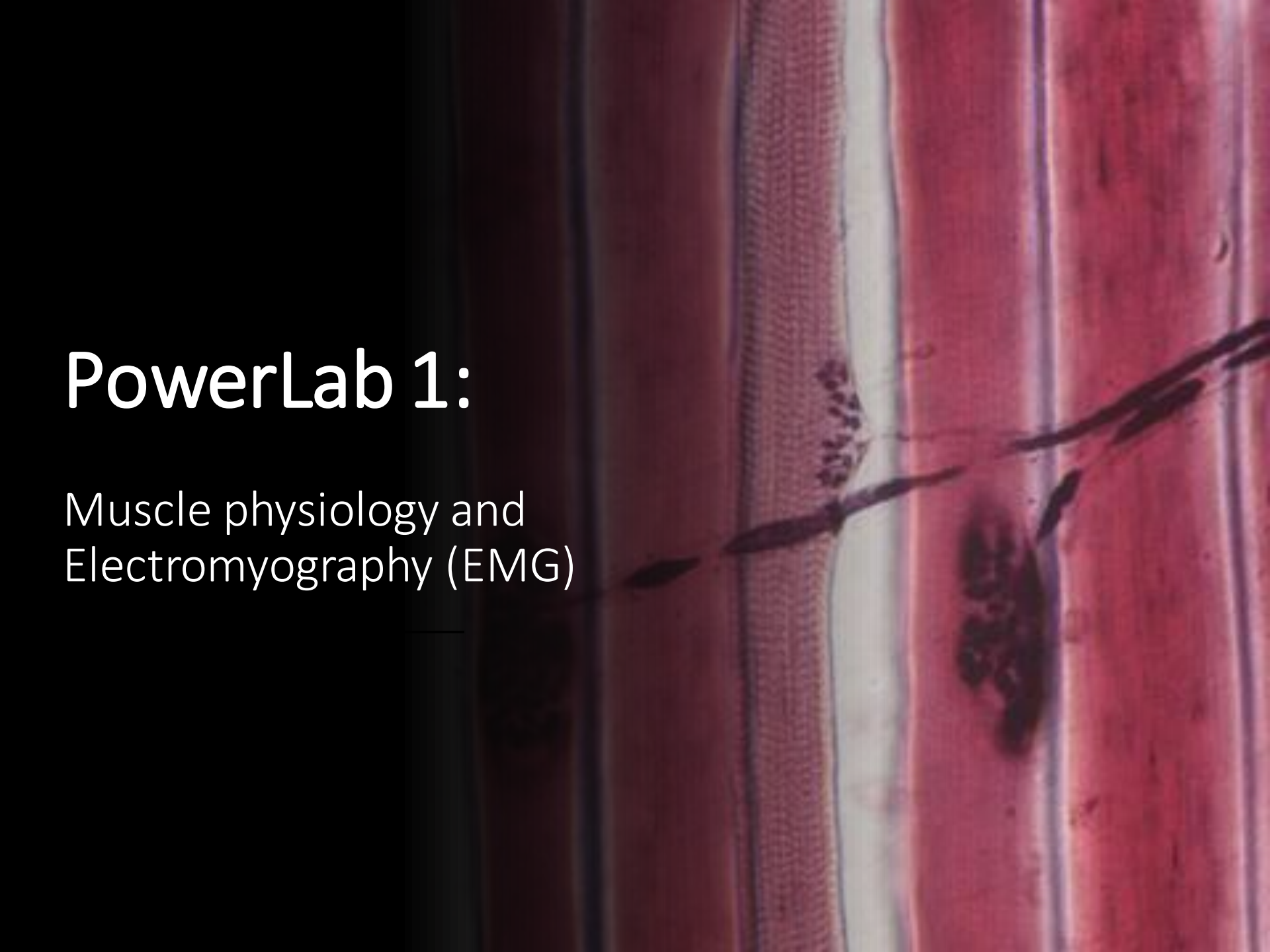


PowerLab 1:

Muscle physiology and Electromyography (EMG)

