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Development of “Normal” Dermatomes and Somatotopic Maps by “Abnormal” Populations of Cutaneous Neurons

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Abstract

During development, motor and sensory axons grow to peripheral targets with remarkable precision. Whereas much has been learned about the development of motoneuron connectivity, less is known about the regulation of cutaneous innervation. In adults, dorsal root ganglia (DRG) innervate characteristic skin regions, termed dermatomes, and their axons project somatotopically in the dorsal horn. Here, we have investigated whether cutaneous neurons are selectively matched with specific skin regions, and whether peripheral target skin influences the central connections of cutaneous neurons. To address these questions, we shifted limb buds rostrally in chick embryos prior to axon outgrowth, causing DRGs to innervate novel skin regions, and mapped the resulting dermatomes and central projections. Following limb shifts, cutaneous innervation arose from more rostral and from fewer DRGs than normal, but the overall dermatome pattern was preserved. Thus, DRGs parcel out innervation of skin in a consistent manner, with no indication of matching between skin and DRGs. Similarly, cutaneous nerves established a “normal” somatotopic map in the dorsal horn, but in more rostral segments than usual. Thus, the peripheral target skin may influence the pattern of CNS projections, but does not direct cutaneous axons to specific populations of neurons in the dorsal horn.


Keywords




dorsal root ganglia; chick; hindlimb; sensory; development; dorsal horn; somatotopy; central projections








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