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Identifying novel molecular mechanisms underlying lateral line sense organ development using an unbiased, comparative approach

Inner ear ‘hair cells’ are highly specialised cells that transduce mechanical stimuli (fluid movement in the inner ear) for hearing and balance. Understanding how hair cells develop, and how they regenerate in birds, fishes and amphibians, is the focus of much research.

In fishes and aquatic-stage amphibians, hair cells are also found in lateral line 'neuromasts' arranged in lines over the head and trunk, which detect local water flow; they are used in obstacle avoidance and prey/predator detection. In some fishes and amphibians (e.g. sharks, sturgeons and salamanders), lines of neuromasts on the head are flanked by fields of electrosensory 'ampullary organs' (Figure) containing modified hair cells (electroreceptors) that detect weak electric fields in water, used primarily for hunting live prey.

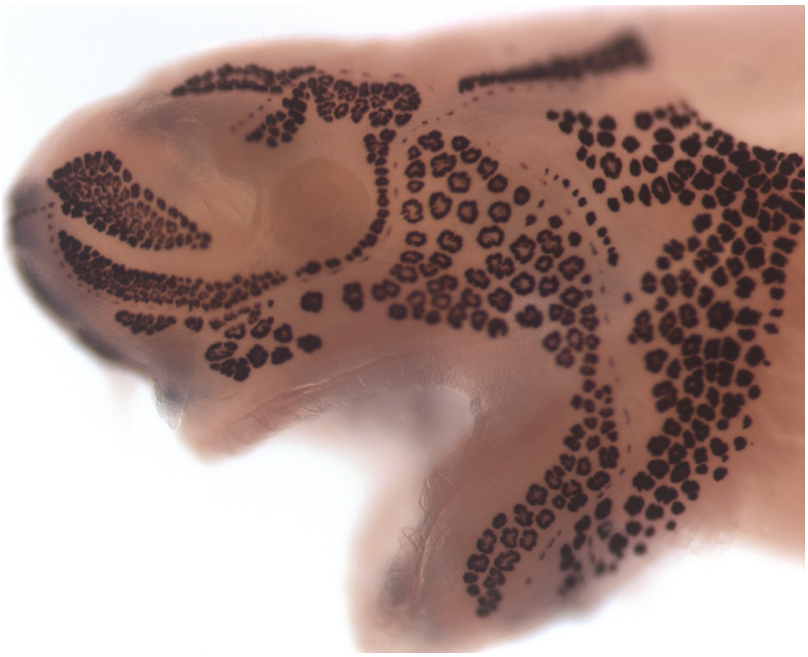

Figure: Head of a late-larval Mississippi paddlefish (*Polyodon spathula*), showing gene expression in stitch-like lines of mechanosensory neuromasts and their flanking fields of rosette-like electrosensory ampullary organs.

We have used a comparative transcriptome sequencing approach in paddlefish, which have more ampullary organs than any other species (Figure), to generate an unbiased lateral line organ-enriched gene-set with which to identify candidate genes likely to be important for hair cell and/or electroreceptor development (Modrell et al., 2017, *eLife* 6, e24197).

The aim of the PhD project is to use this gene-set to identify novel molecular mechanisms underlying lateral line organ development, focusing on genes likely to be involved in cell-cell signalling. Their expression and function, where possible, will be compared in a sturgeon (closely related to paddlefish) and zebrafish (which has neuromasts but lacks ampullary organs). The project’s unbiased, comparative approach will identify novel receptor/ligand pathways important for hair cell *versus* electroreceptor development, and conserved *versus* lineage-specific mechanisms.