



Laboratory of Transcriptional Regulation

Development and evolution, eye, brain, Pax genes, Wnt/ β -catenin signalling

Zbyněk Kozmik

zbynek.kozmik@img.cas.cz

www.img.cas.cz/research-groups/zbynek-kozmik

We are interested in studies of development and evolution of development (evo-devo). Our focus is on the role of transcription factors and signalling cascades, especially on the role of the Wnt/ β -catenin signalling pathway and transcription factors of the Pax gene family. We use a combination of gain-of-function [transgenic] and loss-of-function [conditional knock-outs] approaches using laboratory mouse as a model organism to study embryonic development. We utilize several model systems including fish, amphioxus, *Platynereis* and cnidarians to study various aspects of evo-devo, especially the evolution of eyes and gene regulatory networks.

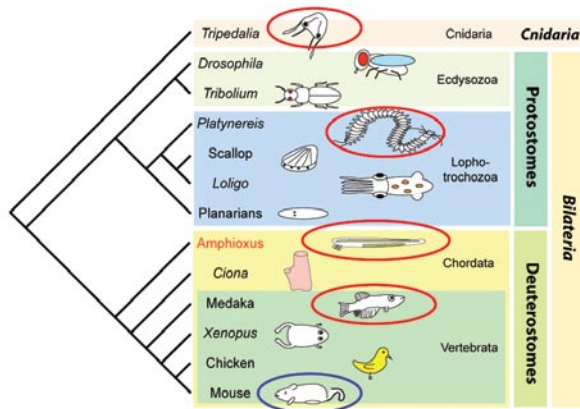


Fig. 1. Animal models used in the Laboratory for studies of development and evolution of development

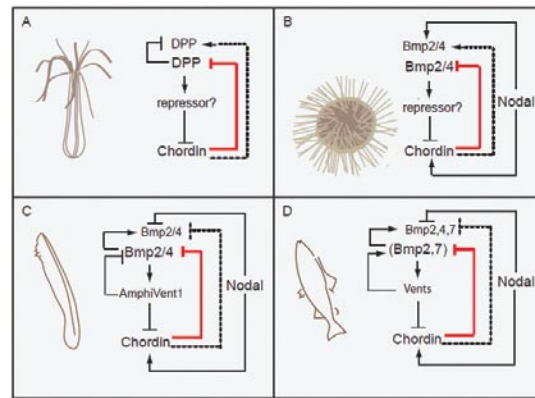


Fig. 2. Simplified schemes depicting Bmp-Chordin gene regulatory networks in cnidarian *Nematostella* (A), echinoderm sea urchin (B), cephalochordate amphioxus (C) and vertebrate zebrafish (D) during gastrulation. [Figure taken from Kozmikova et al., 2013]

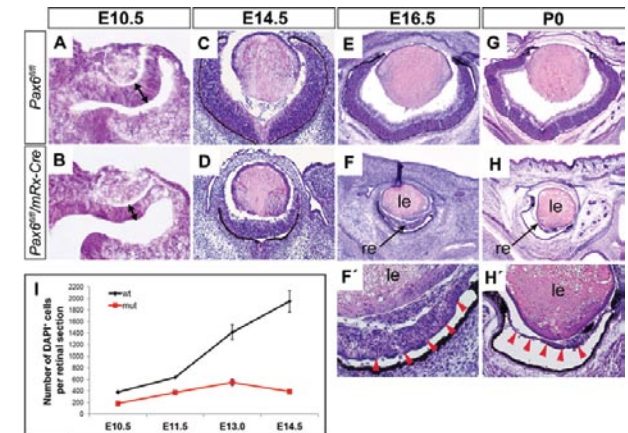


Fig. 3. Morphological consequences of Pax6 inactivation in early retinal progenitors. [Figure taken from Klimova and Kozmik, 2014]

- GACR, GAP305/10/2141 – Evolution of photoreceptors: insights from ancestral regulatory circuits, 2010–2014, Z. Kozmik
- GACR, GAP305/11/2198 – Genetics of mammalian eye development, 2011–2014, Z. Kozmik
- MEYS, EE2.3.30.0027 – Founding the Centre of Transgenic Technologies, 2012–2014, R. Sedláček, V. Kořínek, Z. Kozmik
- GACR, GAP305/12/2042 – The role of transcription factors *Tof* in the induced cell pluripotency (iPS) and during neurogenesis, 2012–2015, O. Machoň
- MEYS, LK11214 LK-NAVRAT – Genetic regulation of embryonic development of the brain and the eye, 2012–2016, O. Machoň
- MEYS, LH12047 LH-KONTAKT II – The role of alternative splicing in evolution of vertebrate body plan, 2012–2015, Z. Kozmik
- GACR, 14-20839P – The role of pituitary homeobox gene in anterior specification and left-right asymmetry in the basal chordate amphioxus, 2014–2016, V. Soukup
- ASCR, IAA500520908 – The role of Pax genes in eye evolution, 2009–2013, Z. Kozmik
- GACR, GCP305/10/J064 – Reconstructing urbilaterian photoreceptors: comparative study between Branchiostoma [Chordata] and *Platynereis* [Annelida], 2010–2013, Z. Kozmik



1. [Klímová L, Kozmik Z:](#) Stage-dependent requirement of neuroretinal Pax6 for lens and retina development. **Development** 2014 141(6):1292–302.
2. [Antosova B, Smolíkova J, Borkovcova R, Strnad H, Lachova J, Machon O, Kozmik Z:](#) Ectopic activation of Wnt/ β -catenin signaling in lens fiber cells results in cataract formation and aberrant fiber cell differentiation. **PLoS One** 2013 8(10): e78279.
3. [Klímová L, Lachova J, Machon O, Sedlacek R, Kozmik Z:](#) Generation of mRx-Cre transgenic mouse line for efficient conditional gene deletion in early retinal progenitors. **PLoS One** 2013 8(5): e63029.
4. [Kozmikova J, Candiani S, Fabian P, Gurska D, Kozmik Z:](#) Essential role of Bmp signaling and its positive feedback loop in the early cell fate evolution of chordates. **Dev Biol** 2013 382(2): 538–54.
5. Ono H, [Kozmik Z](#), Yu JK, Wada H: A novel N-terminal motif is responsible for the evolution of neural crest-specific gene-regulatory activity in vertebrate FoxD3. **Dev Biol** 2013 385(2):396–404.



Front row from the left: Jindra Pohořelá, MSc / Technician, Iva Dobiášovská / Diploma Student, Chrysoula Pantzartzi, PhD / Postdoctoral Fellow, Barbora Antošová, MSc / PhD Student, Veronika Nosková / Technician, Jitka Láčhová, MSc / Technician
Back row from the left: Olga Tichá, MSc / PhD Student [since September 2013], Iryna Kozmiková, PhD / Research Fellow, Andrea Kuželová, MSc / PhD Student [since September 2013], Lucie Klírmová, MSc / PhD Student [now maternity leave], Zbyněk Kozmik, PhD / Head of Laboratory, Jiří Pergner, MSc / PhD Student, Peter Fabian, MSc / PhD Student, Vladimír Soukup, PhD / Postdoctoral Fellow

Not in the picture: Naoko Dupačová, PhD / Postdoctoral Fellow [maternity leave], Jana Smolík, PhD / Postdoctoral Fellow [maternity leave], Kamil Matulka, PhD / Postdoctoral Fellow, , Anna Zitová, MSc / Technician [maternity leave], Michaela Liegertová, MSc / PhD Student, Jan Mašek, MSc / PhD Student, Radim Židek, MSc / PhD Student, Ondřej Machoň, PhD / Research Fellow