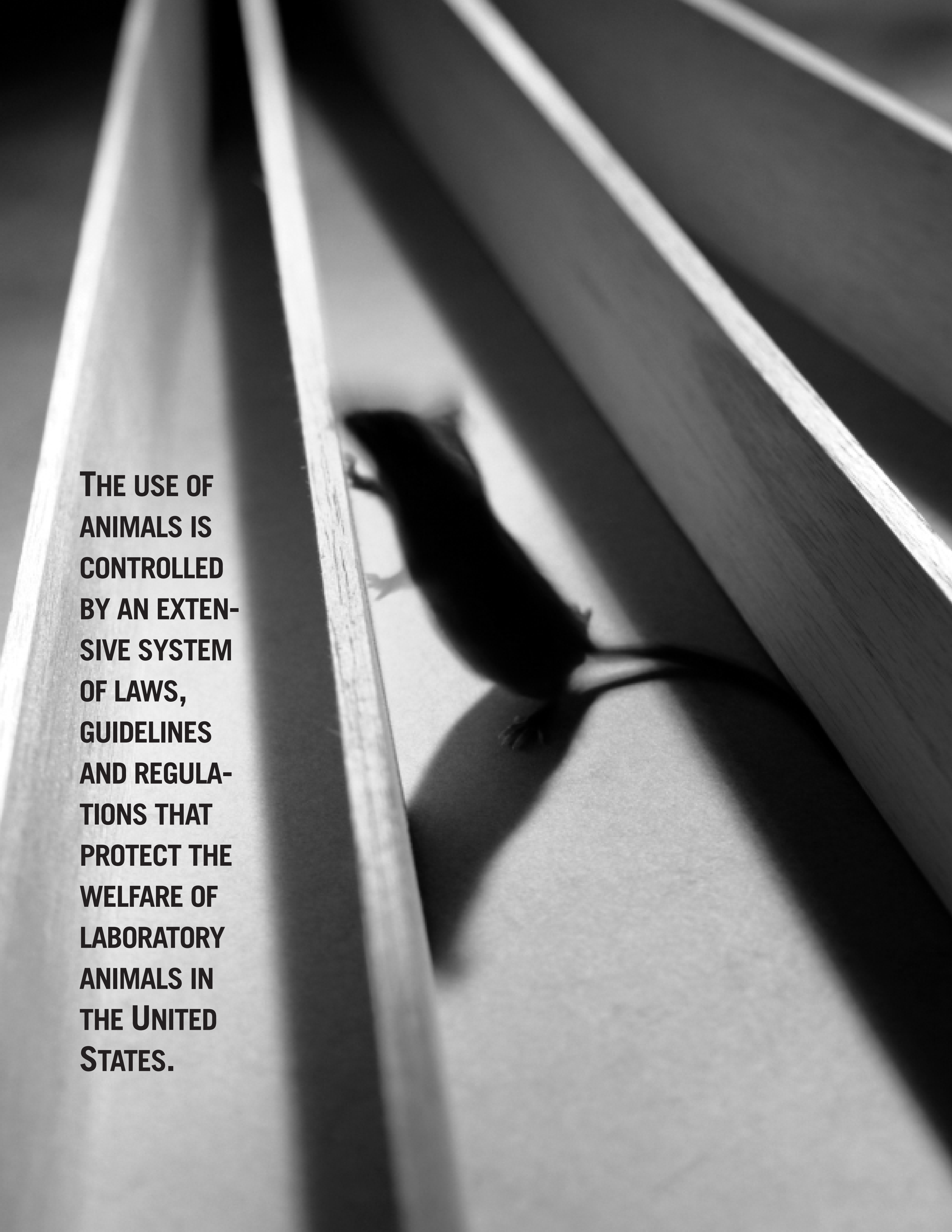
While some people question whether animals should ever be used in research, most people believe that it would not be proper to conduct experiments on humans without first doing studies in other living animals.

Still, many people are justifiably concerned about the care and treatment of the animals in research. They ask if it's necessary, if the animals are being treated humanely and if they are allowed to suffer.

The answer is that it is necessary to use animals in medical research. Computer modeling alone won't do; important discoveries are made as a result; and the animals themselves are protected by laws that eliminate cruelty of any sort.

Moreover, the people who conduct the research recognize their special obligation to safeguard the welfare of laboratory animals. Their research is guided by the following principles: Use as few animals as possible, use them only when absolutely necessary, be sure to design experiments that yield scientifically valid results, and take good care of the animals, using the most humane methods and treatments possible.

Just how necessary animals in research are, what discoveries are made as a result, and how animals are treated in research is explained in the following questions and answers prepared by Michael Dabney, a communications specialist in the UCSD Office of Animal Research Information.



