Motor coordination

Motor coordination is the combination of body movements created with the kinematic (such as spatial direction) and kinetic (force) parameters that result in intended actions. Motor coordination is achieved when subsequent parts of the same movement, or the movements of several limbs or body parts are combined in a manner that is well timed, smooth, and efficient with respect to the intended goal. This involves the integration of proprioceptive information detailing the position and movement of the musculoskeletal system with the neural processes in the brain and spinal cord which control, plan, and relay motor commands.

The cerebellum plays a critical role in this neural control of movement and damage to this part of the brain or its connecting structures and pathways results in impairment of coordinaton, known as ataxia.

Coordinated movements are achieved by well-timed activation of selected muscles. This process relies on intact cerebellar circuitry, as demonstrated by motor impairments following cerebellar lesions. Based on anatomical connectivity and symptoms observed in cerebellar patients, Nashef et al., hypothesized that cerebellar dysfunction should disrupt the temporal patterns of motor cortical activity, but not the selected motor plan. To test this hypothesis, they reversibly blocked cerebellar outflow in primates while monitoring motor behavior and neural activity. This manipulation replicated the impaired motor timing and coordination characteristic of cerebellar ataxia. They found extensive changes in motor cortical activity, including loss of response transients at movement onset and decoupling of task-related activity. Nonetheless, the spatial tuning of cells was unaffected, and their early preparatory activity was mostly intact. These results indicate that the timing of actions, but not the selection of muscles, is regulated through cerebellar control of motor cortical activity [1].

Eye-Hand Coordination

Eye-Hand Coordination

1)
Nashef A, Cohen O, Harel R, Israel Z, Prut Y. Reversible Block of Cerebellar Outflow Reveals Cortical Circuitry for Motor Coordination. Cell Rep. 2019 May 28;27(9):2608-2619.e4. doi: 10.1016/j.celrep.2019.04.100. PubMed PMID: 31141686.