Biozentrum Lectures

How fish colour their skin – a paradigm for development and evolution of adult patterns

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Prof. Christiane Nüsslein-Volhard is Director and Scientific Member of the Max Planck Institute for Developmental Biology in Tübingen. She studied biochemistry and received her PhD in Genetics at the University of Tübingen. Subsequently, she worked as a postdoctoral fellow at the Biozentrum and at the University of Freiburg. From 1978 to 1981, she led a research group at the European Molecular Biology Laboratory (EMBL) in Heidelberg. Jointly with Eric Wieschaus, she was distinguished with the Nobel Prize in Medicine or Physiology for her discovery of genes that control embryonic development in Drosophila in 1995. For her scientific achievements, she has received a number of prestigious awards and honors. In 2004, Christiane Nüsslein-Volhard founded the CNV-Foundation to support talented young female scientists with children.
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Pigment cells in zebrafish – melanophores, iridophores and xanthophores – originate from neural crest-derived stem cells associated with the dorsal root ganglia of the peripheral nervous system. Clonal analysis indicates that these progenitors remain multipotent and plastic beyond embryogenesis well into metamorphosis, when the adult colour pattern develops.

Pigment cells share a lineage with neuronal cells of the peripheral nervous system; progenitors propagate along the spinal nerves. The proliferation of pigment cells is regulated by competitive interactions among cells of the same type. An even spacing involves collective migration and contact inhibition of locomotion of the three cell types distributed in superimposed monolayers in the skin.

This mode of colouring the skin is probably common to fish, whereas different patterns emerge by species specific cell interactions among the different pigment cell types. These interactions are mediated by channels involved in direct cell contact between the pigment cells, as well as unknown cues provided by the tissue environment.
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