Neuromechanics of Human Movement

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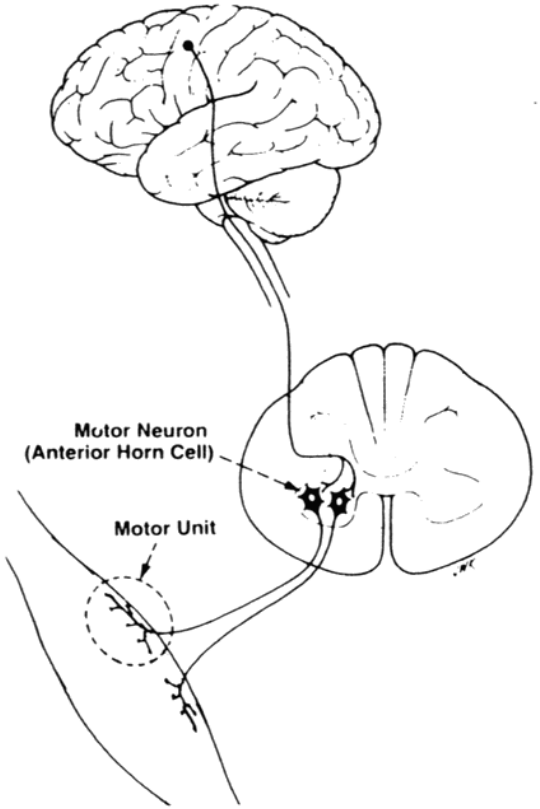
Neural: Motor Unit (MU)

- Fundamental *functional* unit of contraction
- Alpha motoneuron and all skeletal muscle fibres innervated by its axon

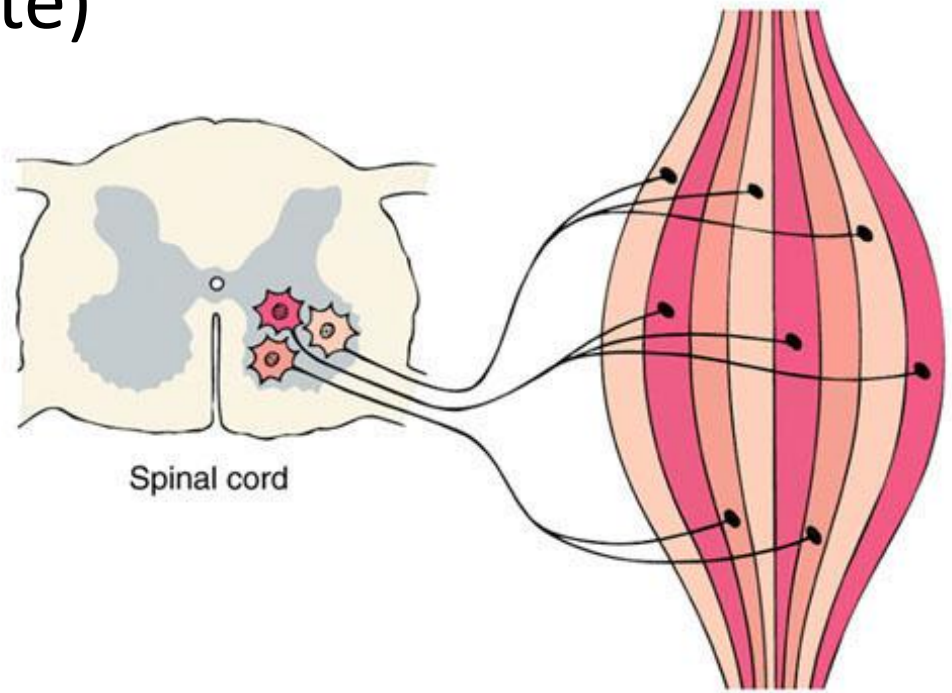


Neural: Motor Unit (MU)