Experiments and Objectives

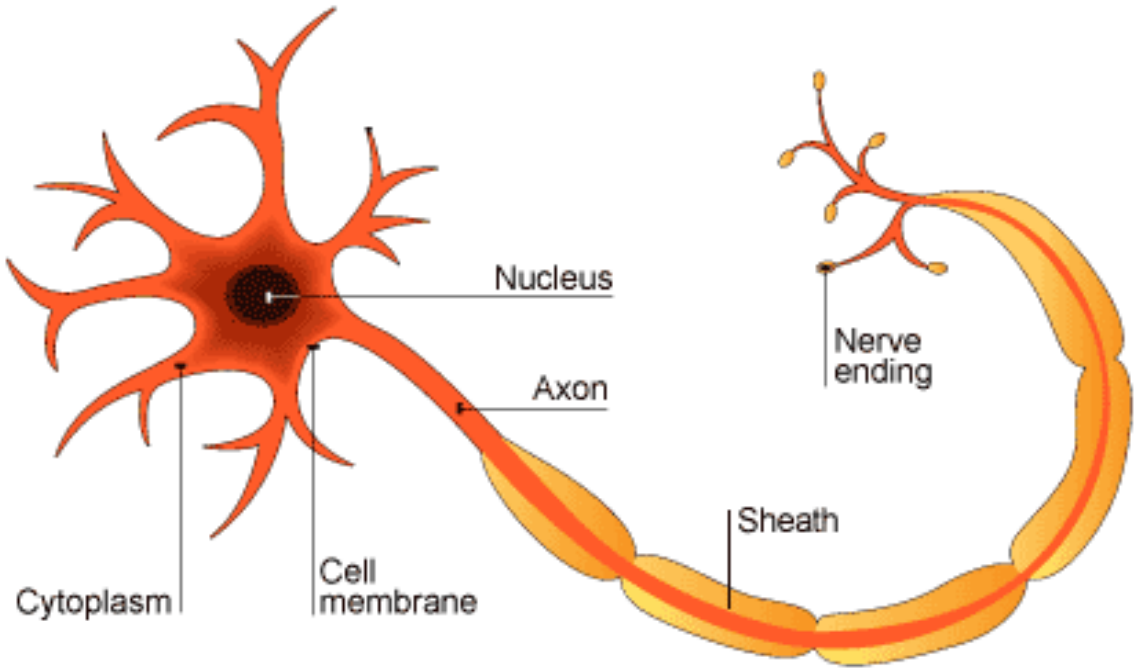
Voluntary Muscle Contraction

- Motor units and muscle physiology
- Regulation of muscle tension
  - Recruitment and Frequency modulation
- Antagonistic muscle function

Evoked (Involuntary) muscle contraction

- Physiology of an action potential
- Events at a neuromuscular junction
- Calculation of nerve conduction velocity

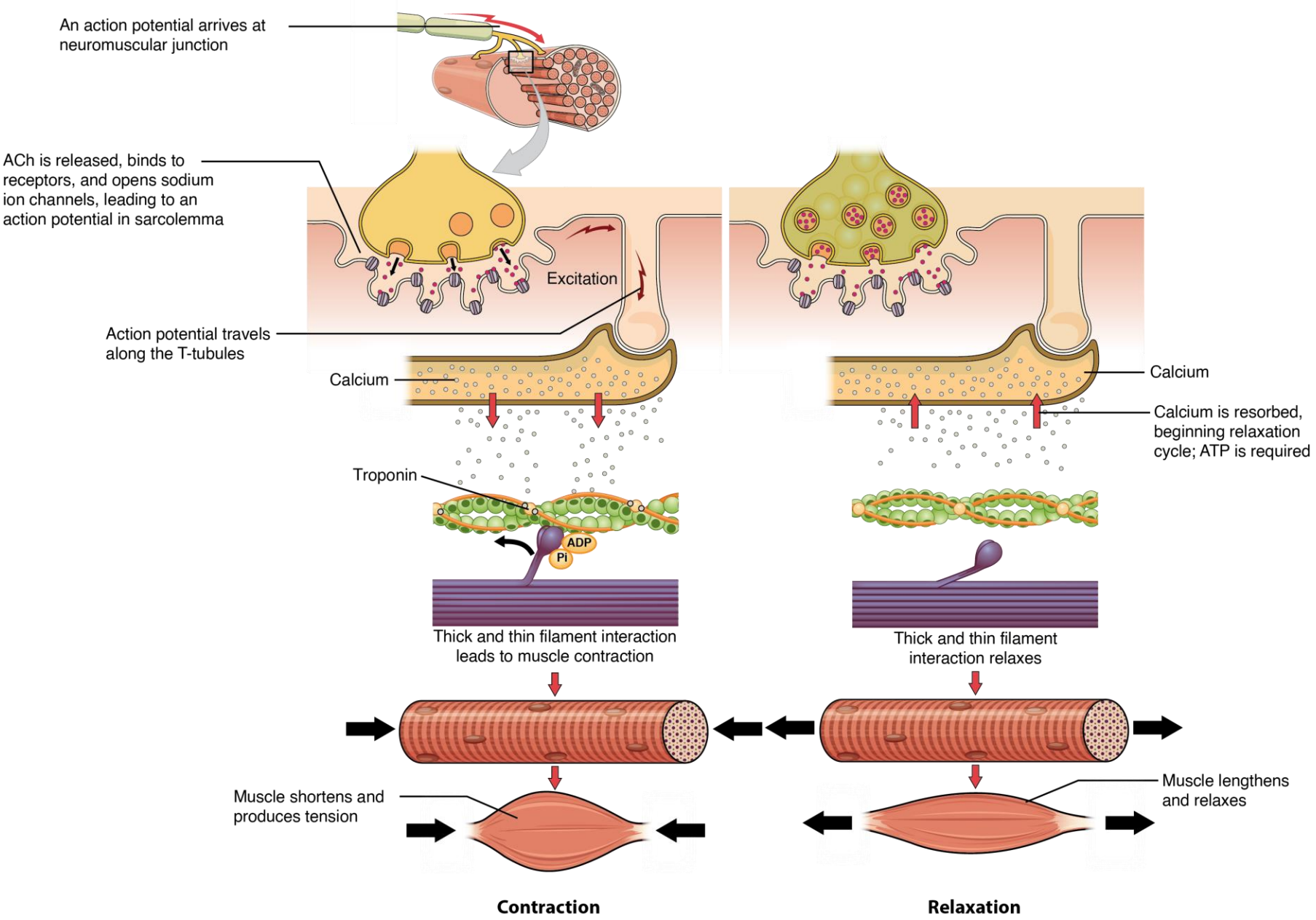
Motor neuron and action potential(s)



