Science News

Seeing a fish's thoughts

Thu, 31st Jan 2013

Ginny Smith

A new imaging technique has allowed scientists to see thoughts occurring in real time as fish contemplate their prey.

Japanese researcher Akira Muto and colleagues, writing in current biology, genetically engineered zebra fish to produce a glowing green label called GFP in an area of the brain called the optic tectum, which is involved in decoding vision. The green glow was switched on whenever nerve cells in this part of the fish brain became active, meaning that different regions of the optic tectum quite literally “lit up” when the fish looked at different things.

What did they find?

First, they showed that the brain cells in the optic tectum responded when a spot was flashed on and off in the fish’s visual field. They then moved the spot around and found that the area that lit up also moved around this region of the brain.

This is known as “topographic mapping”. It occurs because the brain is laid out like a map of the fish’s visual world, so one part of the eye always sends signals to the same part of the brain.

They also offered the fish a “paramecium”, which is a small organism that young zebra fish like to eat. When the paramecium moved around in front of the fish, nerve cells lit up in the optic tectum on the opposite side to the side the prey was on. This is because the brain is cross-wired- the left hemisphere controls the right side of the body, and vice versa.

And when the fish began its prey capture behaviour: approaching the prey and pursuing it with its eyes, one particular part of the tectum, towards the rear, always became active. The researchers suggest that this area may therefore be connected to a brain region that produces these prey capture behaviours.

This technique could also be used to look at other regions of the brain, as fish can be bred to express the fluorescent protein in other areas of interest. It is particularly useful as you can see the changes in real time, and it is relatively non-invasive, so the animals can be studied when behaving in a natural way. This allows researchers to find out more about how the brain controls movement and hunting.

Why did they use zebra fish?

Zebra fish are rather special as they are transparent when they are in the embryonic and larval stages- that is before they are fully grown. They also grow rapidly, and a fertilised egg can become a fish able of catching prey after only 4 days. This means that fish can be bred with this fluorescent protein, and you can actually watch them, under a microscope as they are very small, and see which bit of their brain glow when they see different moving or stationary stimuli!

References

- Real-Time Visualization of Neuronal Activity during Perception Akira Muto, Masamichi Ohkura, Gembu Abe, Junichi Nakai, Koichi Kawakami Current Biology - 31 January 2013 http://dx.doi.org/10.1016/j.cub.2012.12.040

Comments

Unfortunately that dead fish saga is one of the most important experiments in the field - it shows that the parameters determined and generally agreed were rubbish.

imatfaal, Tue, 5th Feb 2013

Probably somewhat more effective than doing neuro-imaging on dead fish.

I like the idea of being able to observe the fish brain activity when the fish are more or less acting normally. An EEG, or MRI might be difficult to do in the water while the fish are active, especially with small fish.

However, if the the fish is mostly transparent, what about adding some kind of contrast to the blood... could one see the blood flow in the brain, somewhat like a PET or FMRI, without all the expensive equipment?

CliffordK, Fri, 1st Feb 2013

See the whole discussion | Make a comment