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Time to change the channel: Predator-Prey Arms Races and the Evolution of Tetrodotoxin Resistance in Snakes

Arms races between predators and dangerous prey can lead to rapid and elaborate counter-adaptation. Newts of the genus *Taricha* possess the sodium channel blocker tetrodotoxin (TTX), which is lethal to most predators. Garter snakes have repeatedly evolved resistance to TTX through their ecological interaction with toxic newts. Sodium channel genes are highly conserved across vertebrates, yet garter snakes have evolved resistance through a few key mutations in these proteins in a very short evolutionary time. Snake species around the world have evolved TTX resistance through the same set of mutations, painting a clear picture of constraint driven convergent evolution at the protein level. Understanding the molecular mechanism of adaptation helps explain the dynamics of predator-prey arms races in this system, wherein predators sometimes "win" the race, but prey never do.

