Spatiotemporal organization of neuronal activity in the cervical cord of behaving primates.

By elsc_admin
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Abstract:

Spinal neurons operate as a processing link that integrates descending and peripheral information and in turn, generates a specific yet complex muscle command. The functional organization of spinal circuitry during normal motor behavior dictates the way in which this translation process is achieved. Nonetheless, little is known about this organization during normal motor behavior. We examined the spatial organization of neural activity in the cervical spinal cord of behaving primates performing an isometric wrist task by estimating the averaged intraspinal activity of neuronal populations. We measured population response profiles and frequency content around torque onset and tested the tendency of these profiles to exhibit a specific organization within the spinal volume. We found that the spatial distribution of characteristic response profiles was non-uniform; namely, sites with a specific response profile tended to have a preferred spatial localization. Physiologically, this finding suggests that specific spinal circuitry that controls a unique feature of motor actions (with a particular task-related response pattern) may have a segregated spinal organization. Second, attempts to restore motor function via intraspinal stimulation may be more successful when the spatial distribution of these task-related profiles is taken into account.

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