

Isolated Nerve Muscle Experiment

Dr. Simge Aykan

December 2019

Preparation of Frog Experimental Model

- Removal of the brain by cutting of the upper jaw from the caudal border of the tympanic membrane
- Destruction of the spinal cord by pithing

Insensitive to pain and reflexes are destroyed

Preparation of Frog Experimental Model

- Removal of skin around the leg
- Separation of calcaneal tendon and gastrocnemius muscle
- Attachment to the recording system

Determining the Direct Stimulus Threshold

- The muscle is directly stimulated
- Stimulator's voltage level is gradually increased

Note the voltage that you see the first contraction

Threshold stimulus: The voltage at which the first perceptible contractile response is obtained.

Determining the Indirect Stimulus Threshold and Observing Graded Muscle Response to Increased Stimulus Intensity

- Place the electrodes under the sciatic nerve
- Increase the stimulator's voltage gradually

Note the voltage that you see the first contraction (threshold voltage)

- Increase the stimulator's voltage level from threshold to 0,48 volts and observe the muscles response

Note the maximal stimulus

Maximal stimulus: The voltage that produced the highest spike

- Why there is a difference between direct and indirect stimulation threshold?
- Why there is no increase at the tension after the maximal stimulus?

Wave Summation and Tetanus

- Switch the stimulator's the frequency display to the “Continuous pulse”
- Set the pulse rate to 1 Hz and increase by 1 Hz approximately every seconds. Incomplete and complete tetanus was recorded
- Observe the wave summation and tetanus

Post-tetanic potentiation

- Higher single twitch response after tetanization of the muscle
- Temporary
- Mechanism is not clear
 - Phosphorylation of myosin light chains?

Muscle Fatigue

- Reversible physiological condition in which a muscle is unable to contract even though it is being stimulated
- Can occur with short-duration maximal contraction or long-duration submaximal contraction
- Mechanism is not completely understood, could be several factors affecting excitation-contraction coupling
 - buildup of inorganic phosphate (Pi) from ATP and creatine phosphate breakdown, which may block calcium release from the sarcoplasmic reticulum
 - potassium accumulation in the T tubules may block calcium release from the SR and alter the membrane potential of the muscle fiber