'Eating with the eyes' is hard-wired in the brain

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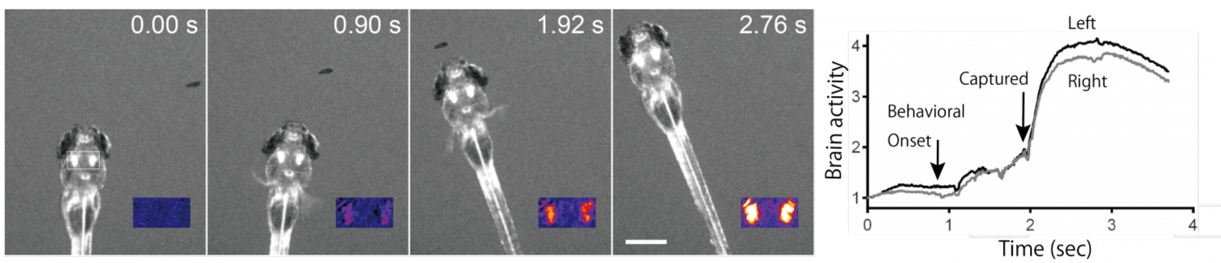


The hypothalamus in a 4-day old zebrafish larva was activated upon visual recognition of prey, a paramecium and during prey capture behavior. Credit: ©National Institute of Genetics (NIG)

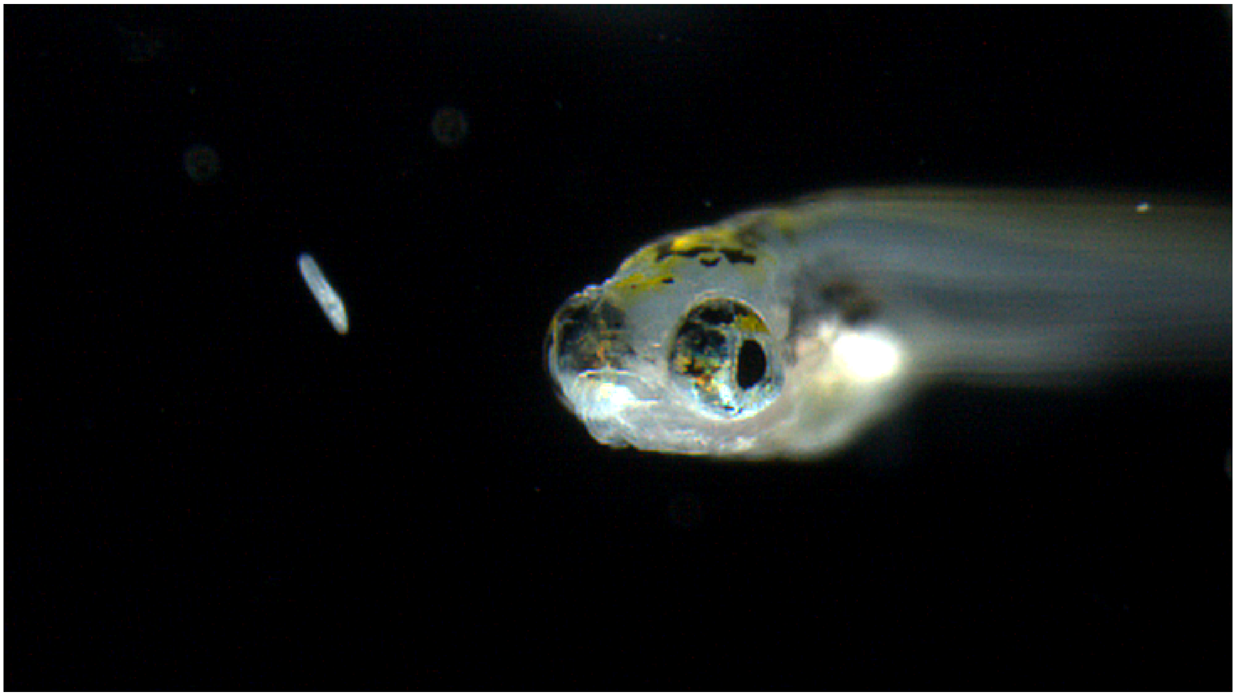
Have you ever wondered why looking at food can make you hungry? By visualizing neuronal activity in specific areas of the zebrafish brain, scientists at the National Institute of Genetics (NIG) in Japan have revealed a direct link between visual perception of food and feeding motivation. The study, published in the April 20, 2017 issue of *Nature Communications*, suggests that "eating with the eyes" is deeply rooted in evolution.

"In vertebrate animals, feeding behavior is regulated by a brain area called the hypothalamus. The hypothalamic feeding center integrates information about bodily energy requirements and environmental food availability. Zebrafish, like humans, mostly use vision for recognition of food or prey. It was not known how the hypothalamus receives visual information about prey. We first demonstrated that neurons in the hypothalamus do, indeed, respond to the sight of prey. Then we looked for neurons in the visual system that responded to prey and discovered 'prey detector' neurons in an area called the pretectum. Furthermore, we found a direct neural link connecting the prey detector neurons to the hypothalamic feeding center," Dr. Muto, the leading author of the study, explained.

The key to this discovery was recent progress in the development and improvement of the highly sensitive, genetically encoded calcium indicator GCaMP, which can be used to monitor neuronal activity in the form of calcium signals. Another important factor is the ability to control the specific neurons in which GCaMP is expressed. This was critical for recording distinct calcium signals from identifiable neurons.

Prof. Kawakami, the senior author, manages a zebrafish facility containing thousands of fish tanks, each of which contains genetically different fish that can turn on, or drive the GCaMP expression in different types of cells in the brain or in the body. This collection of driver fish lines is being used to study tissues and cell types by researchers all over the world. Of the nearly 2,000 such driver fish lines in the lab, two played important roles in the current study: one for the imaging of the prey detector neurons, and the other for the feeding center in the hypothalamus.

"Successful brain imaging was made possible through development of our genetic resources, on which I have spent more than 20 years. This is the power of zebrafish genetics. This work showcases a successful application of our genetic resources in the study of brain function," Prof. Kawakami said.



A Zebrafish larva trying to catch prey. Credit: ©National Institute of Genetics (NIG)

"Our study demonstrates how tightly visual perception of food is linked to motivational feeding behavior in vertebrate animals. This is an important step toward understanding how feeding is regulated and can be modulated in normal conditions as well as in feeding disorders," Dr. Muto said.

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