
Using Rats In Scientific Research

Living organisms have systems which all work together to enable survival. In the animal kingdom, rats and humans are both mammals, and they have very similar systems and organs in their body. A mammal is a warm-blooded vertebrate animal which has fur or hair, gives birth to babies, as opposed to laying eggs, and feed their young milk. The systems which enable survival in mammals include the circulatory system, musculoskeletal system, digestive system, excretory system, respiratory system, reproductive system and nervous system. Other types of mammals include dogs, lions and whales. Rats are often used to provide an understanding of human anatomy, as the internal systems and structures are very similar.

In rats and human is, the circulatory system pumps blood around to the body cells with the heart producing new blood cells and taking the deoxygenated blood to the lungs, where the oxygenated blood is created. The heart of both mammals has four chambers, which are called the right atrium, left atrium, left ventricle and right ventricle. The respiratory system in both rats and human's exchanges carbon dioxide and oxygen with air. They both have lungs to provide this function, a nose, trachea, bronchi and pharynx.

The musculoskeletal system of a rat is almost identical to that of a human, with a similar skeletal structure. The main difference is the skull which is shaped differently. The muscles are denser in rats as they are smaller and, they have a tail which is absent in humans. The nervous system of both rats and humans are similar because they conduct messages from the nerves and send these to the brain. Due to this rat's and humans react to pain and sensation in a similar way.

The digestive system of both rats and humans, have the same three main areas of digestion, which include the salivary glands, oral cavity and abdominal cavity. They both have a small and large intestine. The small intestine is used to absorb, and digest food and the large intestine absorbs water and undigested food. The main difference in the digestive system is that rats do not have a gall bladder and instead use bile ducts in their liver, which breaks down fats and proteins. The liver in a rat is very large due to the many functions. The excretory system of both rats and humans includes the kidneys, urethra, and urinary bladder. The excretory system removes wastes from the body and filters blood and urine.

The reproductive system of female rats and humans have the same function; however, they are structured differently. For example, in human female reproductive system, the uterus is pear shaped and in rats it is shaped with uterine horns. This is because the female rat's reproductive system is designed to carry many offspring at one time. The reproductive system of male rats and humans are similar in that they both contain testes and a scrotal sac; however, the genitals of a rat are internal and in a human male, they are external.

Rats have been bred for classroom use and education for many years, providing a valuable learning experience and a comprehensive understanding of the anatomy, and how all the systems work together. By dissecting a rat, and observing the internal systems, a thorough learning experience is achieved, that would not be the same as observing someone else completing a dissection, either in person or on a video. Whilst there are some ethical issues associated with using rats for classroom use, rats have been used widely in scientific research

and this has contributed to valuable medical breakthroughs. There are strict protocols which must be followed in working with rats and other animals for research and experimentation.

Aim:

To dissect the rat and find out the differences and similarities between humans and rats successfully.

Equipment:

- Scalpel
- Probe
- Dissecting Board
- Newspaper
- Gloves
- Camera
- Scissors
- Forceps

Method:

1. Collect your dissecting equipment and materials required for this experiment
2. Put on your safety glasses, lab coat and plastic gloves
3. Using the dissection scissors, open the package where the rat has been preserved in. If there is any extra preserving juice left in the packet, empty the preserving substance in the sink.
4. Observe the external organs of the rat and make sure you take photos of the following: vibrissae, incisors, pinna, auditory meatus, the teats and the anus. If you have a female rat, look for the urinary aperture, vaginal orifice and vulva. If you have a male rat, look for the scrotal sacs, prepuce and the urogenital orifice.
5. Using your dissecting scissors, pull the skin muscle away from where the organs are placed and cut a hole in the abdominal wall and cut a vertical line from the throat to the anus and horizontal lines at the bottom of the rat, at the bottom of the rib cage and the throat.
6. Locate and observe diaphragm, the heart, the thymus and the lungs. Make sure you take photos of these organs.
7. Observe and take photos of the following abdominal organs: the coelom, mesenteries, the liver, oesophagus, stomach (cardiac sphincter, greater curvature & lesser curvature), spleen, pancreas, small intestine (use your scissors to cut out the small intestine making sure you do not damage any organs), the colon which is also known as the large intestine, cecum and the rectum.
8. As you see the internal organs, you may take cut out each organ and do closer observations of the organs.

Results

The functions of the major organs of the digestive system is to absorb nutrients and digestive food. The major organs in the rat's digestive system is the oesophagus, liver, pancreas, gall bladder, stomach, small intestine, colon, caecum, anus, rectum, caecum and bile duct. The oesophagus carries food to the stomach where it is stored, and the beginning of protein and fats are broken down. The bile is produced in the liver and transferred to the small intestine through bile ducts. The small intestine absorbs nutrients while the large intestine is where the water and some bacteria is stored. The pancreas is where digestive enzymes is made, and they are taken to the small intestine. The caecum is the transfer point of the small and large intestine. The caecum is like the appendix in humans. The rectum and anus are the last part of the digestive system where faeces are stored and excrete through the anus.

Discussion

1. Give an opinion as to why or why not rats should be used for classroom research.

Yes, rats should be used for classroom research because it helps us to know what is inside of us and rats as we are very similar because we are both mammals.

2. Find some data on the breeding and treatment of animals bred for scientific purpose.

3. How valuable was the learning experience?

4. Would it be equally valuable to watch a video on a dissection?

5. Do you think it is cruel, important, not worth it, irreplaceable?

Evaluation

In this experiment, a rat was dissected, and observations were made of the internal and external systems. A rat was used to gain further understanding of the human anatomy as it is similar in structure. Observations of the similarities and differences of the rat and human organs and systems was gained. The procedure was straight forward and easy to understand. The experiment provided a good insight in the structure of the organs and appearance in rats. In this experiment the rat dissection enabled a detailed observation of the systems of both the male and female rats, including a study of their reproductive organs.

This experiment could be improved by having a longer time to dissect a rat, so that the organs could be viewed in more detail providing an improved analysis of each organ. The experiment could also be improved by using a fresh rat, as the identification of the organs are clearer. In the preserved rat, the internal organs were similar in colour, making it more difficult to find them.

Rats provide a valuable understanding of the human anatomy and have been used widely in classroom education, along with medical research. There are ethical issues associated with rats being used for classroom learning. Some of the issue raised include animal rights and animal cruelty, and whether it is necessary to use animals in research and experiments.

With increased new technology, other interactive ways to learn the anatomy of a rat are becoming increasingly available, providing an alternative to the ethical dilemma of dissecting rats and other animals for classroom use, research and experimentation. This may not provide the skills required to dissect the mammal but could provide the same knowledge. This could be an option for those who do not want to take part in an experiment to receive and understand the knowledge.

The results of this experiment were as expected, as the major organs and systems of the rat were observed to provide a greater understanding of how they work, and then comparing this to theory and knowledge about the structure of the systems and organs of humans, and a greater understanding of the overall way in which mammal's internal systems and organs work

Conclusion

Overall the experiment was successful in showing the internal and external anatomy of a rat. The initial theory was proved in that rat's organs are like a human's organs, but smaller. The internal systems of a rat were observed in their appearance, shape, texture and structure, providing an insight into the internal systems of a human. The dissection was successful, and it matched the aim of this practical experiment.

Bibliography

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