An action potential, also known as a nerve impulse , is a short duration electrical current generated due to the movement of charged ions across the cell membrane of a neuron.

This current travels down the axon and terminates at the nerve endings.

Events at the Neuromuscular junction



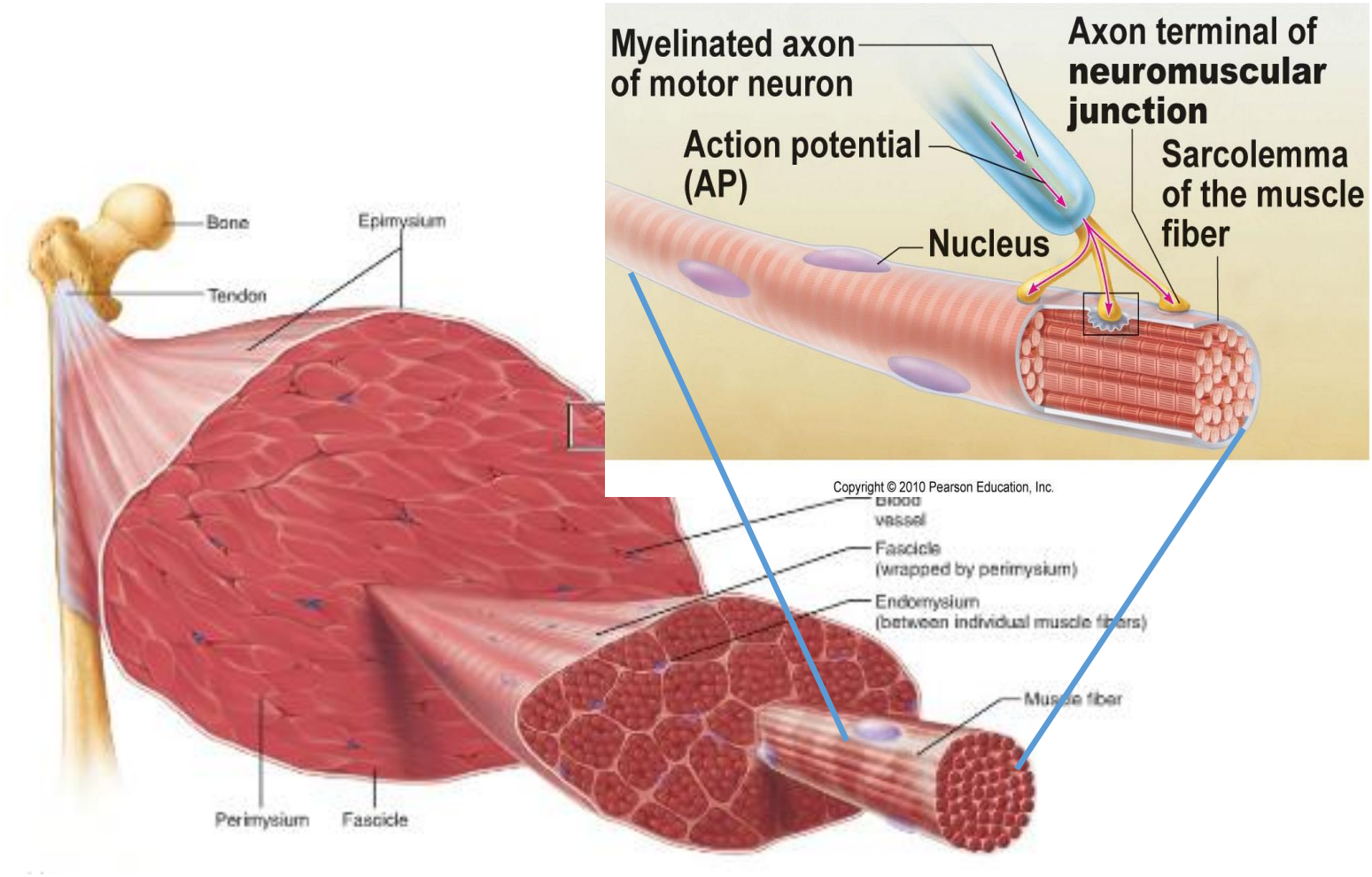
Regulation of muscle contraction

- A muscle (e.g. : biceps) contains numerous muscle fibers.
- The muscle fibers are ‘controlled’ by motor neurons.

