Fish brains help explain human sensory perception

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Advanced calcium imaging of zebrafish brains is helping University of Queensland researchers discover how sensory stimuli such as sights and sounds are integrated in the human brain.

The research into how fish interpret and integrate sensory information, led by School of Biomedical Sciences ARC Future Fellow Dr Ethan Scott, could improve understanding of how humans combine senses like sight, touch and sound to create a complete experience.

The team's studies showed that the zebrafish's tectum - a mid-brain

structure known for its visual processing - is more similar to its human counterpart, the superior colliculus, than previously thought.

"In order to function efficiently, fish and humans need a unified sensory view of the external world contributed to by multiple senses," he said.

"Zebrafish are transparent and, since the larvae also develop externally, we can observe the brain from its earliest developmental stages through to full function.

"Using fluorescent calcium imaging, we were able to monitor neural activity across large populations of neurons in a completely intact functional zebrafish brain."

Dr Scott said the first step in laboratory tests was to show the fish visual stimuli and observe the calcium dynamics in the tectum.

"Visual processing in the zebrafish tectum is well known and we found a predicted set of outcomes that replicated previous studies," he said.

"We then introduced stimuli for other senses, such as sound and the detection of water flow, which have not been studied in the zebrafish tectum.

"When we introduced sounds, we saw a small number of cells within the tectum respond to these stimuli.

"There were also responses in the tectum to the flow of water across the body of the fish.

"Although the tectum in larval zebrafish was thought to be used solely for visual processing, our research has shown that it responds to at least three types of stimuli."

Dr Scott said the discovery had a number of implications.

"The tectum was much less responsive to a visual stimulus if other stimuli were taking place at the same time, and this suggests there was some sort of sensory integration or gating occurring," he said.

"Since similar processes take place in the mammalian superior colliculus, our research indicates the fish tectum is more similar to the superior colliculus than has previously been recognised.

"This is useful, because it suggests that the zebrafish tectum, with all of its great experimental attributes, is an appropriate platform for studying how the superior colliculus works, including how information from different senses are integrated there."

Dr Andrew Thompson, a former School of Biomedical Sciences PhD student who graduated in December 2015, and continues to work in the Scott lab, is the lead author on the study.

The research is published in *Current Biology*.

Provided by University of Queensland