Program/Abstract # 21
A new role for an old gene: Brachyury and the subdivision of the endomesoderm
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In the past decade, the brachyury gene has been identified in many metazoans. From cnidarians to vertebrates, brachyury homologs are expressed in the blastoporal region and are necessary for the specification of the cells in which it is expressed. This striking consensus caused us to re-examine in depth the function of this T-box gene in sea urchins. Here we present evidence that, in this basal deuterostome, brachyury is required for the regulation of endomesodermal subdivision. We discovered that at the periphery of the endomesoderm brachyury antagonizes mesodermal differentiation and promotes endodermal fate, thereby orienting the tissue’s subdivision. The current knowledge of the molecular apparatus regulating subdivision of the endomesoderm in bilaterians is relatively poor. In sea urchins, two molecular pathways have been implicated in this process: the transcriptional repressor foxA, which plays a central role in endoderm differentiation; and the Notch pathway, which is required for mesoderm induction. We have found that sea urchin brachyury acts upstream of both pathways. Brachyury upregulates foxA transcription, while it reduces the expression of delta, the ligand of the Notch pathway. Further, using chimeras we determined that in sea urchins brachyury cannot induce ectopic cell fate development. Strikingly, both inhibition of mesoderm differentiation and the inability of sea urchin brachyury to induce cell fate ectopically are in contrast to chordates where brachyury misexpression causes ectopic mesoderm development. Thus, our data reveal the existence of a new role for brachyury and provide a working model for the molecular basis of endomesodermal subdivision.
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Program/Abstract # 22
Essential role for PDGF signaling in trigeminal placode formation
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The peripheral sensory nervous system of the vertebrate head arises from two cell types: ectodermal placodes and neural crest. Placodes are thickened regions of the head ectoderm, which delaminate or invaginate to form portions of the cranial ganglia and sense organs. At midbrain levels, the ectoderm is destined to contribute neurons to the trigeminal ganglion, which innervates much of the face and jaws. The trigeminal ganglion forms via interactions between the midbrain neural tube and adjacent ectoderm. This induction triggers expression of the early placode marker, Pax3, ingestion of placode cells and finally their differentiation into neurons. Here, we investigate the role of PDGF signaling in trigeminal placode induction. We show by in situ hybridization that PDGF receptors a and b are expressed in the cranial ectoderm at the time of trigeminal placode formation, with their cognate ligands PDGFB, PDGFC, and PDGFD expressed in the midbrain neural tube. We assayed placode induction in culture by combining quail ectoderm with chick neural tube. Blocking PDGF signaling in vitro results in a dose-dependent abrogation of the placode marker, Pax3. This effect was confirmed by in ovo injection of the PDGFR inhibitor with a similar loss of Pax3 and the later placodal marker, CD151. Furthermore, placode-derived trigeminal neurons fail to form in the absence of PDGF signaling in ovo. These studies present the first evidence for a signaling pathway involved in neurogenic placode formation in amniotes. Our results show that PDGF signaling is necessary for induction of the trigeminal placode and subsequent neurogenesis within the condensing trigeminal ganglia.
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Program/Abstract # 23
Lens regulates sensory innervation of the cornea via Semaphorin3A
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The cornea, one of the most highly innervated tissues of the body, is innervated by trigeminal sensory afferents. During development, axons are initially repelled at the corneal margin,