The anatomy of movement

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Tripathi P. The anatomy of movement. J Behav Neurosci Res.2021;4(2):9.

OPINION

Motor function is involved in almost every aspect of behaviour, from talking to gesturing to walking. A simple movement like reaching out to pick up a glass of water, on the other hand, might be a complex motor activity to research. Your brain must not only figure out which muscles to contract and in what order to lead your hand to the glass, but it must also calculate the force required to pick up the glass. Other elements, such as the amount of water in the glass and the substance it is composed of, influence the brain's computations. Many anatomical regions are involved in motor function, which is unsurprising. One of the main brain areas involved in motor function is the Primary Motor Cortex (M1). Primary Motor Cortex (M1) is found in the frontal lobe of the brain, along the precentral gyrus, which is a hump. The primary motor cortex's job is to generate brain impulses that control movement execution. Primary Motor Cortex (M1) signals cross the midline of the body to activate skeletal muscles on the opposite side, implying that the left hemisphere of the brain controls the right side of the body and the right hemisphere controls the left. The primary motor cortex contains representations of every part of the body, which are placed somatotopically: the foot is next to the leg, which is adjacent to the trunk, which is near to the arm and hand. The quantity of brain matter dedicated to a specific body part indicates how much control the primary motor cortex has over that body part. The complicated movements of the hand and fingers, for example, necessitate a lot of cortical space; therefore these body parts have greater representations in Primary Motor Cortex (M1) than the trunk or legs, which have relatively basic muscle patterns. The motor homunculus is a disproportionate map of the body in the motor cortex. The secondary motor cortices are other areas of the cortex that are engaged in motor function. The posterior parietal cortex, the premotor cortex, and the Supplementary Motor Area (SMA) are among these areas. Visual information is converted into motor commands via the posterior parietal cortex. The posterior parietal cortex, for example, would be involved in calculating how to move the arm toward a glass of water based on its location in space. The premotor cortex and the supplementary motor area receive this information from the posterior parietal areas. The premotor cortex is located just front of (in front of) the primary motor cortex. It is engaged in sensory movement guidance and governs the body's more proximal muscles and trunk muscles. The premotor cortex would assist in orienting the body before reaching for the glass of water in our scenario. The supplemental motor region is located above and to the side of the premotor area, as well as in front of the primary motor cortex. It is involved in the coordination of two-handed movements as well as the planning of complex movements. The premotor and supplemental motor areas both provide information to the primary motor cortex and brainstem motor regions. The corticospinal tract fibres are formed by neurons in the Primary Motor Cortex (M1), Supplementary Motor Area (SMA), and premotor cortex. The corticospinal tract, which is made up of over a million fibres, is the only direct channel from the cortex to the spine. The bulk of these fibres cross over to the other side of the body as they descend into the brainstem. The fibres continue to descend through the spine after crossing, eventually terminating at the appropriate spinal levels. In humans, the corticospinal tract is the primary control channel for voluntary movement. Other motor pathways emerge from groupings of motor neurons in the subcortical cortex (nuclei). These networks regulate posture and balance, proximal muscle coarse motions, and head, neck, and eye movements in response to visual targets. Through interneuronal circuits in the spine and projections to cortical motor areas, subcortical pathways can influence voluntary movement. Both white and grey matter makes up the spinal cord. Nerve fibres that go through the spine make up the white matter. Because the nerve fibres are protected by myelin for quicker signal transmission, it is white. The corticospinal tract, like many other major fibre bundles, runs through the lateral white matter of the spine. Gray matter, which is made up of cell bodies such as motor neurons and interneurons, lines the inside of the spinal cord. The grey matter in a cross-section of the spinal cord has the shape of a butterfly. In the ventral horn of the spine, fibres in the corticospinal tract synapse onto motor neurons and interneurons. Fibers from the cortex's hand regions end on motor neurons higher in the spine (in the cervical levels) than fibres from the leg regions, which end in the lumbar levels. As a result, the lower layers of the spine have far less white matter than the upper levels. Motor neurons regulating distal muscles are positioned more laterally in the ventral horn than neurons controlling proximal muscles. The most medially situated neurons are those that project to the trunk muscles. Extensor neurons (muscles that increase joint angle, such as the triceps muscle) are located at the grey matter's border, whereas flexor neurons (muscles that reduce joint angle, such as the biceps muscle) are located more interiorly. It's vital to remember that a single motor neuron in the spine can receive thousands of inputs from cortical motor regions, subcortical motor regions, and interneurons. Interneurons that receive input from the same regions allow for the development of complex circuits.

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Received: March 10, 2021; Accepted: March 18, 2021; Published: March 26, 2021