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115/04 - "Psychophysiological Analysis of Learning and Memory using Zebrafish as an in vivo Model System"
Instituição/*Institution*: Harvard Biological Laboratories, Cambridge - USA
Duração/*Duration*: 2006/01 - 2010/08
Investigadores/*Researchers*: Prof. Florian Engert, Dr. André Valente, Dr. Bettina Reiter, Dr. Johann Bollmann, Dr. Adam Kampff, Doctor Michael Orger

Objectives: The zebrafish (*Danio rerio)* has been an excellent vertebrate model for genetic analysis of early development and has also been used to study aspects of neural development and function. It is known that fish exhibit a wide range of learning behaviors but it is not clear at what point during development they begin nor have these behaviors been analyzed systematically. Before moving on to *in vivo* 2-photon imaging of neural circuitry, we are answering questions related to the *ontogenesis of the learning and memory behaviors we assay for* – When do animals start learning and how does that correlate to their developmental biology and age range? How does the ability to learn correlate with it's persistence and extinction?

Methods: The performance of developing zebrafish in both classical and operant conditioning assays was tested with a particular focus on the emergence of these learning behaviors during development. Strategically positioned visual cues paired with electro- shocks were used in two fully automated assays to investigate both paradigms. These allow the evaluation of the behavioral performance of zebrafish continuously throughout development, from larva to adult.

Results: We found that learning improves throughout development, starts reliably around week 3, and reaches adult performance levels at week 6. Adult fish quickly learned to perform perfectly, and the expression of the learned behavior is manifestly controlled by vision. The memory is behaviorally expressed in adults for at least 6 h and retrievable for at least 12 h.

Conclusions: We have developed a computer-based automated behavioral assay which we can easily control and comprehensively analyze. Using this automated system we show that a strong ability to learn is already present in young juvenile fish and we further characterize the ontogenesis of learning and memory during zebrafish development.

Discussion: The transparency and small size of the larva combined with its vertebrate brain organization, is an exceptional model. The barin areas equivalent to the amygdala and hippocampus are much more exposed to manipulation and imaging than in mammals and its amenability to genetic screening and manipulation tools provide a unique experimental system to explore the psychophysiology of learning and memory in future studies.

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Keywords: Learning, Memory, Zebrafish, Development, Conditioning.