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THE NEURAL CREST, A KEY REGULATOR OF BRAIN DEVELOPMENT AND HOMEOSTASIS

Sophie E Creuzet
Neuro-PSI CNRS, France

The neural crest (NC), a defining feature of vertebrate embryo, generates most of the skeletal tissues encasing the developing forebrain and provides the prosencephalon with functional vasculature and meninges. Our investigations show that, aside from its structural role in craniofacial ontogenesis, the NC exerts a potent morphogenetic paracrine role on the brain and sense organs development. In the light of recent findings, which document the molecular mechanisms whereby the migratory NC cells control cephalic neurulation and forebrain morphogenesis, our investigations show that cephalic NC regulates the morphogenetic activities of secondary brain organizers and modulates long-distance cues emanating from these territories. NC cells act in these processes through a multistep control and exert cumulative effects counteracting signals produced by the neighboring tissues. By this mechanism, the cephalic NC cells supersede ventralizing influences and promote the elaboration of the prosencephalic alar and roof plates. Altogether, these data highlight the developmental relationships between the cephalic vesicles and the migratory NC cells, and show that the cephalic NC itself acts like a dorsalizing brain organizer. In addition, our work opens new avenues for revisiting the etiology of neurological disorders in the light of cephalic NC dysfunctions. In experimental models which virtually reproduce developmental encephalopathies and pervasive developmental disorders characterized by defective cognitive functions, our recent data reveal that congenital social impairments may have an extrinsic origin and involve misregulation of trophic factors produced by the CNC cells.

sophie.creuzet@inaf.cnrs-gif.fr