

Eye size determined by maximum running speed in mammals

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Maximum running speed is the most important variable influencing mammalian eye size other than body size, according to new research from The University of Texas at Austin.

Species with larger eyes usually have higher visual acuity, says Chris Kirk, associate professor in the Department of Anthropology. But what are the [ecological factors](#) that cause some mammals to develop larger eyes than others?

"If you can think of mammals that are fast like a [cheetah](#) or horse, you can almost guarantee they've got really big eyes," says Kirk. "This gives them better vision to avoid colliding with obstacles in their environment when they're moving very quickly."

Kirk and physical anthropology doctoral student Amber Heard-Booth are the first to apply Leuckart's Law — a hypothesis that was developed specifically for birds and speed of flight — to 50 species of mammals. The paper is forthcoming in the journal *Anatomical Record*. Heard-Booth presented the findings at the 2011 American Association of [Physical Anthropology](#) Meeting, where she was awarded the Mildred Trotter Prize for exceptional graduate research in evolutionary morphology.

Previously it was thought that the time of day that an animal is active (nocturnal or diurnal) would be the main factor driving the evolution of mammalian eye size. However, comparative research on the anatomy of

the eye has shown that although nocturnal and diurnal species differ in eye shape, they often have similar eye sizes. Although nocturnal species may appear to have bigger eyes because more of the cornea is exposed to let in more light, activity pattern only has a modest effect on eye size.

By comparison, body mass plus maximum running speed together can explain 89 percent of the variation in eye size among mammals.

The researchers controlled for [body size](#) and evolutionary relationships, and found that the relationship between eye diameter and maximum running speed is stronger than the relationship between body mass and running speed.

"You start looking at comparative data and one thing that is always going to influence eye size is body size. An elephant is always going to have bigger eyes than a mouse," Kirk says. "Elephants are the biggest animals we measured, but they are not that fast compared to a cheetah or zebra. At the same time, porcupines — the biggest of the rodents in our sample — are slow while some smaller rodents are much faster.

"There is going to be the effect of body mass, but when you look at maximum running speed in isolation or when you hold body mass constant, it's still significantly related to eye size," Kirk says. "And when you combine maximum running speed and body mass as your two variables influencing how big an eye is, they can explain almost all of the differences observed between species. This is a highly significant result."

Provided by University of Texas at Austin

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