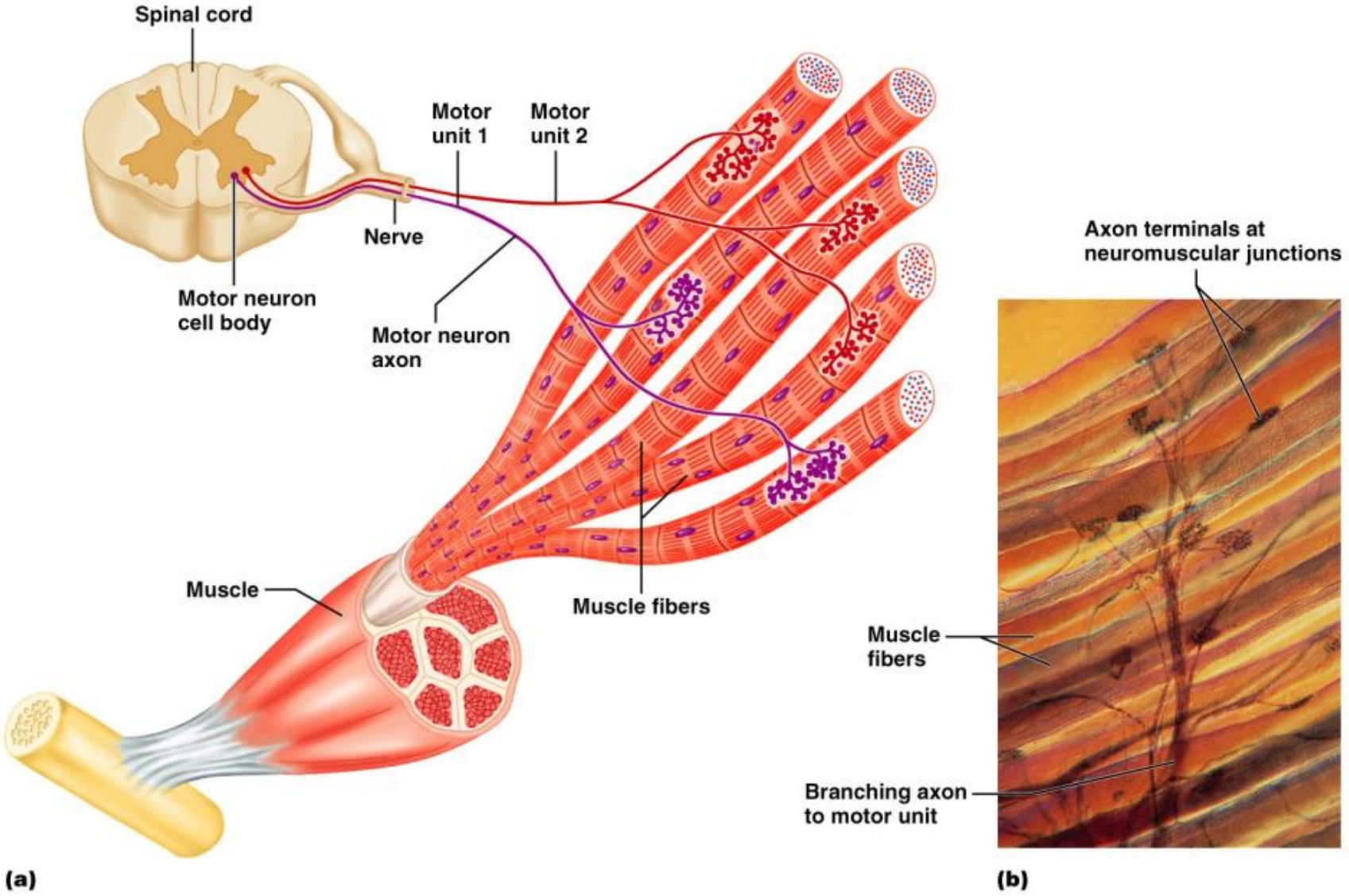
- Using differences in the size of the motor unit (i.e. the number of muscle fibers a single motor neuron controls) and the frequency of firing of these motor neurons, muscle contraction can be regulated in two ways:

