

# Research shows impact of BMR on brain size in fish

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A commonly used term to describe nutritional needs and energy expenditure in humans – basal metabolic rate – could also be used to give insight into brain size of ocean fish, according to new research by Dr Teresa Iglesias and Dr Dan Warren at Macquarie University.

Research found that fishes living deeper in the ocean have smaller brains than expected given their [body size](#), and the deeper in the ocean you go, the smaller-brained the fishes are.

The [basal metabolic rate](#) (BMR) is a measure of [energy expenditure](#), and has been shown here to be a key factor in the decrease in [brain size](#) of deeper-ocean fishes.

This decrease was best explained by a fall in BMR and could not be explained by a decrease in light availability or a decrease in water temperature.

"Ultimately, we want to look at the relationship between fish species' ecology and investment in brain size, however to do this, we must identify and then take into account factors that systematically affect brain size. Fishes that live very deep are known to have much slower metabolisms than species that live in relatively shallow water and one of the costs of that appears to be a reduction in brain size," said Dr Iglesias.

"Our results tell us that when studying why and how bigger brains in fish could be advantageous, we should first account for the effects of BMR

as well as body size and evolutionary relationships."

"For us this study represents one of our first steps on a research program that will hopefully last for decades. Brain size is very interesting, but it only gives us a very coarse picture of what these species are doing," said Dr Warren.

"We are currently working with other investigators at the Okinawa Institute of Science and Technology and Yale University on a study of relative investment in different brain areas.

"Now that we have a good picture of the relationship between depth and brain size we can begin to explore the evolution of the brain in much more detail."

**More information:** "Life in the unthinking depths: energetic constraints on encephalization in marine fishes." *J Evol Biol.* 2015 Mar 28. [DOI: 10.1111/jeb.12631](https://doi.org/10.1111/jeb.12631)

Provided by Macquarie University

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