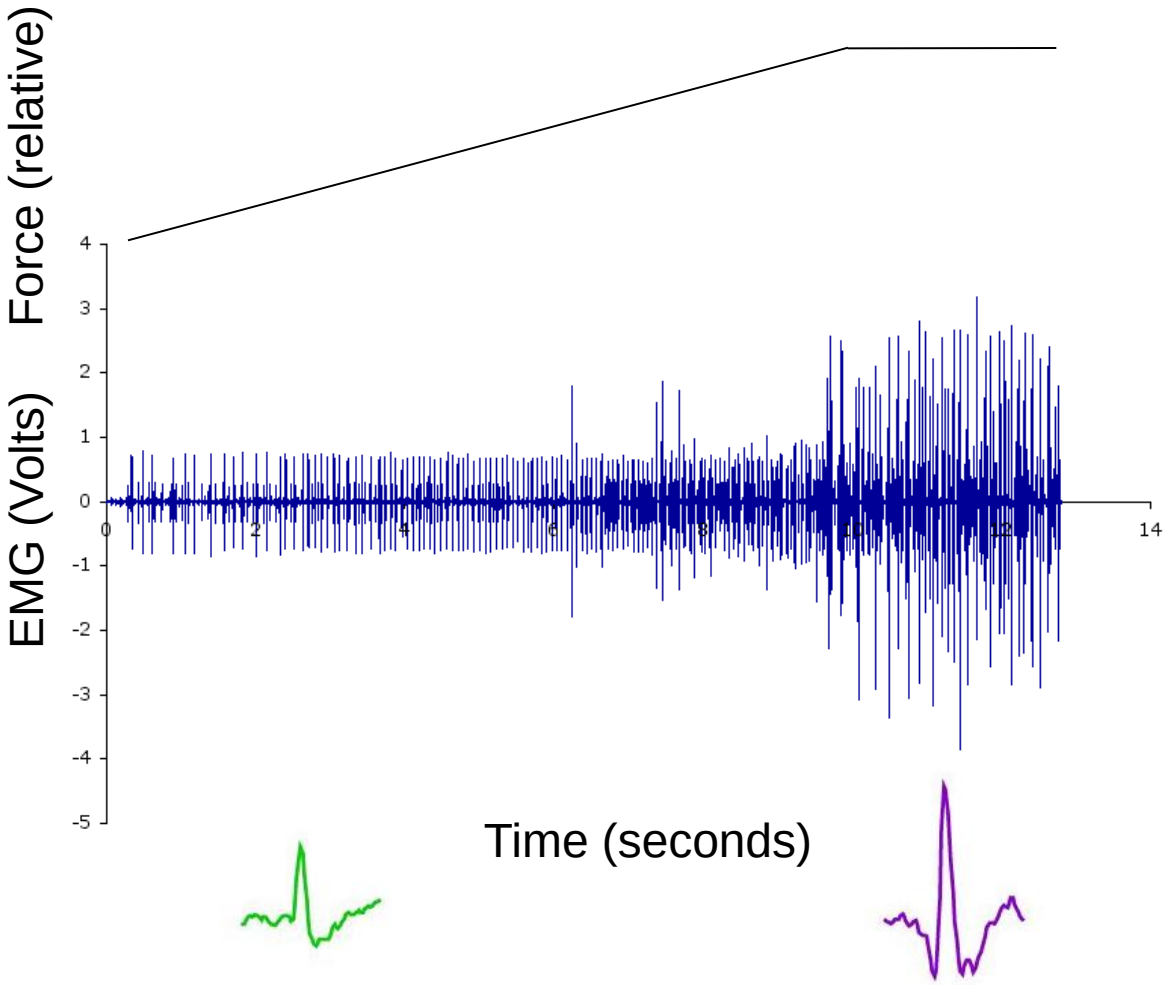
1

- Force is controlled by altering the number of active MUs (de/recruitment), and changing their frequency of activation (rate coding – MU discharge rate)