  - Recruitment (of different motor units)
  - Frequency modulation

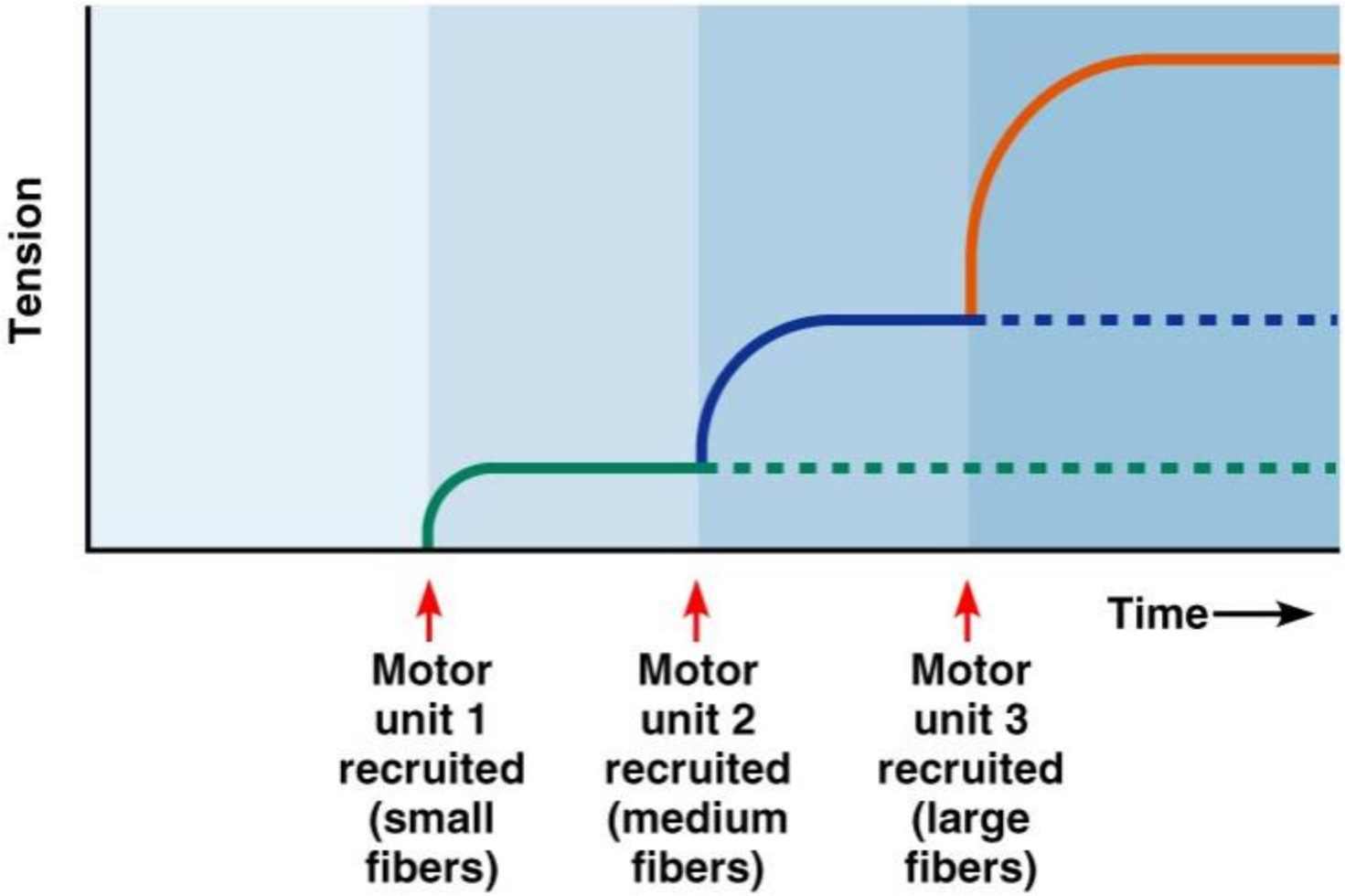
Motor Unit Architecture



Motor unit

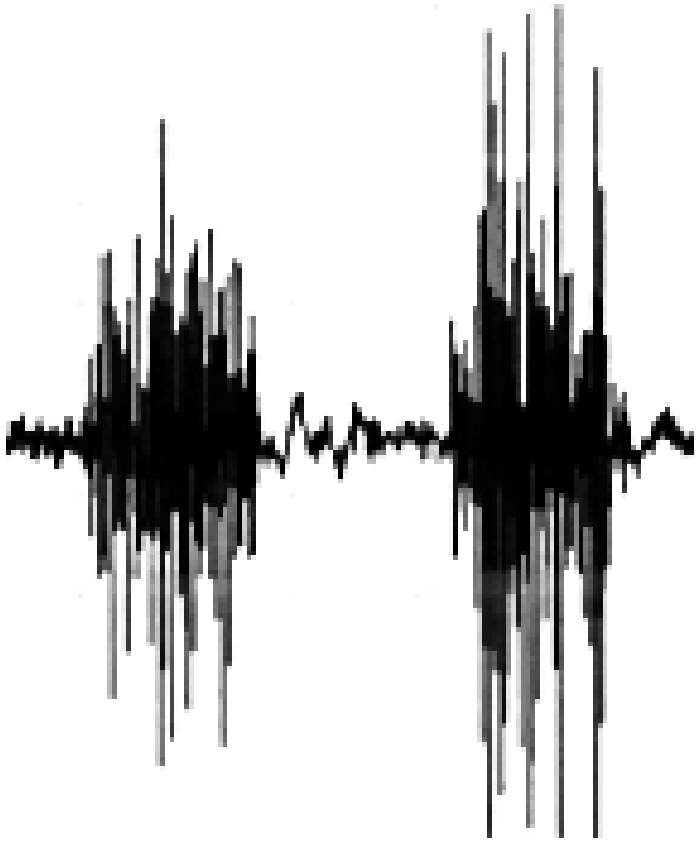


