Molecular specification of the neural crest

The neural crest is a population of multipotent cells unique to the vertebrate embryo that give rise to an immense variety of derivatives. Most of the glia, Schwann cells and neurons of the peripheral nervous system arise from the neural crest. The autonomic nervous system derives entirely from the crest including both sympathetic and parasympathetic branches, and the specialized enteric nervous system. Endocrine and paraendocrine cells are also neural crest derivatives. The melanocytes of the body also develop from the neural crest. At cranial levels, the neural crest gives rise to most of the skeleton and connective tissue of the head, face and neck. The neural crest cells also contribute to the development of the cardiovascular system.

This enormous variety of cells has a common origin in the most dorsal part of the neural tube, from where they migrate towards different locations in the embryo. How is this common population of neural crest cells specified? What is the molecular basis for its early determination? How different is the molecular basis of neural crest specification in mouse, chick, *Xenopus* or zebrafish embryos? These are the questions that are addressed in the reviews presented here.

Several reviews in this issue analyze the role of different inductive molecules on neural crest induction. Barembaum and Bronner-Fraser analyze the role of Wnts, FGFs and BMPs in neural crest induction. Wnts seems to be an important factor required for induction of the neural crest cells, and Raible and Ragland examine how the same signaling molecule is used many times during neural crest development, controlling different process such as induction, delamination and cell fate determination. They propose that it is likely that these multiple functions found for the extracelular signals could also be found for transcription factors. Other important player during neural crest development is the Notch signaling, which is discussed by Cornell and Eisen. They discuss the role of Notch signaling during neural crest specification and cell determination in zebrafish, chick and *Xenopus* embryos.

The concerted action of BMPs, Wnt, FGF and RA activate a genetic program that leads to the final specification of the neural crest cells. A neural crest genetic network is proposed by Steventon et al. Many of these factors work at different steps of neural crest development. The different steps of neural crest ontogeny are discussed by Morales et al., in which they propose that neural crest cells have to overcome competition between cell fate and apoptotic signaling. A particular gene family, the *Sox* genes, is important for neural crest development and they are analyzed by Hong and Saint-Jeannet.

Most of our knowledge about neural crest induction comes from work performed in *Xenopus*, chick and zebrafish. In the case of mammalian embryos, there is currently a paucity of data concerning induction of neural crest cells. Trainor examines how BMPs, Wnts and FGFs are involved in mice neural crest induction, migration and differentiation. Stoller and Epstein analyze a particular group of neural crest: the cardiac neural crest which represent a fascinating example of neural crest development. The roles of BMPs, Notch, Semaphorin and RA in cardial neural crest development, as well as some congentital diseases are discussed.

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