Keynote Lecture IX
Neural Crest Induction during Development

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Dr Marianne Bronner-Fraser received her ScB in Biophysics from Brown University and her PhD in Biophysics from Johns Hopkins University in 1979. She joined the faculty at University of California, Irvine, in 1980 and became a Full Professor in 1990 as well as co-director of the Developmental Biology Center. In 1996, she moved to the Division of Biology at Caltech where she is currently the Albert Billings Ruddock Professor of Biology. From 2001 to 2003, she was the Chair of the Faculty at Caltech.

Dr Bronner-Fraser has a long-standing interest in how complex organisms develop from single cells. This question has its roots both in Embryology (study of the developing organism) and Evolution (how organisms diverge from a common ancestor). Dr Bronner-Fraser has taught courses in Developmental Biology, Cell Biology, Developmental Neurobiology both at the University of California and at Caltech. Together with her husband, Dr Scott Fraser, she was co-Director of the Embryology Course at the Marine Biological Laboratory at Woods Hole, MA, from 1996-2001. This course is over 100 years old and teaches graduate students and post-graduate students from all around the world modern approaches to Developmental Biology. (mbronner@caltech.edu)

Neural crest cells arise within the ectoderm during neurulation and give rise to most of the peripheral nervous system. Following neural tube closure, they come to lie within the dorsal neural tube from which they emerge and subsequently migrate extensively to numerous and characteristic sites. There, they differentiate into neurons and glia of the peripheral nervous system, cartilage and bone of the face, melanocytes and various other cell types. Fate mapping experiments have demonstrated that the neural crest arises at the juncture between presumptive epidermis and neural plate. However, injection of lineage tracer into individual cells reveals that single neural fold cells are not committed to a neural crest fate; rather these cells can form all ectodermal derivatives (epidermis, neural tube, neural crest).

Inductive interactions between the neural and non-neural ectoderm can generate neural crest cells, suggesting that signals travel through the epidermis to generate neural crest cells prior to neural tube closure. Induction of the neural crest appears to be a multiphasic process and involves a combination of an early Wnt signal, likely mediated by Wnt6, together with later functions for BMP signaling pathways. We show that Wnt is both necessary and sufficient for this stage of neural crest induction. Recent experiments have focussed on the initiation of neural crest induction in the gastrulating embryo. Our results suggest that cells in the gastrula are already conditionally specified to form neural crest cells. Finally, we have been taking a genomics approach together with gain- and loss-of-function experiments to identify the array of molecules expressed as a result of neural crest induction and will discuss the results of these screens.