

I bet you didn't know

Why & How scientists measure mammals' whiskers



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Did you know that most mammals have whiskers? Humans are one of the few types of mammals that do not have whiskers.

Guinea pig (credit: Robyn Grant)



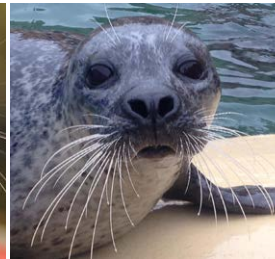
Rat (credit: Maria Panagiotidi)



Water vole (credit: Wildwood Trust)



Seal (credit: Alyx Milne)



Sea lion (credit: Alyx Milne)



Figure 1. Types of whiskers. You can clearly see that the sea lion's whiskers are arranged in rows.

Little is known about how whiskers grow and how they work because few species have been studied. A group of biological scientists and engineers in the UK have been measuring the size and shape of mammalian whiskers to try and find out more (Figure 1).

What are whiskers for?

Whiskers are for touch sensing. Scientists think that whiskers are important for guiding movement from one place to another. Nocturnal, arboreal, and aquatic mammals tend

to have relatively long whiskers that are organised in rows and columns, which suggests that whiskers are important for helping a mammal to orient itself in dark, complex spaces. Mammals that are active during the day (and inactive or asleep at night), such as horses, tend to have fewer and less-organised whiskers. Whiskers could be important for searching for food and hunting. Seals that hunt fast-moving prey (fish) have more moveable whiskers than walrus that feed on slow-moving or stationary prey (such as clams and snails) at the bottom of shallow waters. However, some mammals

that hunt moving prey in the dark, such as whales and bats, can have very short whiskers or even no whiskers and rely on other senses to help them locate food (echolocation). We don't know why some mammals have whiskers and some do not. Whiskers are also thought to be important for messaging between mammals, for example to allow young mammals to keep close to their mother or to locate an opponent in a fight. Some mammals remove or shorten another's whiskers, for example a mother cat may trim her kittens' whiskers, perhaps to keep the kittens close to her.



What is known about whiskers?

Different mammals have different arrangements and numbers of whiskers (Figure 1). Most research on mammalian whiskers has been carried out on laboratory mice and rats, and mammals kept in zoos. Whiskers are thin, curved structures that are made of a substance called keratin (like human hair). They are always growing (just like hair). Studies have shown that mouse whiskers grow 1mm a day.

Most mammals' whiskers are round and smooth along their surface, except seal and sea lion whiskers, which are oval (perhaps to be more streamlined). Seal whiskers are also not smooth, but undulating (or wavy) along their surface, which is thought to help them sense better underwater.

Most whiskers are tapered, which means they are thinner nearer the tip than at the base. This means that whiskers are more bendy (flexible) towards the tip. Whiskers bend when they contact a surface. The bending is sensed by receptors in the skin, within the whisker follicle. The receptors send messages through nerves to the brain. The size and shape of the whisker will determine how bendy it is, and so the size and shape will affect the information that reaches the brain.

Questions to discuss with children

- What types of whiskers have you seen? Are they arranged in rows? What size, shape or colour are they?
- What do you think whiskers are for?
- Why do you think some animals have longer or shorter whiskers?
- Why do you think most research has been carried out on mammals in laboratories or zoos?

What did the scientists want to find out?

As few species of mammals have been studied, Dr Robyn Grant and her team wanted to measure the size and shape of whiskers in a wider variety of mammals. This will help them to find out what whiskers are for, how they work, and how they grow.

What did the scientists do?

Dr Robyn Grant and her team of scientists collected whiskers from 19 species of mammals from museum specimens. These included a fox, a hamster, a porcupine and a meerkat. The whiskers were plucked from each mammal and in total, 687 separate whiskers were collected. These whiskers were photo-scanned to create images of the whiskers. The image of each whisker was placed onto a Euler spiral to see if it fitted along the curve (Figure 2). The scientists observed, recorded and compared the curliness, the length, and the taper of the whiskers.

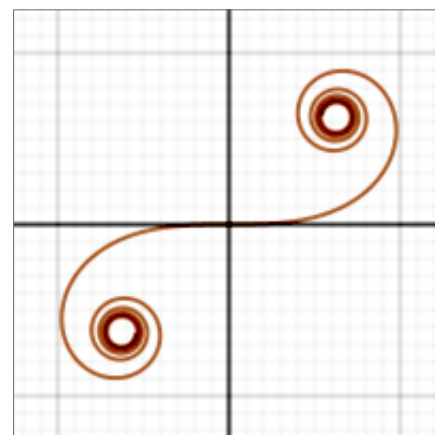


Figure 2. A Euler spiral is a curve that curves more as it gets longer. Also called *spiro*s, *clothoids*, or *Cornu spirals*.

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What did they find out?

All the different types of mammals investigated had tapered whiskers that fitted on the outline of a Euler spiral. This might mean that a common ancestor (but now extinct) had similarly shaped whiskers.

Mammals that live in the sea have thicker, stiffer, more tapered whiskers than terrestrial and arboreal mammals. This means that aquatic mammals have specially shaped whiskers that reduce drag (as they are shorter) and can be positioned in the water without wobbling around (as they are stiffer).

Smaller mammals tend to have longer, thinner and more flexible whiskers than larger mammals.



Why is this research important?

To find out more about whiskers, scientists need an accurate way to measure the shape and the size of whiskers. The method the scientists used is quick and easy, and the Euler Spiral model could be a useful tool in helping scientists to compare the whiskers of a wider variety of mammals. Previous studies have compared whiskers to different shaped curves, but these have been difficult to use.

Knowing more about whiskers could help us improve the welfare of mammals in human-designed environments like zoos and natural habitats where human activity has disturbed the natural environment.

What next?

Further studies must include a wider variety of mammals. This will tell us more about how whiskers are used by different mammals in different habitats.

What could children investigate?

The Teacher Guide that accompanies this article describes investigations that children could carry out to find out more about the form and diversity of whiskers. Examples could include:

- What can you sense with your fingers?
- How are whiskers arranged in different mammals?

- Is the arrangement or number or length of whiskers related to the length of the snout?
- Do all cats (or another animal) have the same arrangement/length/number of whiskers?

Children could create a photo bank of different mammals to answer some of these questions and create graphs to show the relationship between snout length and features of whiskers.

Glossary

aquatic – relating to water - an aquatic animal lives in water for most or all its life

arboreal – relating to trees - an arboreal animal lives in trees for most or all its life

echolocation – a process for finding distant objects by means of sound waves that bounce back to the source

Euler spiral – a curve that curves more as it gets longer

mammal – a warm-blooded animal with a backbone that has hair or fur; females produce milk to feed their young and (typically) give birth to live young

nerves – bundles of fibres that carry messages to or from the brain or spinal cord

nocturnal – happening at night - a nocturnal animal is active during the night

prey – an animal that is hunted and killed by another for food

receptors – specialised cells that send messages when stimulated

species – a group of living things capable of breeding and producing young

taper – becoming thinner towards one end

terrestrial – on or relating to the earth - a terrestrial animal lives on the ground for most or all its life

whiskers – a long projecting hair or bristle growing from the face or snout of many mammals

The paper that inspired this work was:

Ecomorphology reveals Euler spiral of mammalian whiskers

By Gary Dougill¹, Eugene L. Starostin^{2,3}, Alyx O. Milne¹, Gert H. M. van der Heijden³, Victor G. A. Goss², Robyn A. Grant¹.

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