READING PASSAGE

Lesson 2 – Animal Research and Vaccines

Preventing Disease: How do Animals Help?

Think of a disease. What comes to mind? Perhaps you thought of AIDS or Zika — or maybe hepatitis or influenza ("flu"). Vaccines cannot prevent all diseases. But they do prevent many. The deadly disease smallpox once afflicted people across the world. With the help of vaccines it was wiped out by 1980. Scientists are working on vaccines to prevent other diseases you may hear about. Perhaps one day we can get rid of some of those diseases too.

However, before we have a vaccine, someone has the idea to make one. Usually, such ideas come out of research labs. Most universities, hospitals or biotech companies have such labs. Scientists in these labs might specialize in studying a virus or bacteria that causes disease. As they learn about the disease, they try to figure out how to prevent it. However, testing a vaccine, drug, or surgical procedure often requires the use of animals.

Why do scientists work with animals?

From an idea, a scientist creates a hypothesis. Often, the only way to test a hypothesis is by working with animals. Mice are among the most popular animals that scientists use. Scientists also work with other animals. Depending on the study design, they may use fruit flies, rats, rabbits, chickens, and monkeys, among others. Using animals enables scientists to test hypotheses more efficiently. Here is why:

(1) Living things are very complicated.

We cannot use chemicals, cells or computers to answer all scientific questions. Even advanced computers cannot model every aspect of a living system. Specific hypotheses related to living processes may be testable only with living creatures.

(2) Unknown chemicals and procedures cannot be tested on people.

Until something is likely to work, scientists can't test it on people. That would be dangerous and unethical.

(3) Scientists can get results faster.

The most widely-used animals, such as mice and fruit flies, have short life spans. Using them, scientists can get answers more quickly. Tests done on people would take much longer. Also, animals, notably small animals, are easy to get in large numbers. Larger numbers increase the sample size. Bigger sample sizes increase the confidence of statistical analyses. The same study on people would take much longer because of the time needed to get a large sample size.

(4) Scientists can use animals that are genetically similar.

Animals enable scientists to design robust scientific experiments. For example, results are hard to interpret if individuals differ greatly in their genetic makeup. However, breeding in the lab provides genetically similar individuals. Scientists can therefore be more confident in how they interpret the results.

How do animals help scientists to make vaccines?

Vaccine research and development typically benefit from animal research. Consider a type of virus or bacteria that makes animals sick. Scientists can study the disease in the animals. They can then better understand what happens in people. For example, untreated rabies is almost always fatal in humans and animals. The French scientist Louis Pasteur studied rabbits to develop the rabies vaccine. He then tested his vaccine on dogs before treating human infections.

Scientists can also use an animal virus to develop a vaccine. In this case, they use a virus similar to one that infects people. The animal virus must be able to infect humans without causing serious illness. People infected by the animal virus then become immune to the human virus. Edward Jenner made the very first vaccine this way. He made his vaccine from cowpox. This virus infects cows. A mild cowpox infection protects people from getting smallpox. Smallpox is similar to cowpox but is often deadly when people are infected.

Scientists can also use animals to check the immune response caused by a possible vaccine. In this approach, the animal's immune system substitutes for a human's. Hence, we call this an *animal model*. Scientists can use the model to study how the immune response develops and adapts to experimental changes. The researcher could change the number or timing of doses. Other changes could be the amount of vaccine in each dose or how the dose is administered (such as orally or by injection.)

The role of clinical trials

Research with animals can take several years. Scientists need enough data to feel confident that a drug, vaccine, or surgical procedure will work in people. Animal studies can provide a wealth of data. But the work is far from finished. This is when scientists test their idea in people. These tests are called *clinical trials*. Only clinical studies can show whether or not a product truly works in people. If clinical trial results are unacceptable, scientists try to understand why. In this case, scientists may return to working with animals. Never doubt that today we enjoy our relative freedom from disease because of the help of animals.