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Shaping up and shipping out: The role of cilia in growth and patterning

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Almost every cell in the body is equipped with a specialized structure called the primary cilium. In addition to their well-described roles in mechanosensation, emerging evidence indicates that cilia also participate in intercellular signaling. In this capacity, cilia have been equated to cellular antennae that detect molecular signals in the environment and thus influences how cells behave. Ciliary defects are associated with a number of human diseases and disorders, the majority of which may be due to the mechanosensory role of cilia. Here we describe a new role for cilia in patterning and growth of the craniofacial skeleton.

We disrupted anterograde intraflagellar transport in neural crest cells by inactivating one of the kinesin-II motor subunits, Kif3a in this tissue. The facial prominences and their associated skeletal elements are derived from cranial neural crest: thus, this genetic approach inactivated Kif3a cells that give rise to the facial skeleton. Despite the dramatic truncation in cilia, cranial neural crest cells still migrated normally into the facial prominences. In addition, cranial neural crest cells that lacked cilia still differentiated into osteoblasts and deposited a mineralized matrix on a timescale equivalent to their wild-type and heterozygous littermates. Loss of Kif3a resulted in a dramatic alteration in the pattern and subsequent growth of the facial skeleton. We will discuss the molecular and cellular basis for this defect in skeletal patterning, and present a novel mechanism whereby disruptions in ciliary function is responsible for a class of craniofacial dysmorphologies.

The authors have no conflict of interest.

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