Recruitment and Size Principal



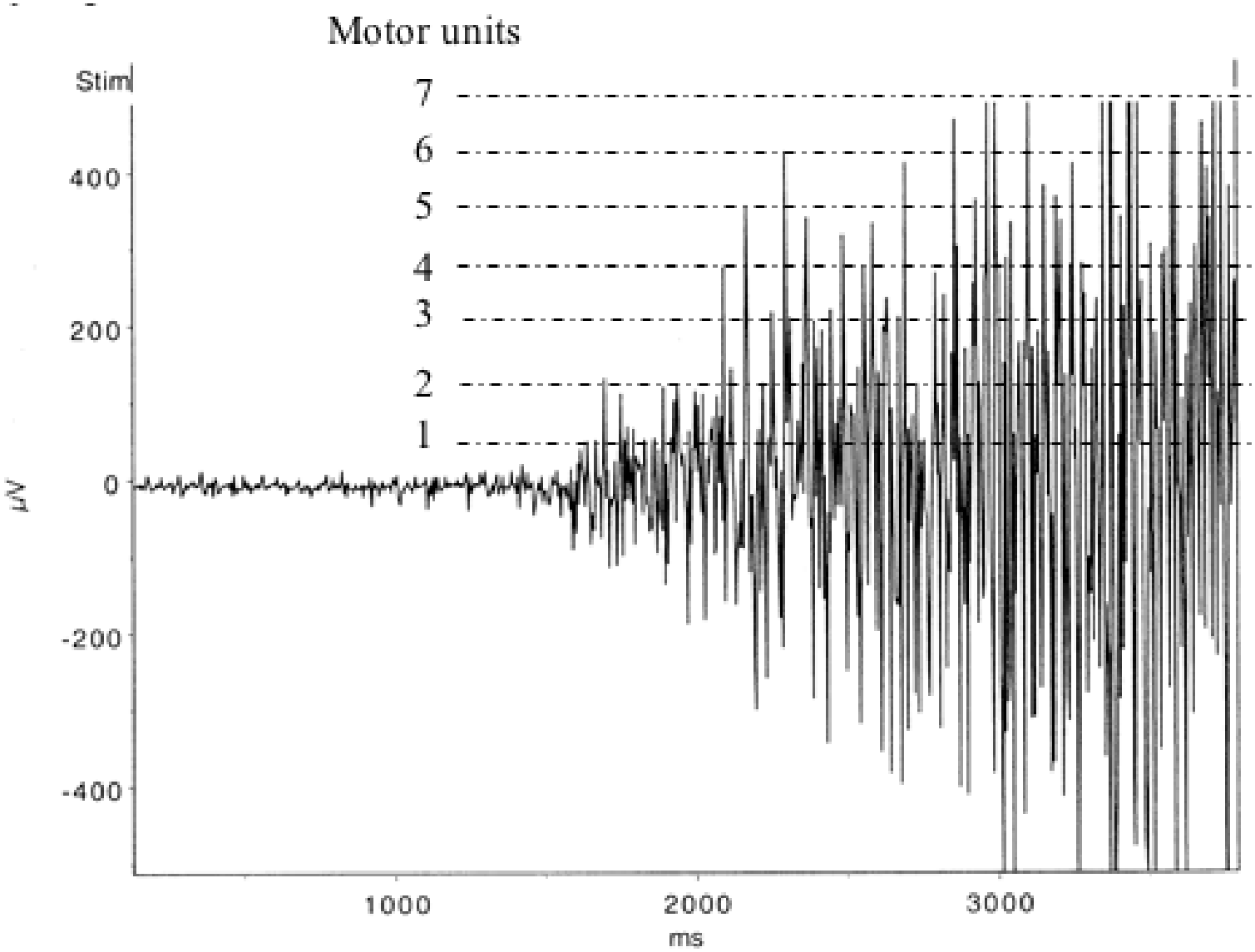
EMG (Electro-myo-graph)

An EMG measures the electrical activity generated by a muscle fiber/motor unit during its contraction.



