ShapingSensorySignalswith Inhibition during Active Touch

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Active movements of sensoryorgans are essential for animals to interactwith the externalenvironment. Movementitselfproducessensorysignals, known as reafference, some of which are intertwinedwithsensory input evoked by touchwithexternalobjects. The brainneeds to disentanglesensorysignalscomingfromtouch versus self-movement. Here, wediscoveredthatfast-spikinginhibitoryinterneurons in the somatosensory cortex are driven by self-initiatedmovement, whichdepends on the sensoryreafference and ismediated by the feedforwardthalamocorticalpathway. The inhibition thensuppressesmovement-related input to excitatoryneuronssuchthat the spikes in excitatoryneuronsmainlyrepresenttouch. The functionalproperty of fast-spikinginterneuronsisendowed by theirstrong connections with the thalamocortical inputs, which carry bothtouch and self-movementactivities. In contrast, a different type of interneurons, namelysomatostatin-expressinginterneurons, which are onlyweaklyconnected to the thalamocortical inputs, show selectiveresponse to touch but not self-movement. Touchelicitedspikes in the somatostatininterneuronswith a longer latency, whichcould arise fromfacilitatingsynaptic inputs from local excitatoryneurons. Thus, inhibitoryinterneurons in the cortical circuits are assembledwithspecificconnectivity and synapticdynamics to shapedifferent aspects of sensoryrepresentation.