CDB SEMINAR

Robert Cerny

Charles University in Prague, Czech Republic

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16:00-17:00 C1F CDB Auditorium

Pre-oral gut, and ancient pharyngeal origins of craniofacial patterning

Summary

Despite the wide variety of adaptive modifications in the oral and facial regions of vertebrates, their early oropharyngeal development is considered strictly uniform. It involves sequential formation of the mouth and pharyngeal pouches, with ectoderm outlining the outer surface and endoderm the inner surface, as a rule. At the extreme anterior domain of vertebrate embryos, the ectoderm and endoderm directly juxtapose and initial development of this earliest ecto–endoderm interface, the primary mouth3, typically involves ectodermal stomodeal invagination that limits the anterior expansion of the foregut endoderm. Here we present evidence that in embryos of extant non-teleost fishes, oral (stomodeal) formation is preceded by the development of prominent pre-oral gut diverticula (POGD) between the forebrain and roof of the forming mouth. Micro-computed tomography (micro-CT) imaging of bichir, sturgeon and gar embryos revealed that foregut outpocketing at the pre-oral domain begins even before the sequential formation of pharyngeal pouches. The presence of foregut-derived cells in the front of the mouth was further confirmed by in vivo experiments that allowed specific tracing of the early endodermal lining. We show that POGD in sturgeons contribute to the orofacial surface of their larvae, comprising oral teeth, lips, and sensory barbels. To our knowledge, this is the first thorough evidence for endodermal origin of external craniofacial structures in any vertebrate. In bichir and gar embryos, POGD form prominent cranial adhesive organs that are characteristic of the ancient bauplan of free-living chordate larvae. POGD hence seem arguably to be ancestral for all ray-finned fishes, and their topology, pharyngeal-like morphogenesis and gene expression suggest that they are evolutionarily related to the foregut-derived diverticula of early chordate and hemichordate embryos. The formation of POGD might thus represent an ancestral developmental module with deep deuterostome origins.

Host:
Kuratani Shigeru
Evolutionary Morphology, RIKEN
saizo@cdb.riken.jp
Tel: 078-306-3064 (ext: 4543)