THE USE OF ANIMALS IS CONTROLLED BY AN EXTENSIVE SYSTEM OF LAWS, GUIDELINES AND REGULATIONS THAT PROTECT THE WELFARE OF LABORATORY ANIMALS IN THE UNITED STATES.

Animal Research

How necessary are animals to medical research?

More than two-thirds of the research projects that led to Nobel Prizes in physiology and medicine involved animal experiments.

According to one of those laureates, Dr. Joseph Murray, who performed the first human kidney transplant in 1954, "Scientists agree that whenever a cure for AIDS is found, it will be through animal research."

Animals are still required and used for research into stem-cells, gene therapy, the brain's role in learning and memory, organ transplantation, spinal-cord injury, cancer and diabetes.

Why not computer models?

Biomedical science does use computer models and tissue samples whenever it's feasible, says Tony Yaksh, the anesthesiology researcher who chairs the Animal Subjects Committee at UCSD. However, many questions can still only be answered in a complete non-human living system.

"Medical advances resulting from biomedical research reflect an integration of various elements of research," Yaksh says. "Any element alone would not yield the drug therapy or clinical treatment we have grown accustomed to seeing."

How successful has animal research been?

Over the past century, animal research has contributed to the discovery of antibiotics that treat bacterial infections, vaccines for smallpox, tetanus and measles, anti-coagulants for blood clots, and better anesthesia.

Animal research at UCSD has contributed to:

- the discovery of the first direct evidence of how a cancer gene works
- the technology for growing replacement skin for burn victims
- the development of a new vaccine against malaria
- a treatment for lung disorders that kills premature infants
- a compound that rapidly dissolves painful gallstones

In a Heartbeat: sudden death of mice and men

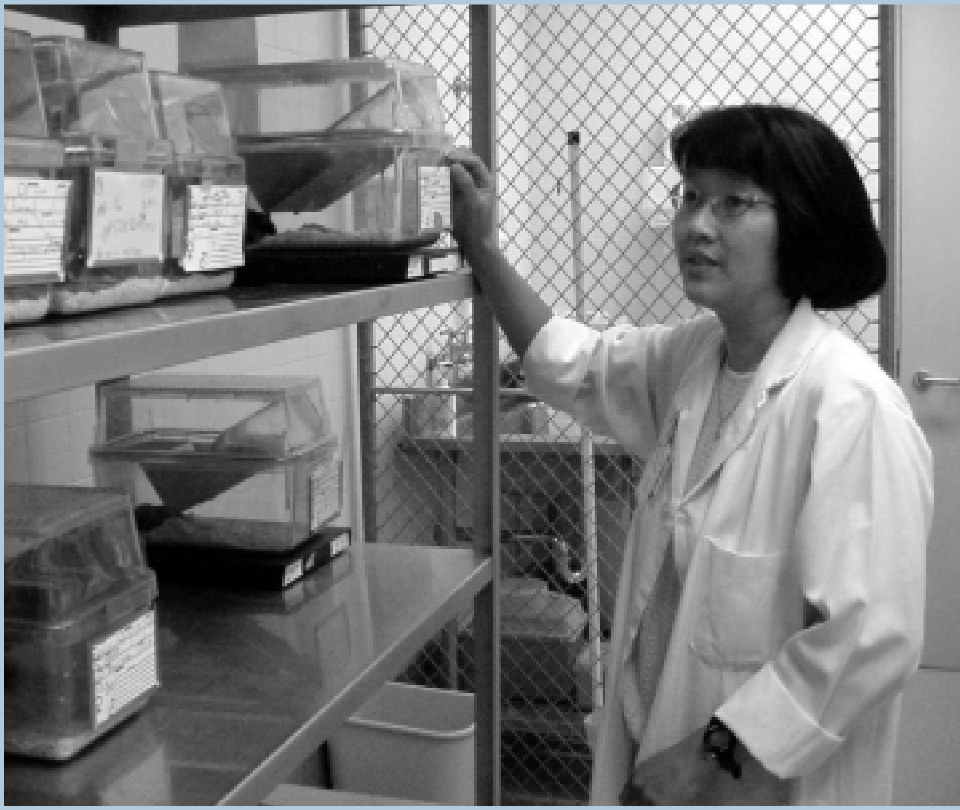
Scientists who monitored the heart rhythms of specially engineered mice discovered that they lacked a molecular switch called HF-1b and were highly susceptible to the same sort of heart-rhythm irregularities that occur in human cases of sudden cardiac death.

