Mean Field Theory of Muscle Contraction

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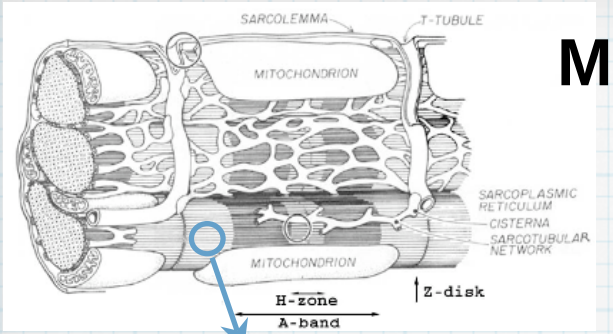

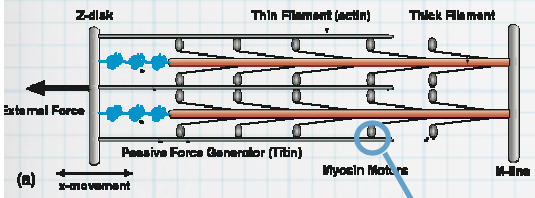

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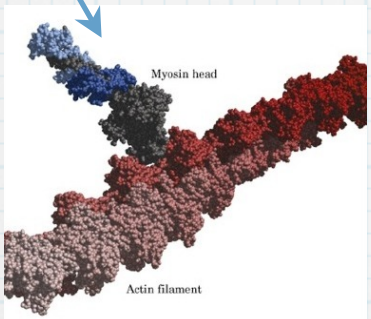
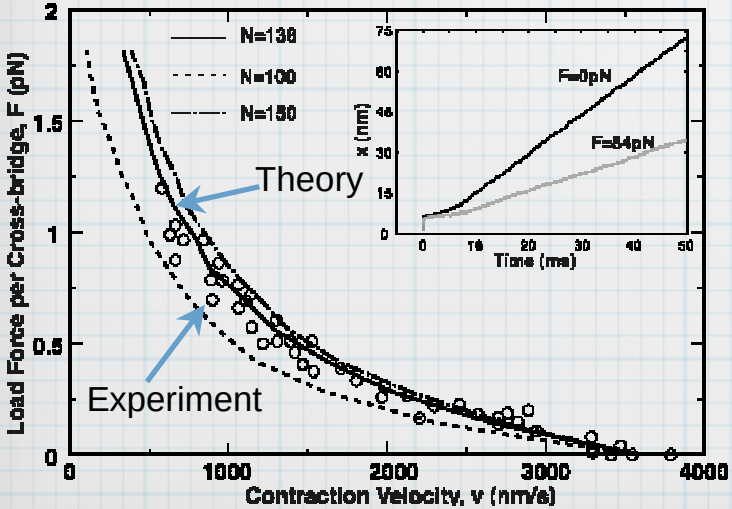


Myosin-II Motor



Researchers at Johns Hopkins University work on understanding complex biological systems from the level of the chemistry of individual molecules to their assembly into moving and working structures like the muscles of the human body.

How do conformational changes (coordinated movement of atoms through space) in the protein molecules called myosin-II connect to muscle contraction? These molecules, by participating in a hydrolysis reaction between water and adenosine triphosphate (ATP), are the elementary force generators responsible for muscle fiber shortening. The researchers use the tools of non-equilibrium statistical mechanics and develop a theory of muscle movement and ensemble force generation. At the molecular level, the structure and kinetics of the myosin molecules are incorporated; at the macroscopic level, the force velocity relationship and mechanical efficiency are explained using their theory.

A striking feature of muscle dynamics is that the myosin motors are synchronized to achieve optimal tension and efficiency.

G. Lan and S. X. Sun, Biophys. J. 88:4107-4117 (2005)
G. Lan and S. X. Sun, Biophys. J. submitted.