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Laboratory of Transcriptional Regulation
Eye development and evolution, Pax genes, Wnt signalling



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Research topics

We are interested in the genetic basis of mammalian eye and CNS development. Our focus is on the role of transcription factors and signalling cascades, especially on the role of Pax genes and Wnt/ β -catenin pathway. A combination of gain-of-function (transgenic) and loss-of-function (conditional knock-outs) approaches is used.

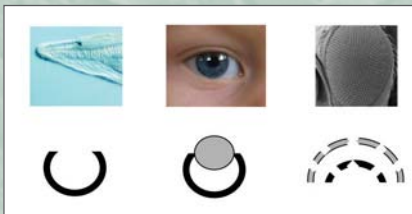
Our second main interest is eye evolution. Several model systems including mouse, amphioxus, scallop, medaka and jellyfish are used in the laboratory. Early morphological studies have suggested that eye has evolved multiple times during the course of evolution. In contrast, more recent genetic data indicate a central role of Pax6 in eye development in most animals. In fact, eye assembly always relies on the same basic principle, i.e. photoreceptors located in the vicinity of dark shielding pigment. Cnidaria as the likely sister group to the Bilateria are the earliest branching phylum with a well-developed visual system. We have shown that camera-type eyes of the Cubozoan jellyfish, *Tripedalia cystophora*, use genetic building blocks typical of vertebrate eyes, namely a ciliary phototransduction cascade and melanogenic pathway. Our findings indicative of parallelism provide a new insight into eye evolution.

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Selected recent papers

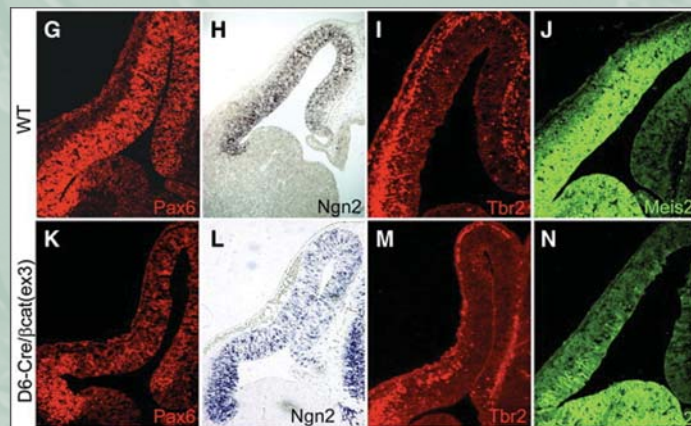
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Morphological diversity among animal eyes is in contradiction to the conserved nature of Pax6 transcription factor. Three major eye designs represented by the cup-like frontal eye of amphioxus (left), camera-type eye of vertebrates (middle) and the compound eye of insects (right). A highly conserved transcription factor Pax6 implicated in formation of the three eye types (Kozmik, 2008).



Assembly of the cnidarian eye from vertebrate-like components (Kozmik et al. 2008; ref. 2)



Permanent activation of canonical Wnt/ β -catenin signalling inhibits expression of neurogenic genes (Machon et al., 2007).