

Canines in Biomedical Research: *Benefiting People & Pets*



The relationship between dogs and people may pre-date recorded history. Over millennia, dogs have become our most beloved pets and our hardest working partners. They guide those with special needs; help police, fire and rescue personnel; and even assist in herding other animals. One of the most significant results of our partnership with dogs has been their contribution to our understanding, preventing and curing disease. In fact, ***dogs and people get many of the same diseases*** from heart disease to cancer. Studies with dogs in medical and scientific research often yield ***life-preserving and life-enhancing treatments that help not only people, but also dogs themselves.***¹ Most of the top 25 drugs² prescribed in the U.S. were developed thanks to studies with dogs. Dogs are not used often in biomedical research, but when they are it is for very important work and only when scientifically necessary. Research with dogs involves strict oversight by federal authorities, the Animal Welfare Act and veterinarians.

DOG RESEARCH STATISTICS & TRENDS

~60,000 dogs were part of research, education, or drug and product safety testing in 2015, as reported to the USDA by U.S. research facilities. Dogs account for less than 0.05% of all animals in research. In fact, the number of dogs used in research has decreased by 71.1% since 1979. 99% of research animals are mice, rats and fish, but a relatively small number of dogs still are needed because they are the most appropriate model, or the only one possible, to answer a research question. Research canines are purpose bred and typically are beagles or mongrels.

Most institutions have laboratory dog adoption programs. When appropriate and feasible, efforts are made to find permanent new homes for retired research dogs. Scientists, students, and staff often adopt the dogs they have worked with, cared for and learned from.

DISCOVERING CURES FOR PEOPLE & PETS

Cancer: Research with dogs could lead to better diagnostic tests for bladder cancer in both canine and human patients.³ Numerous studies are addressing innovative treatments like immunotherapy⁴ for other types of cancer suffered by dogs and humans, such as skin cancer,⁵ bone cancer,⁶ and nasal adenocarcinoma.⁷ PBS has recently highlighted the role of dogs in cancer research. Searchable databases for animal cancer and comparative medicine clinical trials are available online.^{8,9}

Diabetes: The 1923 Nobel Prize in Medicine was awarded for the discovery of insulin in dogs,¹⁰ and they continue to serve as an essential model for alternative treatments to preserve the insulin-producing cells of the pancreas, improve the quality of life for humans and dogs with diabetes, and ultimately to find a cure for the disease.¹¹

Heart Disease: Dogs played a major role in the development of surgical procedures for heart valve and artery replacement; angioplasty studies with dogs have significantly advanced our understanding of narrowed or clogged arteries and re-narrowing of coronary arteries after angioplasty. The canine aorta is a relevant model for testing the implantation of devices, such as the stent designed to prevent the recurrence of arterial narrowing.¹² Dogs also benefit from this research because they develop cardiac problems like those experienced by people.¹³

Spinal Cord, Bone, & Muscle Conditions & Injuries: Dogs are integral to the study of spinal cord injury,¹⁴ the development of prosthetic devices for human hip and knee replacements, tendon and ligament repair, and assessment of biomaterials for orthopedic devices.^{15,16} Older dogs have been used to study osteoarthritis, cervical disc degeneration, and vertebral fusion because the pathophysiology of such dogs is similar to that of aged humans.^{17,18,19} These research advances afford companion dogs many of the same benefits as for humans, such as hip and knee replacement, arthroscopic ligament repair, and other procedures associated with degenerative joint disease.²⁰ Dogs — young and old, big and small — may suffer from hip dysplasia, a malformation of the ball and socket joint of the hip. Fortunately, treatment options are available to help pets stay mobile and free of pain.²¹

Aging & Alzheimer's Disease: Unlike mice and rats, older dogs naturally develop significant brain pathology and may display learning and memory problems, strikingly like changes seen in people.²² Dogs develop senile plaques in their brains made up of a protein identical to one that humans produce. Multiple teams of NIH-supported investigators are studying aged beagles to find treatments for dementia, such as special diets and behavioral enrichment.^{23,24,25} When the University of Washington requested volunteers, local pet owners offered more than 1,000 dogs, and 32 were selected, to participate in a study of an experimental anti-aging drug started in 2015.²⁶

Genetic Abnormalities: About 6 in 100,000 babies are born with centronuclear myopathy, which weakens skeletal muscles so severely that children have trouble eating and breathing; often dying before age 18. By discovering a similar condition in canines, researchers have a means to diagnose the disease, unravel its molecular intricacies, and target new therapies.²⁷ Spontaneous genetic models in dogs are available for research involving muscular dystrophy, sleep apnea, progressive retinal atrophy, hereditary nephropathy, hemophilia A and B and dilatative cardiomyopathy.^{28,29} An ongoing study begun in the dog model³⁰ suggests that a new kind of gene therapy for hemophilia B could be safe and effective for human patients.

Kidney Disease: Kidney dialysis treatment of dogs³¹ whose organs have failed is one example of a medical solution developed for humans that is now also saving pets.

Transplantation of Organs & Cells: Pioneering surgeons in kidney, heart, and other organ transplantation Joseph Murray³² and Thomas Starzl³³ credit dogs with making essential contributions to their success in treating human patients. Dogs were also critical in the development of hematopoietic cell transplantation or bone marrow transplantation because of their genetic diversity, large size, long life, and the fact that, other than humans, they are the only mammals to possess these qualities.³⁴

PET HEALTH

There are ~70 million pet dogs in the United States per the American Veterinary Medical Association.³⁵ Caring for the health of pets is vital, and thanks to research with purpose-bred canines, we can offer our pets:

- ***Vaccinations against infectious diseases such as canine distemper, parvovirus, rabies, coronavirus, leptospirosis, Lyme disease, measles and hepatitis.***³⁶
- ***Prevention and treatment of heartworm, intestinal parasites, fleas, ticks, mites, and mange.***

With optimal diet³⁷ of great interest to dog owners, pet food and other product manufacturers study dogs to better understand how to create the most nutritious food for our pets. Because of pet overpopulation, dog reproduction is studied with the aim of devising less invasive and lower-cost means of insuring birth control.³⁸

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