

Muscle Physiology Case Studies

Name: _____

Date: _____ Per: _____

*Read through each case and **completely** answer questions on a separate sheet of paper*

Muscle Physiology Case Studies - Case 1

A 17-year-old was working vigorously with a summer construction crew building a new greenhouse. In the intense heat of the day, she began to experience severe pain in the muscles of her limbs and carpopedal spasms. The cramping made her muscles feel like hard knots. The foreman of the crew instructed the young lady to drink some salt water and rest a while.

1. What is the cause of the cramping?
2. Describe carpopedal spasms.
3. Why is the ingestion of salt and water beneficial?

Muscle Physiology Case Studies - Case 2

Parents of a 3-year-old noticed that their daughter was walking "on her toes," had a waddling gait, fell frequently and had difficulty getting up again, and was not able to run because of the difficulty in raising her knees. At age five, there was progressive muscular weakness and muscle wasting. Weakness of the trunk muscles led to increased lordosis and a protuberant abdomen. At age nine, she was confined to a wheelchair. Contractures appeared, first in the feet, as the gastrocnemius muscles tightened.

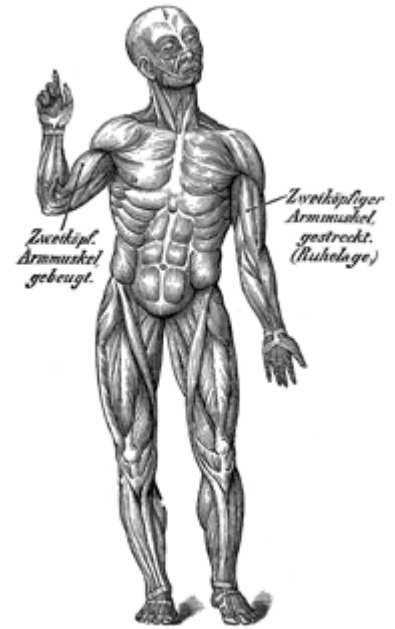
4. This hereditary X-linked recessive disease characterized by progressive muscular weakness is _____.

5. What does dystrophy mean? Why is this term used to describe this case?
6. What muscles would be involved in walking "on the toes"? Which muscles are "weakening"?
7. Name the trunk muscles that weaken in certain cases of lordosis and abdominal protuberance.

Muscle Physiology Case Studies - Case 3

Prior to intubation for a surgical procedure, the anesthesiologist administered a single dose of the neuromuscular blocking agent, succinylcholine, to a 23-year-old female to provide muscular relaxation during surgery and to facilitate the insertion of the endotracheal tube. Following this, the inhalation anesthetic was administered and the surgical procedure completed.

8. Beginning with depolarization at the neuromuscular junction, describe the normal sequence of events which lead to muscle contraction
9. What prevents acetylcholine (ACh) from accumulating in the neuromuscular junction and causing a sustained contraction in a normal individual?
10. Succinylcholine acts as a depolarizing agent that prevents repolarization of the nerve. Therefore,



no further ACh is released until the drug is cleared. Name another site within the neuromuscular junction that might be affected to prevent muscle contraction. (Hint: curare acts by this mechanism.)

Muscle Physiology Case Studies - Case 4

Sarah, a twenty-one year old student at Iowa State University had spent Thanksgiving day with relatives at her grandparent's farm. During her drive back to campus on Friday morning her vision became blurry, and she was forced to pull over to the side of the road. As she sat in her car, her vision worsened. She opened the car hood in hope of attracting aid and tried to relax. In a short time, a highway patrol officer pulled over and approached Sarah. By this time, Sarah was having trouble swallowing and speaking clearly. The officer helped Sarah to his car and rushed her to the emergency room at a nearby hospital.

In the ER, Sarah was able to describe her symptoms to a physician. The physician made note of what Sarah had eaten during the last 24 hours and was especially interested in the fact that Sarah's grandmother canned all of her own vegetables. The physician observed that Sarah's breathing was becoming labored. She ordered Sarah's blood sampled, her gastrointestinal tract pumped, and a mechanical respirator prepared for use. Fearing that Sarah suffered from a case of botulism, she asked that Sarah's grandparents be contacted and samples of the Thanksgiving meal retained, if possible, and sent to a local clinic for analysis.



Case Background

Botulism is a form of food poisoning caused by exposure to a toxin called botulin. Botulin is produced by *Clostridium botulinum*, a spore forming, anaerobic bacterium that can contaminate food. Whereas commercially canned foods are specifically heated to destroy botulinum spores, home canned foods that are not boiled for a half-hour prior to canning may be contaminated.

The botulin toxin binds to the presynaptic membranes at motor end plates and prevents the release of acetylcholine from motor neurons, thereby preventing synaptic transmission and muscle contraction. Treatment includes bed rest, and if required, mechanical respiration, and/or administration of drugs to promote acetylcholine release. The mortality rate for botulism is about 15 percent and the cause of death is suffocation.

Questions

11. What two organ systems are primarily affected by botulin intoxication?
12. List the normal sequence of events that occur during synaptic transmission at a motor end plate.
13. What were Sarah's symptoms and how do they relate to the blockage of acetylcholine release from motor neuron synaptic terminals?
14. What is the significance of *Clostridium botulinum* being anaerobic?
15. Why didn't the physician prescribe an antibiotic?