Module 5 : About Animals' Brains

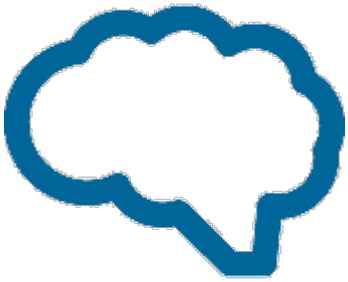
- New research shows science has just begun to understand the animal brain
- New tests designed for the animal help reveal their intelligence
- Comparing the human brain to other animals
- The dog and cat brain

In module 5 you will learn about animals' brains, particularly about the two most common pets. Here are a few study points:

- New research showing science has just begun to understand the animal brain
- New tests designed for the animal can help reveal their intelligence
- Comparing the human brain to other animals
- The dog and cat brain
- Rats, empathy, and continued studies

About Animals' Brains – 5m18s

5.1 Does the Science of Animal Brains Know It All?



Science continually comes back to one thing when discussing animal brains, and that is size.

Brain size is still considered the ultimate determiner for how animals differ, particularly when assessing the human brain compared to other animals. However, psychology shows us that brain size may not exclude certain behaviour and emotion.

Brains of various species are different with regards to lobes.

The human brain has four lobes, which differ from most animals. The lobes are frontal, temporal, parietal and occipital. These lobes give humans the ability to see, control movement and speak. Humans, at least according to our research, are the only animals capable of a complex language. The languages and abilities of humans when compared to animals is a debate for another day; however, it should be noted that animals have their own languages and abilities. Their capabilities differ from ours and are not fully understood.
Researchers are discovering more than the conditioning response that pets have shown us since Pavlov started working with his dogs.

We already understood the navigation elements pets have to a degree. Many animals have a 'homing beacon' that tells them how to return to their den, pack, flock or breeding grounds.

Now researchers are finally testing theories on more than basic emotional, motivational processes and social emotions. It is through various tests of animals that biologists and primatologists are starting to recognise the intelligence animals have.
New research shows humans have underestimated the scale and scope of animal intelligence.

Primatologist Frans de Waal spoke with the Wall Street Journal about chimps, elephants and rats (having studied these three animals) all of which are capable of showing empathy. This is just one example of how new research is taking a different look at how animals think and behave. Evidence has suggested certain emotional processes with dogs' depression after their owner dies. Even horses have displayed emotions associated with loss when an owner has died.

According to the study of whether an ape or person is smarter, one has to realise it depends on the task.
A 2007 study at Kyoto University compared a chimp called Ayumu to several humans. Ayumu was able to recall nine random numbers, whereas the scientist, Frans de Waal, could only remember five. Ayumu also outperformed university students and even a British memory champion.

It suggests that in certain circumstances animals like the chimp may have the smarter brain. When it comes to seeing patterns for a few seconds, versus a human that sees it longer, a chimp has better recall.

Animal psychology and other areas of study have begun to realise that cognition in animals can be

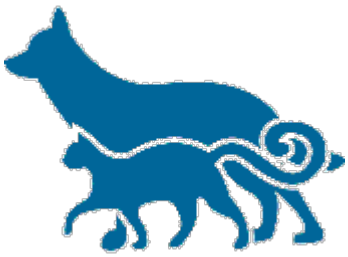
studied using some inventive tests. These tests indicate that the concept of *Scala Naturae*, which has been our ladder of the animal kingdom's order, may be inaccurate.
Even Rene Descartes was incorrect in calling animals "soulless automatons". B.F. Skinner stated that "animal cognition" is nothing but an oxymoron, for while animals are capable of learning they cannot think or feel.

Scientists today are starting to think differently, in order to figure out an animal's level of intelligence.

For example, a chimp is able to pick up a stick and use it as a tool, but an elephant would not react the same way.

For an elephant, their olfactory senses are more heightened; as the tool is their trunk, which is also their nose. Rather than using sight as the main sense they use their trunk to detect different smells. If an elephant picked up a stick to use it as a tool it would block its nose; essentially cutting off its oxygen. However, give an elephant a box to reach food hanging high on a tree and the elephant can use the box as a tool, to stand on and reach the food.
When discussing animal brains, one must realise brains may form differently, have fewer lobes, be smaller or larger in size, but overall there is more than instinct.

5.2 Dogs and Cats



Nicholas Dodman, a scientist at Tufts University School of Veterinary Medicine in Boston, examines cats and other animals in terms of brain functionality, size and structure.

According to Dodman, cats and dogs have temporal, frontal, parietal and occipital lobes in their cerebral cortex just as humans do. Studies also show the regions of the brain are connected in the same way as a human brain. Cats and dogs also have five basic senses. There is a short and long term memory function in both dogs and cats.
In order to understand your pet it is important to realise that the brain of a cat and dog functions in a similar manner to humans, with all the emotions humans can feel.

The myth that a cat has a small brain and poor memory is widespread, but still incorrect. A cat has been tested for memory and shows a capacity to remember events up to 16 hours after they have happened.

Let's take the example of the cat who likes to walk, but will not walk if the two people in its household leave at the same time. If a cat has only a short memory, where it cannot remember getting in trouble for the same thing 30 seconds ago, how can this same cat be fearful of a possible

car ride? Remember, this cat walks only with one human and if two go with it then a car ride is about to happen. The cat, through learning and instincts, is capable of remembering things it does not like.