The discovery is important, according to Van T.B. Nguyen-Tran, an assistant project scientist in UCSD's Institute of Molecular Medicine, since it raises the possibility that early-detection measures could be devised for sudden cardiac attack, which kills an estimated 225,000 people in the United States each year.

The molecular switch seems to be involved in the formation of pacemaking cells that regulate heart rhythm.

Genetic mutations that increase the risk of death from sudden cardiac arrest have been identified before, Nguyen-Tran said, but they account for only about 20 percent of the total. Her study suggests that a defect in the HF-Ib pathway may account for others.

"The more scientists learn about this complex condition, the quicker effective treatment can be developed, including preventive and early-detection measures," she said.



Van T.B. Nguyen-Tran

- a better understanding and treatment of Alzheimer's, heart disease and life-threatening shock.

Which animals are used and why?

Ninety-five percent of the animals used at UCSD are laboratory rats and mice. According to Marky Pitts, director of the UCSD Animal Subjects Program and the Office of Animal Research Information, their small size, naturally short life span, and great genetic diversity make them ideal for research models of human disease. Rodents also share many similarities in structure and function with humans.

Other species, with their own unique biological characteristics that closely resemble those of humans, are also suited for biomedical research. For instance, dogs, which represent 0.16 percent (one in 600) of the UCSD animals each year, are used to study heart and lung disease, diabetes, trauma and shock, anesthesia, microsurgery and organ transplants.

Research on non-human primates, which constitutes 0.021 percent (one in 5,000) of the animals used in research at UCSD, has led to advances in AIDS, human memory and learning, Parkinson's and Alzheimer's disease, spinal-cord injuries, and Rh disease (which affects babies whose blood type differs from that of their mothers).

How well are the animals taken care of?

"Those who work with research animals—scientists, veterinarians, and animal care technicians—do care about them," Pitts says. "Many of them are pet owners and animal lovers themselves, and they recognize that using animals in research is a privilege that carries with it the responsibility to treat those animals humanely."

Furthermore, the use of animals is controlled by an extensive system of laws, guidelines and regulations that protect the welfare of laboratory animals in the United States. Regulations include the Animal Welfare Act of 1966 and the Health Research Extension Act of 1985.

Withering Brain Cells: what monkeys and people have in common

In gene therapy research on older monkeys, Dr. Mark Tuszynski, director of UCSD's Center for Neural Repair, and his team have been able to reverse the process of deteriorating cells in the cholinergic system, a key region in the brain that regulates memory and cognition.

The same network is known to wither and weaken in people with Alzheimer's disease. And, as a result of the research, UCSD surgeons have been able to perform the first ever attempt to use gene therapy to treat a disease of the nervous system in a human being.

As healthy monkeys age, cells in this brain region decrease in density, a process that is roughly similar to aging that occurs when a human turns 70.

The scientists found that, in monkeys, the density of these connections can be restored significantly by transplanting a gene that releases a protein called nerve growth factor (NGF), which is known to maintain connectivity for complex brain communication.

"We were surprised by the extent to which these genetically modified cells were able to reverse the effects of aging," Tuszynski said.

So, in an 11-hour procedure performed April 5 at the John M. and Sally B. Thornton Hospital at UCSD, surgeons implanted genetically modified tissue into the brain of an Alzheimer's patient. The patient, a 60-year-old woman, a former teacher from Oregon who was diagnosed with the disease three years ago, was released two days later.

If successful, the implant should begin to affect brain function within a couple of months. "NGF gene therapy is not expected to cure Alzheimer's disease," Tuszynski said, "but we hope it might protect and even restore certain brain cells and alleviate some symptoms, such as short-term memory loss, for a period that could last a few years."

PHOTO BY PABLO MASON

Dr. Fred Levine

Insulin Deficient: scientists learning from mice how to cure diabetes in humans

Diabetes is caused by a deficiency in insulin. In healthy people, insulin is produced naturally in the pancreas by beta cells. Problems with these cells can lead to diabetes, which require the patient to take insulin injections or, in rare cases, get a pancreas transplant from an organ donor.

Transferring healthy, insulin-producing cells into diabetic humans may one day be a viable alternative to transplanting the whole pancreas, if a biomedical research project headed by Dr. Fred Levine, a pediatric geneticist and associate professor at the UCSD Cancer Center, continues to go well.

After successfully transplanting the engineered cells (called beta cells) in mice, Levine and his team have found a way to grow human beta cells indefinitely in the laboratory so that they secrete insulin when stimulated by blood glucose. Transferring these healthy cells to patients would involve just "a minimal surgical procedure."

While the prospect of developing an unlimited source of beta cells for transplantation has been hailed as a significant advance, there are still problems to be solved before the procedure can be tested in large diabetic animals, Levine said. And human trials may be years away, he adds.