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# COMBINED FUNCTIONAL, CELLULAR AND BEHAVIOURAL STUDIES TO GET INSIGHTS ON SENSORY ORGANS OF *CIONA ROBUSTA* LARVAE


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# ABSTRACT

The ascidian *Ciona robusta* is a powerful model system to approach in a "simple context" cellular, developmental, and behavioral strategies that have been adopted in the lineage of chordates. In particular, the simplicity of *Ciona* CNS (Central Nervous System) permits to follow the fate of each blastomere from neural plate up to the larval stage, thus representing a huge advantage compared to the thousands of cells present in vertebrates. Furthermore, the lineage specific promoters collected by ascidian community in the last years, coupled with the technique of transgenesis through electroporation, permit to label unique or small groups of cells in the developing CNS and visualize them in their final differentiated state in swimming larvae. In the course of my thesis studies, I have exploited all these advantages to study early developmental mechanisms guiding the correct specification of blastomeres of a-lineage row III, the anterior part of neural plate that gives rise to most of the structures of the sensory vesicle of the larva. By transgenesis and chemical inhibition experiments, I have proved the involvement of three signaling pathways, Nodal, Delta-like/Notch and FGF, in the activation of three markers, *Tyrp, Gsx* and *Meis*, specific of each blastomere pairs of a-lineage row III. As further step, I have demonstrated a direct transcriptional control of FGF signaling on one of these markers, the Para-Hox transcription factor *Gsx*. Interestingly, *Gsx* has been instrumental also for the continuation of my studies, since, at later stages of development, it revealed to be a useful marker also for photoreceptor cells differentiation up to the larval stage. The data on this part of work further support the evidences, previously collected by the former PhD student of the Lab, on the involvement of *Ciona Gsx* in the developmental programs leading to photoreceptor cells differentiation, which opens new perspectives about the function of this transcription factor in nervous system formation during evolution.

In the last part of my PhD studies, I spent three months in Gaspar Jekely lab, at the Max Planck Institute for developmental biology, to explore the possibility of *Ciona* larva to sense hydrostatic pressure changes. My experiments showed for the first time that *Ciona* is able to sense pressure

increases by swimming faster upward during a precise developmental window after hatching. Furthermore, I have tested the potential involvement of coronet cells, a group of cells close to the group III photoreceptor cells present in the sensory vesicle, as candidate for pressure detection. These experiments indicated that coronet cells are not involved in pressure perception but, may be, could play a role in the modulation of photic response.