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Mathematicians discover universal law of mammal urination

By David Ferguson
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Scientists at the Georgia Institute of Technology in Atlanta have arrived at a universal law of urination that explains why dogs, goats, cows and elephants — male and female — all take approximately 21 seconds to empty their bladders. **According to *New Scientist***, the research team studied local zoo animals and hours of YouTube videos to arrive at their results.

Patricia Yang and her colleagues study fluid dynamics and specifically how animals interact with liquids. The team previously used high-speed imaging to determine how dogs **shake themselves dry**.

ount each animal's mass, bladder pressure and urethra size as it studied videos of several different species of mammals to create a mathematical model of urinary systems across species, explaining why divergent groups of mammals spend ıe emptying their bladders.

ew Scientist, "have only considered the effects of bladder pressure, but the length of the urethra turns out to be important

st of the research is on humans or animals smaller than humans," and in these animals, gravity is not a huge factor in the rate at which the bladder empties.

In elephants, however, gravity is a factor. Pachydermal urethras average about a yard long and a diameter of about 6 inches. As the urine goes downhill, it gathers speed, enabling the elephant to empty its much larger bladder at approximately the same rate as cat or dog.

Dogs and goats have smaller bladders and shorter urethras. Gravity is not acting on the urine as much so their flow is slower. They empty their smaller bladders in much the same amount of time as the elephant.

An animal's size can affect the speed of its urination, but only slightly. As a rule, the Georgia Tech team found, "the time a mammal takes to empty a full bladder is proportional to the animal's mass raised to the power of a sixth, meaning even very large changes in mass have little effect on the time."

Yang and the team hope that the research can be applied as a means of diagnosing urinary problems in large mammals, as well as in the structures of water towers, which rely on gravity in pumping water. They will present their findings in November at the **American Physical Society Division of Fluid Dynamics meeting** in Pittsburgh, PA.

Watch video about this story, embedded below **via *New Scientist***:

*[image of small dog urinating in the snow **via Shutterstock.com**]*