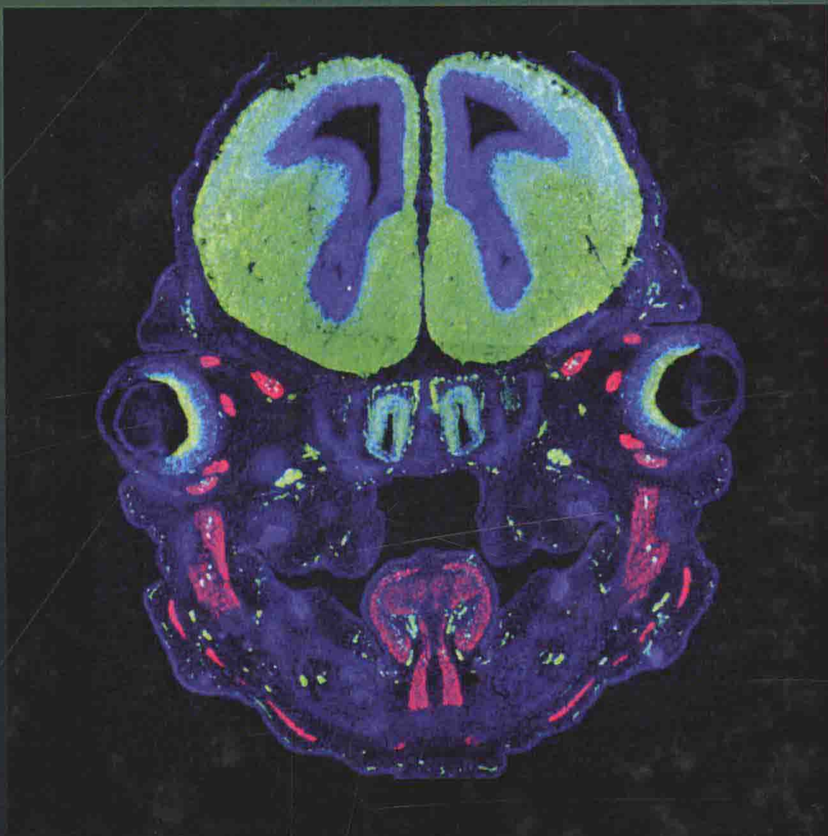
NEURAL CREST AND PLACODES



Edited by

Paul A. Trainor

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Neural Crest and Placodes

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PAUL A. TRAINOR

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PREFACE

Neural crest cells and placodes give rise to an extraordinary array of cell types and tissues. Neural crest cells form bone; cartilage; odontoblasts of teeth; connective tissue; cranial and trunk sensory neurons; peripheral autonomic neurons; and glia, smooth muscle, pigment, and endocrine cells. Ectodermal placodes contribute to the major sensory organs including the olfactory epithelium, lens of the eye, inner ear, and teeth and generate most of the cranial sensory neurons, together with hair and mammary glands. Neural crest cells and placodes are essential for embryonic development and adult homeostasis and are increasingly clinically significant. Collectively, they generate many of the defining characteristics of the craniates and have played major roles in vertebrate evolution.

Neural crest cells and placodes were discovered independently in the nineteenth century and in different species. Neural crest cells were first described by His (1868) in chick embryos, while placodes were described a little latter by van Wijhe (1883) in sharks. The study of neural crest cells and placodes exhibits a rich history, serving as important paradigms for vertebrate evolution, cell and tissue induction, epithelial to mesenchymal transformation, migration, and differentiation, while also providing a profound understanding of the underlying pathogenesis of congenital disorders. The persistence of neural crest cells and placodes into adulthood serves as important models of stem cell biology and tissue homeostasis and provides insights into cancer and metastasis.

Recent studies in tunicates and amphioxus point to neural crest cells and placodes having independent evolutionary origins. However, neural crest cells and placodes develop similarly in many respects and are mutually interdependent. This is particularly true with respect to evolution and development of the vertebrate head and more specifically the peripheral nervous system. For example, cranial neural crest cell-derived glia support placode-derived neurons during the formation and function of the cranial sensory ganglia. Furthermore, cranial neural crest cells establish corridors for the proper migration of epibranchial placode-derived neurons. These properties are a reflection of their extensive coevolution.

This issue of *Current Topics and Developmental Biology* highlights the current state of our knowledge concerning the evolution and development of neural crest cells and placodes throughout the entire body. Where and when did these specialized cells occur and how are they governed by signaling pathways and increasingly complex gene regulatory networks? What contributions do these cells make to specific tissues and organs and how are they integrated? The answers to these questions together with the derivation and application of stem cell-derived neural crest and placode cells in regenerative medicine have major implications for understanding and potentially treating congenital disorders.

Paul A. Trainor

If I have seen further it is by standing on the shoulders of Giants.

Isaac Newton

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