Blind Cave Fish Can't Catch Zzz's



Many grad students can sympathize with the blind form of the Mexican tetra. Researchers speculate they sleep only a few hours a night, because they simply don't have time to rest.

"These fish live in an environment where food is generally scarce and episodically and unpredictably present," said Richard Borowsky of New York University **in a press release by the school**. "If you are asleep when a bit of food floats by, you are out of a meal and out of luck."

BLOG: Fish Feel Pain, Too

Borowsky and his colleagues, Erik Duboué and Alex Keene, discovered that the sightless form of the Mexican tetra (*Astyanax mexicanus*) needs far less sleep than its sighted cousins of the same species. Their observation of fish in the dark may shed light on human sleep disorders.

"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."

BLOG: Alcohol Exposure Makes Fish Anti-Social

"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," said Borowsky.

The researchers first noticed the tetra's sleeping habits while working on a study to breed sight back into the blind form of the fish.

In a study published in *Current Biology* in 2008, the scientists found that when they crossed blind populations from different caves in northeast Mexico, the fish regained working eyes in only one generation. This happened because the different populations have developed blindness independently of each other. Different genetic changes caused blindness in each population, so when the fish were crossbred, the ability to see was partially restored in their offspring.

BLOG: Fish Talk to One Another

While conducting that study, the scientists noticed that the blind tetras were spending less time inactive at the bottom of their aquariums at night than their sighted relatives.

To determine whether what they were seeing was a real difference in sleep patterns, the researchers used two methods. One was to wait until the fish were inactive, then tap their aquarium and see if they reacted sluggishly. A sluggish response meant a sleepy fish.

The other was to deprive the fish of sleep for an entire night to see how they reacted the next day. If they took lots of naps the next day, they were interpreted as being sleep deprived.

The sighted fish reacted to this torment more than their blind cousins.

The researchers determined that, over a 24-hour period, sighted fish slept an average of more than 800 minutes (13 hours) while blind fish slept an average of only 110 to 250 minutes.

To test their observations even further, the researchers then crossbred the fish. They found that, like blindness, sleeplessness was genetic. The hybrid fish were insomniacs,

like their blind parents. This led the researchers to conclude it was a dominant gene that caused sleeplessness.

The blind fish were from diverse populations. They came from three unconnected Mexican cave systems, Pachón, Tinaja and Molino. This suggests the fish arrived at the same evolutionary conclusion to a problem through separate genetic pathways, a phenomenon known as **convergent evolution**.

"We have documented a cave-related phenotype unsuspected until now that might turn out to be the most basic adaptation of aquatic vertebrates to cave life," Borowsky said.

Another experiment on the researchers' list is to determine exactly what evolutionary forces drove the biological convergence of different tetra populations.

The results from the fish sleep experiment were published in the journal *Current Biology*.