

## Project offer

### **Degree project in neuroscience:**

### **Evolution of vertebrate learning and memory using zebrafish as model**

*Department: Neuroscience*

*Place: BMC, Uppsala University*

*Start: January 2018 or as agreed upon*

The mechanisms of learning and long-term memory (L&M) are considered to be some of the greatest challenges for science to resolve. An important approach to unravel complex biological processes is to investigate their evolution. However, much of the present knowledge about L&M has been obtained from studies of rodents. Therefore it is important to widen the perspective to include other interesting animal groups. The primary aim of this project is to deduce the evolutionary relationships of proteins that are involved in L&M in vertebrates. This is done using bioinformatics with a combination of sequence-based phylogenetic analyses and comparisons of chromosomal locations of genes, i.e., conservation of synteny. This dual approach has turned out to be powerful to untangle gene relationships. We study the genomes of species covering the whole spectrum of vertebrates and we focus especially on gene duplications that resulted from the two tetraploidizations (genome doublings) that took place at the origin of vertebrates more than 500 million years ago. We have previously used this strategy to resolve many complicated gene families, for instance several gene families involved in vision and neuroendocrine signalling.

The expression of the memory genes is mapped with qPCR and in situ hybridization in zebrafish and compared with rodents. This is an exciting endeavor because teleost fishes have many additional gene copies that resulted from the teleost-specific third tetraploidization approximately 300 million years ago. Often the duplicates have diverged functionally or with regard to developmental or anatomical expression. This also interesting from an anatomical point of view as the zebrafish brain regions involved in long-term memories have quite different organization from those of mammals. Special attention will be given to proteins known to be involved in synaptic plasticity and in consolidation of long-term memories.

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