

Computational models as a means to test hypotheses about neuromuscular systems: How far have we come?

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Computational models are frequently used to explain phenomena in sensorimotor systems. Neuromuscular models are computational implementations of hypotheses about the constitutive parts and operant mechanisms. Models for neuromuscular function typically contain multiple elements and parameters. These model elements and their parameter values may be difficult to estimate, measure, or describe from first principles, and may vary naturally in the population. Before accepting the result from a simulation, one must explain the differences that invariably emerge between model predictions, experimental data and intuition. While these differences may be justifiably dismissed as unimportant, they can also reflect the validity of the scientific hypothesis, the choice of representation selected for each constitutive element, parameter variability/uncertainty, or even numerical implementation. I will present some examples using sensitivity analysis and cross-validation in the areas of muscle modeling and muscle redundancy that challenge current notions and suggest productive new research directions.