2

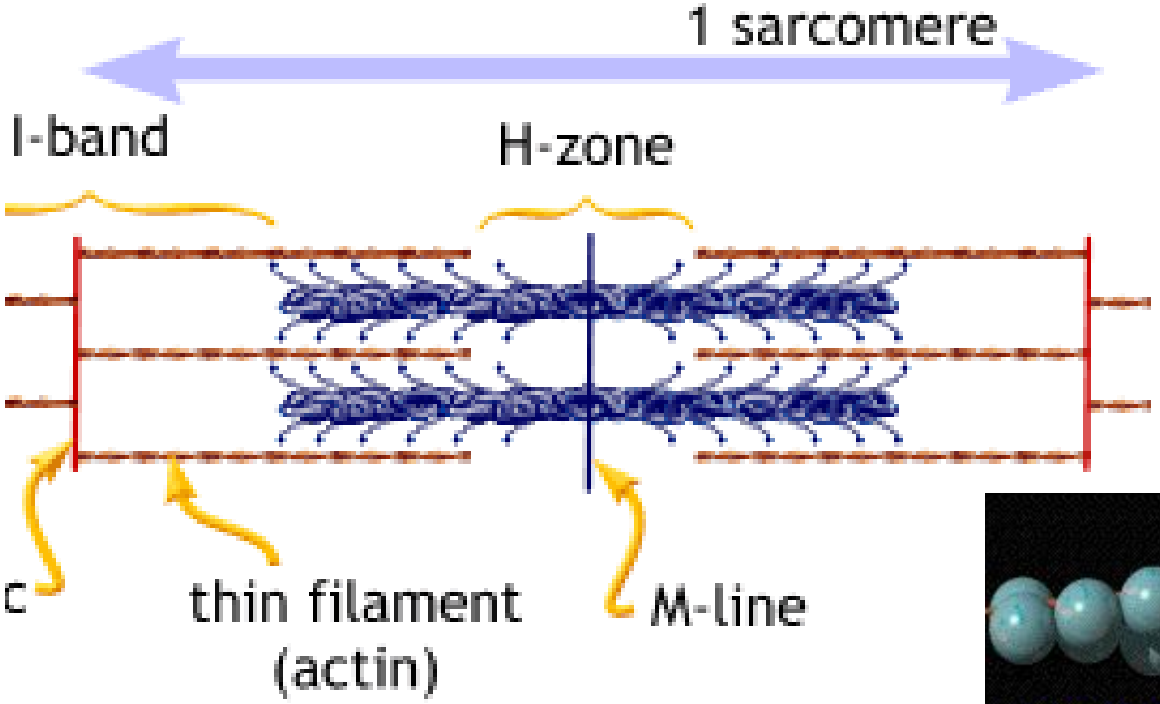


Neural: Motor Unit



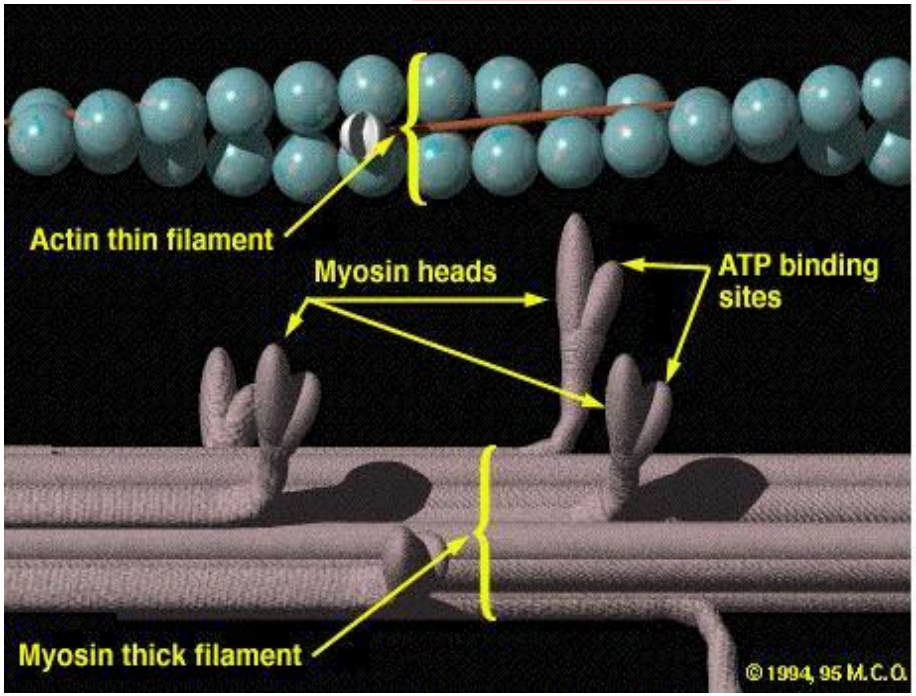
1. First MU recruited
2. Increase firing rate of MU
3. Recruitment of second MU
4. …

