

One of the most common questions asked of a veterinary ophthalmologist is whether a pet can see in color. The answer depends on the pet!

First a brief introduction to color vision in general. Color vision in any species depends on several factors including number and type of specific cells in the retina called photoreceptors, the peak absorbance of light for a given photopigment within a photoreceptor, relative ambient lighting, and specialized cells in the visual area of the brain called “color opponent cells.”

There are two types of retinal photoreceptors – rods and cones. The cones are responsible for color vision and vision in bright light. The rods are used for vision in dim lighting.

There are three types of cones – blue, green and red, based on the wavelength of light in which the cone’s photopigment has peak light absorption.

For example humans have all three cones making us trichromatic. Our blue cone has a peak absorbance at 455 nm wavelength (blue-purple color), our green cone 530 nm (green/yellow color), and our red cone 635 nm (orange/red color).

The more overlap there is in the absorbance range between cones, the more color shade variation perceived. The brighter the ambient lighting, the better cone function will be resulting in visualization of more colors.

Lastly there are different light filtering mechanisms within species such as specialized oil droplets in the cones of some birds, and color opponent cells in the brain that are activated by the perception of one color, but inhibited by the perception of another color. For example, one set of opponent color cells is stimulated by red light but inhibited by green light.

It is generally agreed that domestic species including dogs, cats, horses, cattle, pigs and small ruminants are dichromatic meaning they only possess two types of cones. So although these animals can see color, the spectrum of color they perceive is much less than a human.

The colors perceived vary somewhat between species. Overall they see much more gray since the intermediate wavelength areas between the peak absorbance ranges for the two cones appear as blends with white or gray.

Dogs are thought to see more blues and yellows with reds and greens appearing gray. Horses are thought to see more greens and yellows with reds and blues appearing gray.

Although this may appear to give trichromatic species a visual advantage, the dichromatic species have more rod cells in their retina, which allow much better vision in dim lighting. A dichromatic animal can perceive very subtle differences in grays making objects stand out much better in dim lighting, whereas the same object would blend into a dark, indistinct

background to a trichromatic human!

There are animals that are trichromatic with excellent color vision that is equal to or exceeds a human's. Several species of fish including goldfish, carp, guppy, and trout; primates and a few non-primate mammals such as the red squirrel, prairie dog, and marmot; diurnal birds; tortoises and most amphibians; and diurnal lizards are all trichromatic.

Animals with no color vision (monochromatic) include snakes, nocturnal lizards, rabbits, raccoons, mice, rats and guinea pigs.

This column is provided by the faculty of the OSU Boren Veterinary Medical Teaching Hospital. The large volume of questions does not allow us to directly respond to specific email questions so please watch for your answer in the column. Email your questions for the column to dvmoncall@postoffice.cvhs.okstate.edu and watch for your answer.

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