

Soft-shelled turtles urinate through mouth

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Chinese soft-shelled turtles are exquisitely adapted to their aquatic lifestyle, sitting contentedly on the bottom of brackish muddy swamps or snorkelling at the surface to breath. According to Y. K. Ip from the National University of Singapore, they even immerse their heads in puddles when their swampy homes dry up: which intrigued Ip and his colleagues. Why do these air-breathing turtles submerge their heads when they mainly depend on their lungs to breathe and are unlikely to breathe in water? Given that some fish excrete waste nitrogen as urea – in addition to ammonia – and expel the urea through their gills, the team wondered whether the turtles were plunging their heads into water to excrete waste urea through their mouths, where they have strange gill-like projections. Ip and his colleagues publish their discovery that turtles effectively urinate through the mouth in *The Journal of Experimental Biology*.

Purchasing turtles from the local China Town wet market and immersing them in [water](#) for 6 days, the team measured the amount of urea that passed into the turtles' urine and found that only 6% of the total urea that the animals produced was excreted through the kidneys. Removing the turtles from the water and providing them with a puddle to dip their heads into, the team noticed that the turtles submerged their heads occasionally and could remain underwater for periods lasting up to 100 minutes. They also calculated the [excretion](#) rate of urea through the mouth by measuring the amount of urea that accumulated in the water and found that it was as much as 50 times higher than the excretion rate through the cloaca. And when the team injected urea into the turtles and measured their blood- and [saliva](#)-urea levels, they realised that the saliva-

urea levels were 250 times greater than in the blood. The turtles were dipping their heads into water to excrete urea through their mouths.

Knowing this, the team reasoned that the animals must produce a specialised class of protein transporters in their mouths to expel the waste and, as these transporters can be deactivated by phloretin, the team decided to test the effect of phloretin on the turtle's ability to excrete urea. When the turtles were supplied with phloretin in their puddle of water, they were unable to excrete urea from their mouths when they submerged their head. And when the team analysed the turtles' cDNA, they found that the animals carried a gene that was very similar to urea transporters found in other animals. Finally, they checked to see if the turtles express this gene in their mouths and found evidence of the mRNA that is necessary to produce the essential urea transporter, allowing the reptiles to excrete urea waste through the mouth.

So, why do Chinese soft-shelled [turtles](#) go to such great lengths to excrete urea through their mouths when most other creatures do it through their kidneys? Ip and his colleagues suspect that it has something to do with their salty environment. Explaining that animals that excrete urea have to drink a lot, they point out that this is a problem when the only water available is salty – especially for reptiles that cannot excrete the salts. The team says, 'Since the buccopharyngeal [mouth and throat] urea excretion route involves only rinsing the mouth with ambient water, the problems associated with drinking brackish water... can be avoided'.

More information: Ip, Y. K., Loong, A. M., Lee, S. M. L., Ong, J. L. Y., Wong, W.P. and Chew, S. F. (2012). The Chinese soft-shelled turtle, *Pelodiscus sinensis*, excretes urea mainly through the mouth instead of the kidney. *J. Exp. Biol.* 215, 3723-3733.

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