Whilst the car is parked and turned off this same cat has the capacity to walk past and even sniff the car it has ridden in, but will not go near it if both members of the household step out the front door to go on a walk. This same cat has only been in the car four times, yet the dislike and fear is readily remembered.

This behaviour suggests the cat has a better memory than humans initially believed.
Cat Trivia - Cats have over 1,000 times more data storage space than an iPad.
Source: www.tuxedo-cat.co.uk

Scans of Dog Brains

As science and technology improves, our abilities to see and learn more also improve.

Brain scans are one way that technology has allowed humans to study animals with better results. It has helped scientists and doctors learn more about the human brain, but also allowed researchers to truly see brain function in animals.

Emory University wanted to study a dog's brain while the dog was awake and without restraints. This was not a study done before as most studies involved putting the animal to sleep.

The researchers at Emory University trained the dog to walk and sit in an MRI machine. Using hand signals the researchers trained the dogs that they would receive a treat, while another signal indicated they would not get a treat. Images were taken of these interactions in order to see the brains' reaction to these hand signals.

The study showed that the region associated with receiving a human reward became active. The test proves information already understood by most dog trainers. For the dog to recognise hand signals and action them as the human trainer wants, the brain needs to react. Which part of the brain reacts, how it reacts and whether it is similar to a human's brain reacting to a treat or hand signal, is also an important part of the study. It helps show that in some ways the dog's brain is similar to a human's.

Dog Trivia

Goldsmiths College in London has conducted research on dogs' brains; showing that dogs feel empathy for their human companions and even strangers. The study concludes that a dog's emotional receptors resemble that of a human's. The University of Vienna in Austria has also concluded that dogs know when they are not being treated correctly.

A dog has an increased sense of smell due to olfactory receptors, but the interpretation of those signals is the function of the brain. The combination of the sense of smell and how the brain works give dogs the ability to detect drugs, cancer, bombs and locate missing people.

Studies in Leipzig, Germany, through the Max Planck Institute for Evolutionary Anthropology, show that dogs can learn human language and form conclusions about what new words mean. A border collie named Rico learned 200 words of the human vocabulary. Further testing revealed the ability of Rico to learn new words.

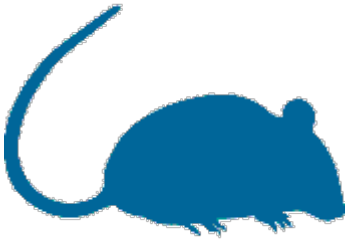
Consider for a moment the pets you may have had or do have. Does your pet react to their name in a different manner than other words spoken? An easy way to assess this is to have more than one pet and conduct an experiment. When you call one pet's name does the other pet react? Do you suddenly have two pets approaching or looking at you? Most likely only one pet will react to the name. There are several variables such as where you call the name from. For example, if you are in the place you feed your two pets you will probably get both pet's attention. However, if you are on the couch then the one you call will react.

FACT

The brain of the domesticated cat is about five centimeters long and weighs 25–30 g

Source: wikipedia.org

5.3 Rat Studies



Rats make some of the best study subjects in a laboratory for several reasons.

They are a small species that can be housed with little funding. Humane tests have been happening recently, where the results suggest the rat brain and other similar brains can be used in a better way.

Live Science recently discussed a study where researchers placed microscopic wires in the brains of rats. The wires were used to establish a connection between two rat brains. Rats with the connection were able to solve problems quicker than a rat without these wires and connection. Miguel Nicolelis, a Duke University Medical Centre researcher, said this is a brain network created with a brain to brain interface. Research took this study a step further by using macaque monkeys.

The result was a heightened capability of the monkeys. Scans of the brains showed synchronicity and therefore an improved performance. The idea is that with technology, better computers can be built based on brain networks or organically powered computers.

It might sound far-fetched and there is certainly plenty to be debated, however, there is one inescapable fact; the brain in any animal has untapped potential. According to most medical research humans only use a small portion of their brain. There is research to suggest that most animals too use only a fraction of their brain power. Research also suggests we misunderstand how much brain power an animal really has.

5.4 Research Will Continue

Research into the animal brain, from a human level all the way down to the smallest organism with a brain, will continue.

Researchers are constantly looking for ways to improve how we use our brains and the intelligence we display. There is also research assessing brains of certain favoured pets, such as dogs, cats, birds and reptiles, in an effort to reduce the myths and misunderstandings the human race has about other living organisms.

Research asks for the acceptance that old theories about intelligence are only partially correct; after all, who has it better? - the domesticated dog and cat that get to live in a comfortable home. Dogs and cats sleep, eat, play and occasionally have 'jobs' (like rescuing humans) but all humans must work to live, to be able to eat and drink, and enjoy life.

Assignment

Animal Brain Research

Time: 10+ minutes

A straight forward task identifying researchers linked to studies.

Download the worksheet below and complete.
Download Worksheet

Summary

The animal brain, even a human's brain, is largely a mystery.

Researchers are only just beginning to find that animals are more intelligent than early scientific theories indicated.

You learned about various studies in this module that are taking images of different animal brains when the animals are awake and thinking, in order to see the areas of the brain stimulated by their actions.

You have also discovered that even rats show empathy when provided the right tests to show their emotions. The animal brain, much like the human brain, is still a mystery. Researchers have yet to develop tests to reveal certain brain processes.

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