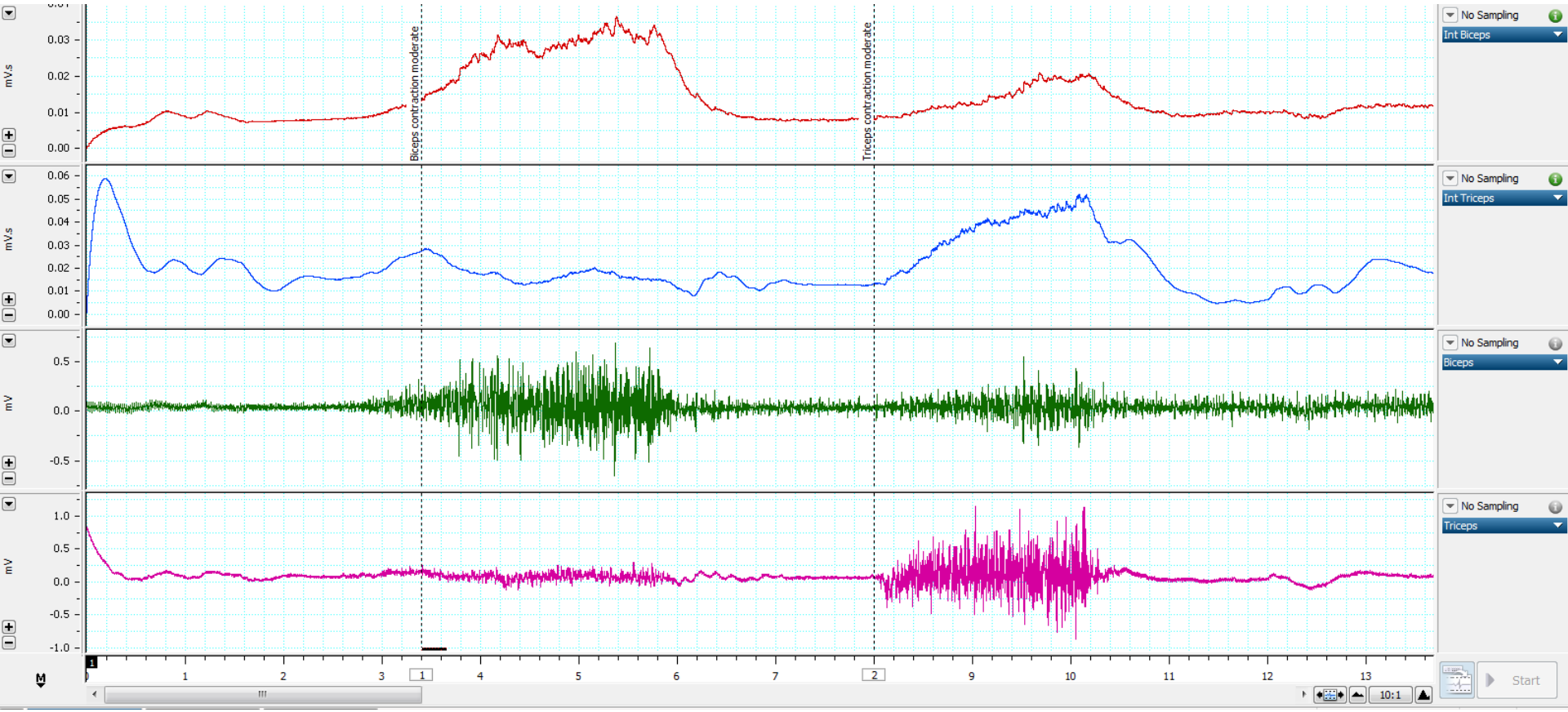
This electrical activity is displayed on the computer screen as a spike (change of voltage in the circuit).

Each spike is the combined electrical output of all motor units firing at that particular time.

