

Through evolution, cavefish have lost sleep

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Cave fish sleep significantly less than their surface counterparts, a finding by New York University biologists that reveals the genes involved in sleep patterns and disorders. Their study, which appears in the journal *Current Biology*, may shed light on how genetic makeup contributes to sleep variation and disruption in humans.

The study's authors were Erik Duboue, an NYU graduate student, Alex Keene, an NYU post-doctoral fellow, and Richard Borowsky, a professor in NYU's Department of Biology.

They examined surface fish in the species *Astyanax mexicanus* and three cave fish populations, Pachón, Tinaja and Molino, all of which inhabit northeast Mexico. While surface and cave fish have different physical appearances and behaviors—or phenotypes—brought about by evolutionary change, the researchers sought to determine whether the [sleep](#) patterns of cave fish also changed as they adapted to cave life.

To do so, they examined [sleep patterns](#) of both the surface and cave fish using two methods. In one, they determined that fish inactive for 60 seconds or more were sleeping. This conclusion was confirmed by tapping on the tank—fish inactive for this length of time were slow to respond to the tapping, a behavior consistent with being awoken from sleep. In the second, the researchers deprived the fish sleep as a way of inducing subsequent sleep behavior. When animals are deprived the chance to sleep, there is a rebound effect, so at the next opportunity, they sleep for longer than normal periods to make up for the deprivation. The researchers tested this rebound effect by disturbing the sleep of fish

all night by moving their containers once a minute. When observed the next day, they slept significantly increased amounts of time.

Using these methods, the researchers found that, over a 24-hour period, surface fish slept an average of over 800 minutes while cavefish slept an average of between 110 to 250 minutes.

The researchers then sought to determine if genetics played a role in the varying sleep behaviors. To do this, they bred cave and surface fish and examined the sleep patterns of these hybrids. Their results showed that these hybrid fish nearly matched the sleep patterns of the cave fish, rather than those of the surface fish, demonstrating that cave fish carry a dominant gene for less sleep.

"In some ways, the sleep phenotypes of cave fish are similar to those of humans with sleep disorders," explained Borowsky. "They go to sleep, but only for relatively short periods, then they awaken and remain awake for relatively long periods."

"The next job is to identify the genes which are responsible for sleep modification in the cave fish. They would be good candidates for the [genes](#) responsible for insomnia and other sleep disorders in humans," he added.

Provided by New York University

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