**Biomedical Engineering**

presents

seminar by Dr. Claire Honeycutt



Expanding our understanding of the brainstem’s role in movement: a perspective from cat to human

While it is well established that the brainstem plays an important role in movement control, the specific role of this structure remains uncertain. Much of what we know about the brainstem contribution to movement comes from the seminal work by Lawrence and Kuypers which concluded that the brainstem (reticulospinal) and cortex (corticospinal) tracts exist within a proximal-distal gradient that defines their influence. Recent work has expanded and challenged this strict framework. The objective of this talk is to highlight our new understanding of how the brainstem contributes to 1) whole-body balance control, 2) hand movement, and 3) movement planning following stroke. First, we evaluated the capacity of the brainstem and spinal cord to generate key features of the balance response. While it has long been established that the brainstem is involved in whole-body balance control, its specific contributions were unclear. We found that these structures could generate a coordinated and appropriately directed muscular response. Second, the startle reflex, which is mediated by the reticulospinal tract, was utilized as a non-invasive probe of movement planning to evaluate if reticulospinal connections exist to the muscles of the hand in humans. While traditionally the corticospinal tract was thought to have exclusive control of the muscles of the hand, recent evidence from the primate demonstrates that reticulospinal tract connections exist to the muscles of the hand. Similarly, we found that the reticulospinal tract likely has connections to the intrinsic muscles of the hand in humans but its functional role is limited to coordinated movement of the whole hand. Finally, the startle reflex was utilized to probe the ability of stroke survivors to plan movement. The reticulospinal tract has often been promoted as an alternative pathway for voluntary movement execution following stroke, but its capacity to serve this function is unknown. We evaluated movements initiated via the reticulospinal tract in stroke survivors and found that planned flexion movements initiated through the startle reflex were not statistically different from movements in unimpaired individuals in terms of onset latency and muscle activation patterns. This opens up the reticulospinal system as a potential therapeutic target following stroke. In conclusion, these results point to an updated and expanded view of the brainstem’s role in movement control, though it is certain that all levels of the nervous system work in parallel to generate a large repertoire of diverse, coordinated movements throughout the whole body.

**Monday, February 3rd 3:00 – 4:00pm**

**Hudson Hall Room 125**

**Refreshments will be served**