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Spike trains to force generation

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The field of neuromechanics, which attempts to integrate neural control with muscle activation and the resulting movement of an organism, is an emerging field of organismal biology. Approaches from experimental biology, robotics, and mathematics have now reached the point where their knowledge about the different facets of (animal) locomotion can be combined and integrated into realistic and useful models. This integration between fields opens up new questions and problems for researchers to solve. In this talk, we explored the interface between neuron and muscle during the initial transfer of information that generates muscle contraction.

Muscle contraction occurs when neuron action potentials stimulate the sarcoplasmic reticulum, releasing calcium ions that then bind to muscle filaments, allowing the myosin to contract the muscle. We will present a model that couples spike-train activation to mass-action equations for calcium ions, which in turn couples to the Hill model for muscle contraction force-velocity relationship. This model allows for investigation of spike trains required to produce partial twitch response, and total tetanic contraction.

Primary authors: NEWHALL, Katie (UNC Chapel Hill); SAMSON, Julia; Dr MILLER, Laura (University of North Carolina at Chapel Hill)

Presenter: NEWHALL, Katie (UNC Chapel Hill)

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