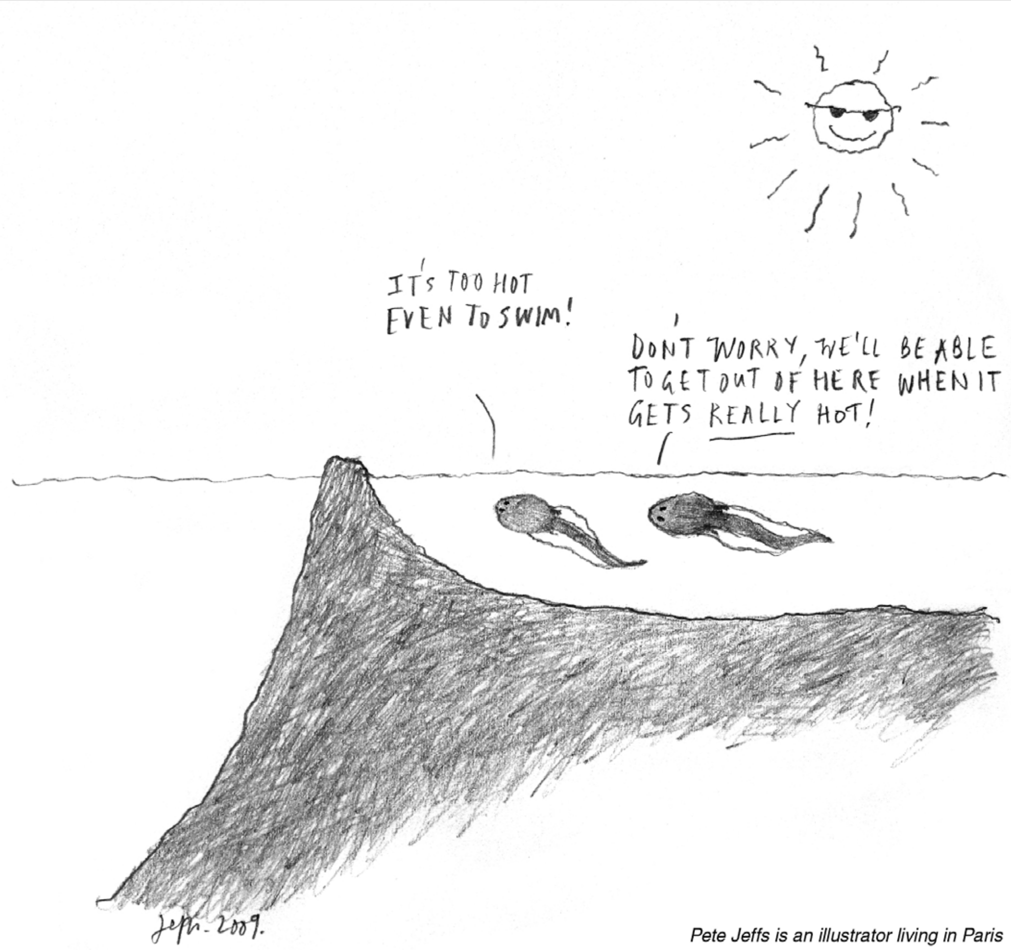
TADPOLES C-START OUT OF HOT WATER



Pete Jeffs is an illustrator living in Paris

Escaping your enemies is key to most creatures' survival, but sometimes your environment can conspire against you too. According to Keith Sillar from the University of St Andrews, UK, and Meldrum Robertson from Queen's University, Canada, the neural circuits that control escape manoeuvres in response to predators are well understood. A neuron, called the Mauthner cell, twists escaping fish and larvae into a tight C-shape before they give an explosive tail flip for freedom, known as a C start. But less is known about the neural circuits that control fish and larvae's escapes from dangerous changes in their environment.

Curious to find out how African clawed frog tadpoles respond when their lakes warm up (p. 2356), the duo electrically stimulated tadpoles and made recordings from the neural circuits that control swimming as they raised the temperature to see how the animals responded. At first the tadpoles' swimming circuit showed normal behaviour, but as the temperature rose the electrical activity declined until it tailed away to nothing at 28°C. However, the swimming tadpoles' electrical activity returned when the temperature fell below this critical level.

Next the team warmed the water above 30°C, and found a new pattern of electrical activity that was similar to the 'C start' electrical activity triggered when a tadpole needs to escape a predator.

Having recorded the electrical activity that controls how the tadpoles swim, the duo warmed the tadpoles' water and filmed them swimming to see how the youngsters reacted to hot water. Sure enough, as the temperature rose the tadpoles began swimming at high speed, but eventually became immobilized at 28°C.

But what happened when the team really turned on the heat to over 32°C? The larvae twisted themselves into a tight C shape and triggered a short fast swimming cycle to escape the uncomfortable water. According to Sillar and Roberston, the first tail flip after bending into a C was so strong that the tadpole almost jumped out of the water.

So why do tadpoles stop swimming as the temperature rises, but switch to an explosive swimming technique when the temperature gets really hot? Sillar and Robertson suspect that warm temperatures incapacitate the tadpoles' swimming circuitry, forcing them to sink into cooler waters where they recover from the heat. But when the temperatures become dangerously high, the tadpole can give a hearty tail flip to escape to cooler waters, and if the edge of the pool is in danger of drying up, this may even catapult them to safety in deeper water.

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Sillar, K. T. and Robertson, R. M. (2009). Thermal activation of escape swimming in post-hatching *Xenopus laevis* frog larvae. *J. Exp. Biol.* **212**, 2356-2364.

Kathryn Knight
kathryn@biologists.com