Mechanical: Muscle Sarcomere



FOUNDATION OF MUSCLE CONTRACTION

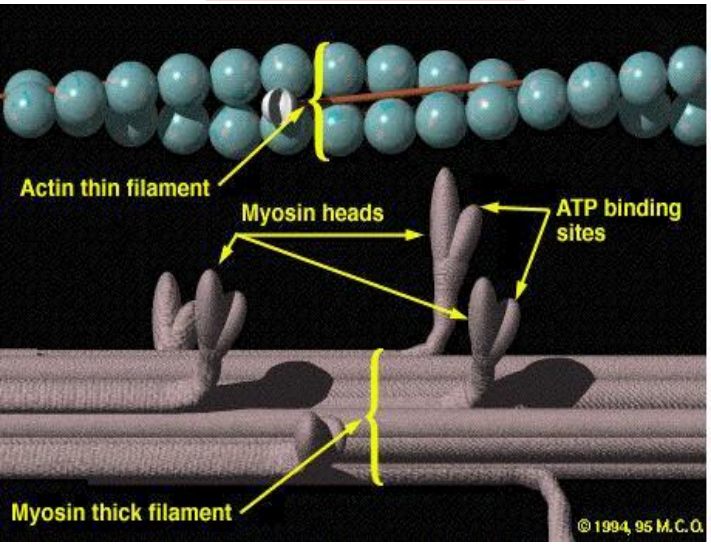
ACTIN



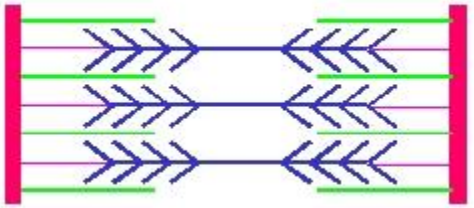
MYOSIN

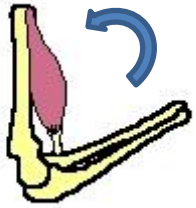
Mechanical: Muscle Sarcomere

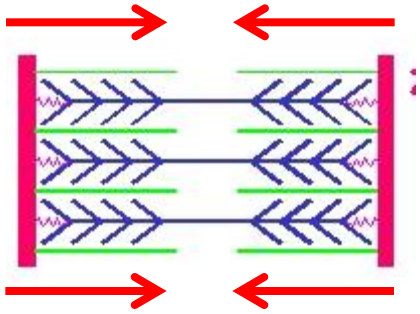
ACTIN



MYOSIN

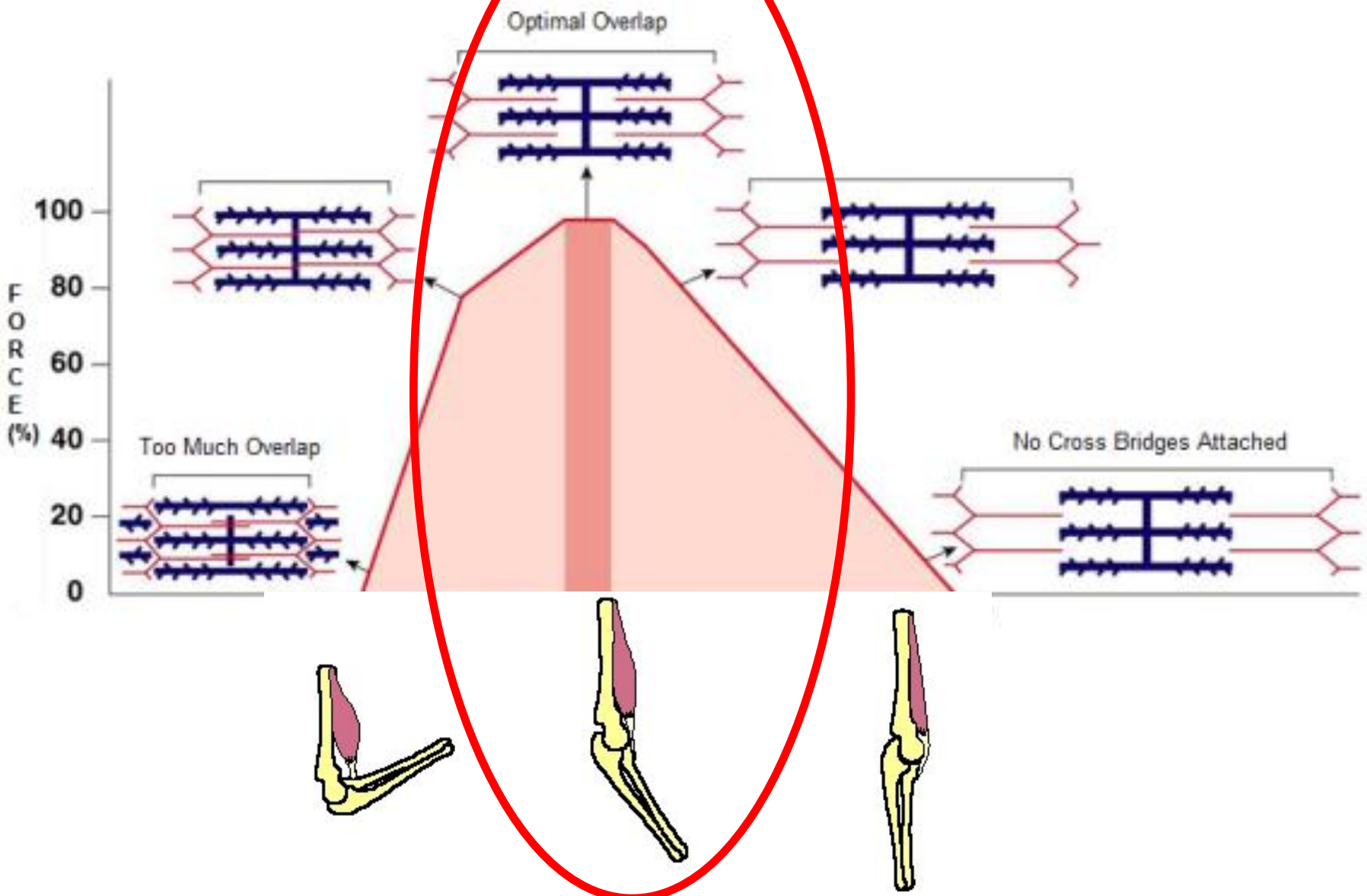






Sliding Filament Theory

Force-Length Relationship



Take Away

- Movements are generated by neural signals
  - Motor unit recruitment and rate coding
- Muscles are designed to perform many actions
  - Shortening (i.e., concentric) & Lengthening (i.e., eccentric)
- Muscles act in an optimal range of the force-length relationship to produce optimal performance