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Dogs May Be Great Sniffers, But This Mammal Can Detect Scents 6 Miles Away

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By Dr. Becker

There are about 20,000 genes in mammals responsible for sense of smell. Of these, only about half are functional and the number falls even lower depending on the species.

Each species has a different number of genes dedicated to scent, and the genes code for olfactory receptors, which detect different smells. Inside your nose are about 6 million olfactory receptors that allow you to recognize *thousands* of different smells[1] (although, some experts believe humans can smell closer to 1 *trillion* different odors, but have stopped noticing[2]).

It sounds like a lot, until you realize that inside your *dog's* nose there are up to *300 million* such receptors. While you can detect certain odors in parts per billion, a dog can detect them in parts per trillion. This, too, sounds like a lot… until you compare it to other creatures in the animal kingdom.

Other animals, including some you probably wouldn't expect, contain far more olfactory receptor (OR) genes than dogs. What this means for certain is still being discovered… while it's generally thought that a greater number of olfactory genes and receptors yields a better sense of smell, this is still being proven.

For now, however, the list that follows is still intriguing and shows the many mammals (and amphibians) that may rely on their sense of smell for survival even more so than your dog.

Story at-a-glance

Each species has a certain number of olfactory genes along with olfactory receptors that detect different smells

In a study of different species, African elephants came out on top, with nearly 2,000 olfactory genes

Also ranking near the top were rats, opossums, and cows

Ranking near the bottom were dogs (811 olfactory genes), followed by guinea pigs

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If you've ever wondered which creatures have the keenest sniffers, researchers from the University of Tokyo's Department of Applied Biological Chemistry set out to find out.

> *"Olfactory receptors (ORs) detect odors in the environment, and OR genes constitute the largest multigene family in mammals. Numbers of OR genes vary greatly among species--reflecting the respective species' lifestyles,"* the researchers noted.[3]

Interestingly, most of the olfactory genes were unique among mammals, with only three genes in common, which the researchers suggest "may have physiologically important functions common to every placental mammal." More than 10,000 unique genes were detected,[4] but some species had significantly more dedicated scent genes than others. Who came out on top?

10. Guinea Pigs: 796 OR genes

9. Dogs: 811 OR genes

8. Western Clawed Frogs: 824 OR genes

7. Horses: 1,066 OR genes

6. Mice: 1,130 OR genes

5. Chinese Softshell turtles: 1,137 OR genes

4. Cows: 1,186 OR genes

3. Opossums: 1,188 OR genes

2. Rats: 1,207 OR genes

1. African Elephants: 1,948 OR genes

With their long trunks, it might not be entirely surprising that elephants ranked number one. What is fascinating is that elephants may be able to distinguish between odor molecules with extremely subtle differences,[5] such that an elephant's world of scents is far bigger than our own. The study's lead researcher noted:

> *"Because their body is so large, they have evolved a dexterous long trunk, which functions like a hand. It can grasp foods or other things. Therefore, they always use olfaction when they search the outer world, maybe driving a superior sense of smell."*

Some additional interesting facts...[6]

- Cows can detect scents that are up to six miles away

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- Dogs may not be able to detect as many different odors as some other animals, but they may be very sensitive to the odors they can detect
- The Chinese softshell turtle likely developed its keen sense of smell since it must find food in marshes and other murky water… at night
- African rats are trained to sniff out landmines

Where Did Humans Rank on the List?

Ranking just under guinea pigs were rabbits… followed by humans, with 396 OR genes. Humans actually ranked highest among the primates analyzed. Wrapping up the list were chimpanzees, marmosets, macaques, and orangutans.

Primates may have a relatively poor sense of smell because they prioritize sight or smell. There's still much left to be discovered, however, and the number of OR genes or receptors likely doesn't tell the whole story.

For instance, your dog has a part of his brain devoted to analyzing smells that's about 40 times larger, proportionally, than the same area in your brain.[7] A tracking dog may be able to, for instance, follow the trail of a single human from 24 hours before, even if tens of thousands of people had crossed the same path.[8]

And while we often think of dogs when we think of creatures with a phenomenal sense of smell, there are many others. Insects, particularly fruit flies, have a wide range of highly developed and sensitive odorant receptors. Even bees, it turns out, have the sensitivity to sniff out bomb residue to a part-per-trillion ratio, and an albatross can smell fish while flying in the air, even from miles away.[9]

And eastern American moles, which are blind, have the unique talent of being able to smell in stereo, which means they can detect different scents coming in each nostril.[10]

Perhaps most fascinating of all, certain animals including dogs can sniff out chemicals in humans' breath, urine, skin, blood, and feces that may be able to detect cancer, changes in blood sugar levels, an oncoming seizure and more.

Dogs can even detect scents from certain hormones, along with other body chemicals released, to essentially smell certain emotions, like sadness or fear. So if you've ever wondered how your dog seems to just know that you're having a bad day, it may be his nose telling him so.

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