Veterinarians in Biomedical Research

A teacher resource developed by the American Veterinary Medical Association
www.avma.org

Why have a teacher guide?

The goal of AVMA sponsored 4th-6th grade learning activities is to heighten awareness of the vital role that veterinary medicine plays in the lives of humans, animals, society, and the environment. This initiative has five objectives:

- To teach children that there is an inseparable relationship between animals and humans
- To teach children that veterinary science makes vital contributions to our world
- To teach children that veterinary science significantly impacts their lives every day
- To interest young students in a career involving biology, mathematics, and applied science
- To promote a greater understanding of the scope of veterinary medicine

What do biomedical research veterinarians do?

Veterinarians who work with animals in a research environment may work for a company or for the U.S. Government. Veterinarians working in pharmaceutical and biomedical research firms develop, test, and supervise the production of drugs, chemicals, and biological products, such as antibiotics and vaccines for human and animal use. In both government laboratories and in corporate research facilities, veterinarians provide daily medical care to the animals involved in research, ensure that the animals are properly and humanely cared for, and use their expertise to improve surgical techniques for humans and animals. Some veterinarians who work for the U.S. Department of Agriculture (USDA) visit research laboratories to ensure that the treatment of the lab animals adheres to the federal laws designed to protect the lab animals. Research veterinarians may also work at other government agencies such as the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA) or the U.S. Public Health Service (USPHS). Research veterinarians at these agencies work to find cures for diseases and sometimes test potential new drugs on the animals to determine if the drugs are effective and safe.

What are some of the specializations of biomedical research veterinarians?

Veterinary researchers generally pursue education beyond a Doctor of Veterinary Medicine (DVM) or Veterinary Medical Doctor (VMD) degree. They have earned a doctorate or master's degree in a field such as pharmacology, virology, bacteriology, pathology, parasitology, toxicology, nutrition, or endocrinology and, like other veterinarians, they keep learning new techniques and procedures throughout their careers.

What contributions do these veterinarians make to animal and human health?

Veterinarians in research seek better ways to prevent, diagnose and treat animal and human health problems. They study many diseases such as cancer and cardiovascular disease using laboratory animals that are carefully bred, raised, and maintained under the supervision of veterinarians. Laboratory animal veterinarians help select the best animal models for particular research projects and carefully monitor the animals to ensure proper care and attention to the animals' well-being.

In addition to developing ways to reduce or eliminate the threat of animal diseases, research veterinarians have made many contributions to human health. For example, research veterinarians were the first to isolate filterable viruses, the first tumor-causing virus, *Salmonella* species, *Brucella* species, and other pathogens. They also helped conquer malaria and yellow fever, solved the mystery of botulism, produced an anticoagulant used to treat some people with heart disease, and developed and refined surgical techniques for hip-joint replacement and limb and organ transplants in people.

What is the employment outlook for biomedical research veterinarians?

An increased emphasis on scientific methods of breeding and raising livestock, poultry, and fish will contribute to a demand for more veterinary researchers. Research veterinarians will also continue to support public health and disease control programs. We can look to research veterinarians to develop new surgical and medical treatments for animals that can be later used to help humans in need of the same type of treatment.

What kinds of animals are used in animal testing and why?

Almost all of the animals used in laboratory work are mice and rats. Cats, dogs, monkeys, and other animals (sheep, pigs, guinea pigs, etc.) make up less than ten percent of the research animal population. Mice and rats are ideal for research projects because it is easy to study long-term degenerative diseases in an animal that has a short lifespan. In addition, mice and rats are inexpensive and easy to obtain. Cats and dogs are chosen to study diseases in the human population such as cancer and AIDS. Monkeys may be research subjects because of their physical similarities to humans, making it easier to study complex human ailments in their systems.

How is animal testing advancing medicine?

Virtually every major medical advance of the last century for both human and animal health is the result of animal testing. From antibiotics to organ transplants, practically every present day protocol for preventing, treating, curing, and controlling diseases in humans is based upon knowledge gained through animal research.

What treatments for diseases are being discovered through animal testing?

Animal testing is helping to treat and understand many diseases affecting people and our quality of life. These diseases include AIDS/HIV, breast cancer, heart diseases, strokes, and addiction to cigarettes and drugs. Animals, too, benefit from laboratory research through the discovery of new treatments for diseases affecting them such as heartworm, anthrax, and cancer.

What does a veterinarian do with the lab animals?

Research veterinarians who work with lab animals are responsible for making sure the animals' health and welfare are protected. Every animal study performed must satisfy criteria established by an *Institutional Animal Care and Use Committee* (IACUC) to ensure that the study is necessary, that the type and number of animals used are appropriate, and that the animals involved do not suffer unnecessarily.

What is the most challenging part of a research veterinarian's job?

Research veterinarians say the most challenging part of their job is the vast amount of knowledge they must have readily available. These veterinarians must understand everything currently known about a disease – from its cause(s), to the way it interacts with the body's cells, to research on potential cures.

Enrichment ideas for this curriculum:

The timeline on your poster features several medical advances showing how veterinarians help animals and people through research. Extend your lesson with information on the timeline.