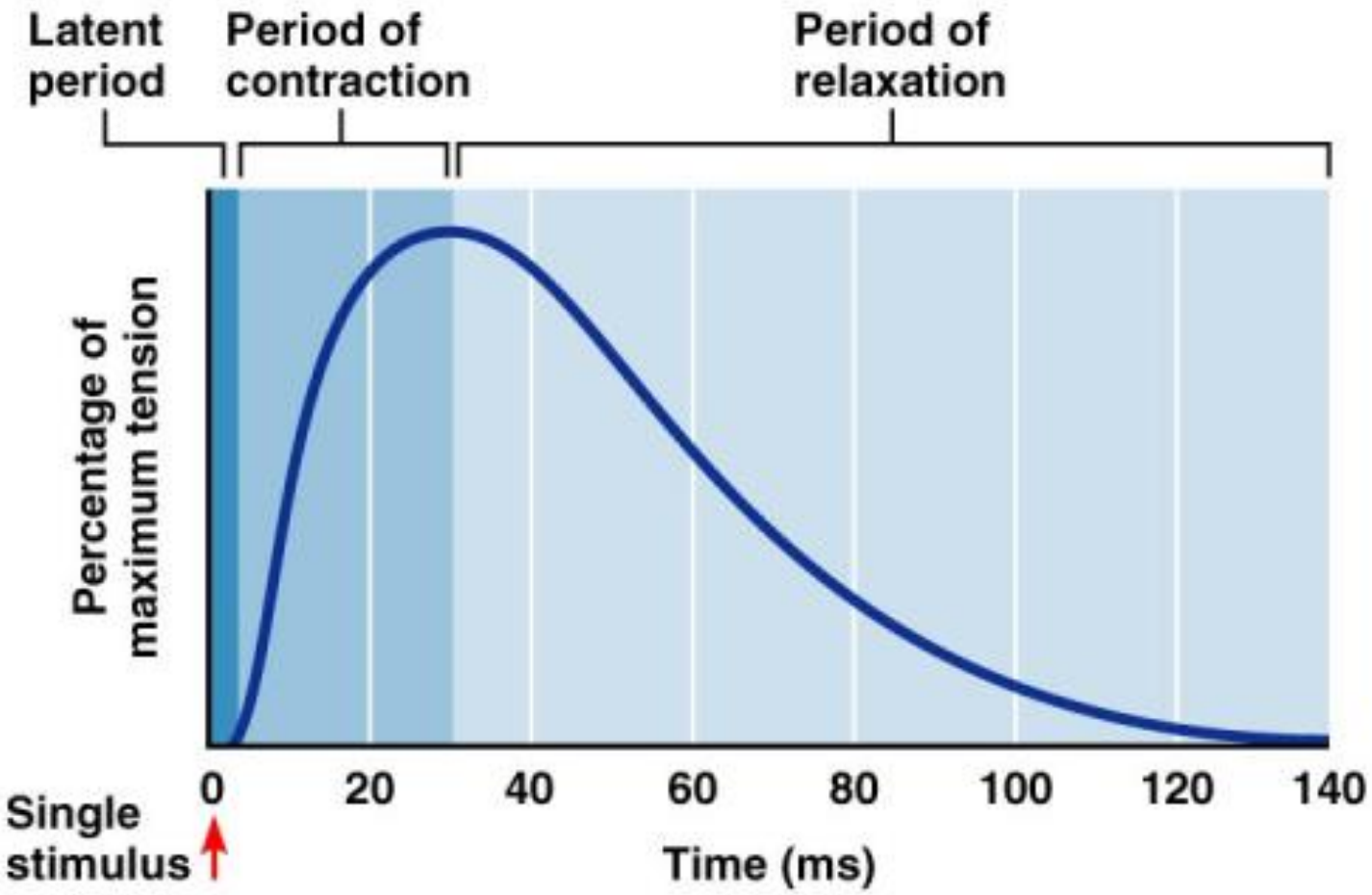


Size Principle: smaller motor units are recruited before larger ones.

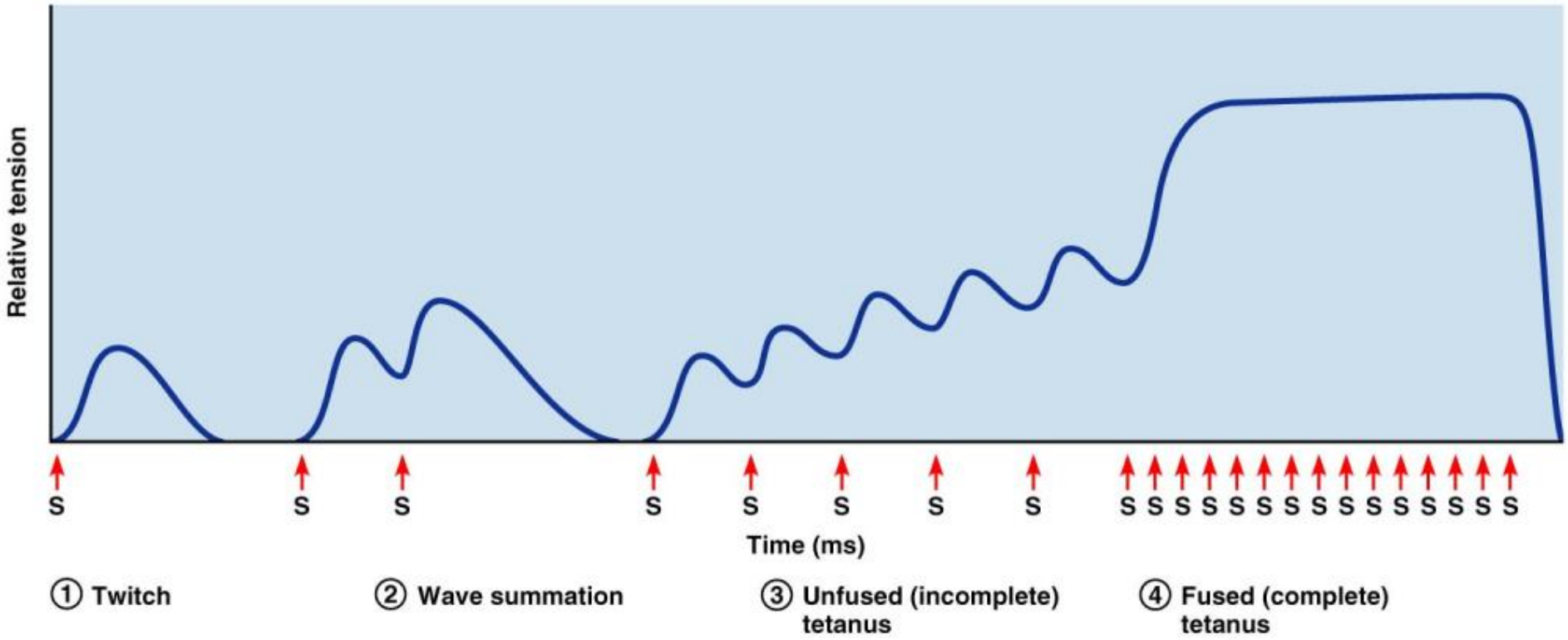
Voluntary EMG



Phases of a muscle contraction



Frequency Modulation



Voluntary EMG