

# Big brains are pricey, guppy study shows

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Male and female guppies (*Poecilia reticulata*). Image: Wikipedia.

Bigger brains can make animals, well, brainier, but that boost in brain size and ability comes at a price. That's according to new evidence reported on January 3rd in *Current Biology*, in which researchers artificially selected guppies for large and small brain sizes.

The findings lend support to the notion that bigger brains and increased cognitive ability do go together, a topic that has been a matter of considerable debate in recent years, said Niclas Kolm of Uppsala University in Sweden. They also represent some of the first convincing evidence that large brains are expensive, evolutionarily speaking.

"We provide the first [experimental evidence](#) that evolving a larger brain really is costly in terms of both gut investment and, more importantly, reproductive output," Kolm said.

Together, the findings strongly support the idea that relative brain sizes among species are shaped through a balance between selection for increased cognitive ability and the costs of a big brain.

The results in [guppies](#) have important implications for us humans. After all, one of the most distinctive features of the human brain is its large size relative to the rest of the body.

"The [human brain](#) only makes up 2 percent of our total [body mass](#) but stands for 20 percent of our total energy demand," Kolm said. "It is a remarkably costly organ energetically."

But support for the so-called "expensive-tissue hypothesis"—that there is a trade-off between the brain and the energy demands of other organs and reproduction—came only from comparative studies among species and were correlative in nature.

In the new study, Kolm's team took a different, within-species approach. They selected live-bearing guppies for large and small brains relative to the size of their bodies. Under that strong selection pressure, they found that [brain size](#) could evolve "remarkably quickly."

After selection, large-brained guppies outscored their smaller-brained peers in a test of numerical learning. With more energy devoted to brain-building, brainy fish—males especially—did have smaller guts. They also left fewer offspring to the next generation.

Those effects were observed despite the fact that the fish were supplied with an abundance of food. The researchers say they are curious to see what will happen in future experiments with fish in a more competitive, semi-natural environment including limited resources and predators.

The findings lead Kolm and his colleagues to suggest that the relatively

small family sizes of humans and other primates, not to mention dolphins and whales, might have helped to make our big brains possible.

**More information:** Kotrschal et al.: "Artificial selection on relative brain size in the guppy reveals costs and benefits of evolving a larger brain." [dx.doi.org/10.1016/j.cub.2012.11.058](https://doi.org/10.1016/j.cub.2012.11.058)

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