

Did you know when fish run out of oxygen they start producing alcohol? And not just any alcohol. The level of alcohol that goldfish and their wild relatives, crucian carp, were found swimming in under ice-covered lakes were way above legal drink-driving limits in many countries.

Scientists at the Universities of Oslo and Liverpool have discovered the reason behind this unusual ability goldfish possess. While humans and most other vertebrate animals die within minutes without oxygen, the fish are capable of converting anaerobically produced lactic acid into ethanol. This then diffuses across their gills into the surrounding water, which avoids a dangerous build-up of lactic acid in the body.

If these fish hadn't evolved a second set of proteins that take over in the absence of oxygen, the amount of lactic acid would kill them in minutes.

"The ice cover closes [the fishes] off from the air, so when the pond is ice-covered the fish consumes all the oxygen and then it switches over to the alcohol," author Dr. Michael Berenbrink, an evolutionary physiologist from the University of Liverpool, UK, told BBC News.

The icy conditions were studied in ponds and lakes in northern Europe. "If you measured them in the field the blood alcohol goes up above 50mg per 100 milliliters, which is the drink-drive limit in Scotland and northern European countries," said Dr. Berenbrink.

Lead author Dr. Catherine Elisabeth Fagernes, University of Oslo, said, "This research emphasizes the role of whole genome duplication in the evolution of biological novelty and the adaptation of species to previously inhospitable environments."

This fish survival technique can help them live for five months, after which they run out of

fuel that is stored in their liver and will die.

The study went on to suggest that this adaptation evolved 8 million years ago in the common ancestor of the carp and goldfish, through a process known as whole-genome duplication. This is when an organism ends up by chance with an extra set of its genes, which can then be re-purposed to take on new functions.

Dr. Fagernes continued in describing the study's findings that the fish have their own specialized alcohol-production system. This includes a modification of a set of the enzymes that channel energy-rich carbohydrates into mitochondria, the energy-producing parts of a cell. During their evolution, the fish gained a second set of the enzymes, which helps turn the metabolic products into alcohol when oxygen levels drop. The enzymes act in essentially the same way as brewer's yeast.

It is no doubt that goldfish are one of the most resilient pets under human care!

This research was reported in Scientific Reports.

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