1885—Veterinary scientist Dr. Daniel E. Salmon discovered the first strain of *Salmonella* and pioneered the fight against infectious diseases. The discovery of this potentially deadly bacterium that causes food poisoning has saved the lives of millions of people and animals.
Circa 1900—When veterinarians proved insects can transmit disease, research was launched to control typhus, malaria, bubonic plague, and yellow fever. Learning that insects can spread disease has helped to protect animals and people from many deadly illnesses.
1993—Dr. Martin Fettman was the first veterinarian to participate in an outer space mission aboard space shuttle Columbia. The space crew studied what happens to people and animals while they are in space where there is no gravity. Their research helped improve the health and safety of astronauts on later space missions.
1996—Dr. Peter Doherty, a veterinary researcher at St. Jude Children's Research Hospital in Memphis, Tennessee, was awarded the Nobel Prize for his discovery of how the body's immune system protects us from infections. This discovery led to further research in the prevention and treatment of infections in both animals and people.
1999—Bronx Zoo veterinarian Dr. Tracy McNamara was the first person to determine that zoo animals and wild birds were dying from the same disease that was infecting people in New York. Once the link between West Nile Virus in animals and people was identified, researchers began to look for ways of preventing and treating this potentially deadly disease.

Glossary:

Anthrax — a disease caused by the bacterium bacillus anthracis that is highly lethal in some forms to pigs, cattle, sheep, goats, camels, wild buffalo, antelopes, and humans
Anticoagulant — a substance that stops blood from clotting
Bacteriology — a branch of microbiology that studies bacteria in relation to disease
Botulism — a disease of the nervous system caused by eating spoiled foods
Brucella — a bacterial disease caused by members of the *Brucella* genus that can infect humans but primarily infects livestock with symptoms that include intermittent fever, sweating, chills, aches, and mental depression. The disease can become chronic and recur, particularly if untreated.
CDC (Centers for Disease Control and Prevention) — an agency of the United States Department of Health and Human Services that works to protect public health and the safety of people by providing information to enhance health decisions
Degenerative disease — a disease where tissue and organs progressively deteriorate over time.
DVM — Doctor of Veterinary Medicine is a doctor for animals
Endocrinology — is a branch of medicine dealing with disorders of the endocrine system and its specific secretions called hormones
FDA (Food and Drug Administration) — an agency of the United States Department of Health and Human Services responsible for the safety and regulation of most types of foods, dietary supplements, drugs, vaccines, biological medical products, blood products, medical devices, radiation-emitting devices, veterinary products, and cosmetics
Heartworm — a parasite roundworm (*Dirofilaria immitis*) that is spread from host to host through the bites of mosquitoes that can cause illness in dogs, cats and many other animals
Hormones — a chemical messenger that carries a signal from one cell (or group of cells) to another via the blood
IACUC— every animal study that is performed must satisfy criteria established by an *Institutional Animal Care and Use Committee* (IACUC) to make sure that it is necessary, that the type and number of animals used are appropriate, and the animals are not allowed to suffer unnecessarily
Lifespan — the typical length of time that any particular organism can be expected to live
Nutrition — the science that examines the relationship between diet and health
Pathogens — biological agents that causes disease or illness
Pathology — the study and diagnosis of disease through examination of bodily fluids, cells, tissue, and organs
Pharmacology — the study of how drugs interact with animals or people to produce a change in function
Protocol — setting up the steps to follow in an experiment before beginning
Salmonella — A bacterium that may cause intestinal infection and diarrhea
USDA *(United States Department of Agriculture)* — the part of the federal government that develops and enforces policies on farming, agriculture, and food
USPHS *(United States Public Health Service)* — the part of the federal government that protects, promotes, and advances the health and safety of the people and animals of the United States
Vaccine — medicine given to a person or animal to prevent a particular disease
Virology — the study of viruses
Virus — a microscopic infectious agent that causes disease

Additional Resources:

www.avma.org The American Veterinary Medical Association
www.fbresearch.org/ Foundation for Biomedical Research
www.aalas.org American Association for Laboratory Animal Science
www.aslap.org American Society of Laboratory Animal Practitioners
www.acvp.org American Association of Public Health Veterinarians
www.usatoday.com/tech/science/space/2007-12-11-nasa_N.htm Public health space mission

Student Activities:

4th Grade Activity Sheet: ***Learn about West Nile Virus*** The students will answer "who," "what," "when," "where," and "why" questions by researching how Bronx Zoo veterinarian Dr. Tracy McNamara discovered that zoo animals and wild birds were dying from the same disease that was infecting people in New York.

5th Grade Activity Sheet: ***A Dog Named Triumph*** The students write a story that shares what happened to Triumph the dog using the information available at www.triumphthedog.net/.

6th Grade Activity Sheet: ***How Research Helps Fight Cancer*** The students enter the phrase "cancer research" into an online search engine and create persuasive essays on what is being done to reduce cancer deaths or eliminate the cause of a particular type of cancer.

Vocabulary Crossword Puzzle Activity Sheet: The students will demonstrate knowledge of the vocabulary words by correctly solving a crossword puzzle using the definitions of each word as clues.