

It's Like Pulling Teeth: A Case Study in Physiology

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Part I—The Hospital

At last the day had come. Mr. Thompson was having his wisdom teeth removed. He was tired of the aches and pains and the sight of his *puffy* face in the mirror every morning. He felt helpless, lying on the *gurney* watching the ceiling lights whiz by as he was being wheeled to surgery.

Mr. Thompson had selected this particular oral surgeon because of the sign outside his practice that read: “We cater to cowards.” But the surgeon still hadn’t seemed to understand Mr. Thompson’s fear of dental procedures; he had wanted to use a local anesthetic. Fortunately, the anesthesiologist was sympathetic to his request for a general anesthetic.

As the mask came over Mr. Thompson’s face, he felt so alone. It reminded him of how he felt as a boy, in the orphanage. Then the halothane started to take effect and he went *under*.

As surgery was about to begin, Mr. Thompson started twitching. The anesthesiologist saw Mr. Thompson’s heart rate increase, his muscle contractions become strong and widespread throughout his body, and the patient began to sweat profusely. As Mr. Thompson’s temperature quickly increased, the anesthesiologist injected a solution into the IV drip. Then Mr. Thompson went limp and all that could be heard was the sound of oxygen rushing through the ventilator, assisting Mr. Thompson’s breathing.

“Next time we do as I say and we use a local,” muttered the angry surgeon as he glared at Mr. Thompson.

Questions

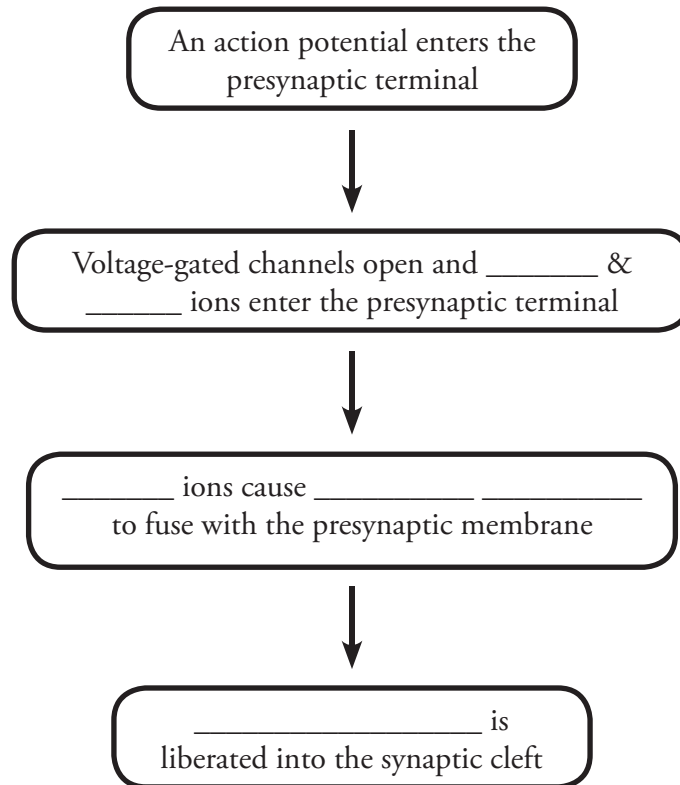
1. How is heat generated in the body?
2. In this case, where halothane-induced heat production quickly elevated Mr. Thompson’s body temperature, where do you think most of the heat is generated?
3. What chemical reaction is responsible for generating the huge amount of heat?
4. Which processes use ATP as an energy source in skeletal muscle?



Part II—The Motor Neuron

Halothane clearly had an effect on Mr. Thompson's voluntary motor system. During this case study you will determine the location of this effect by looking at the normal function of motor nerves, chemical synapses, and the muscles. You will determine how halothane *could* act to produce strong and prolonged muscle contractions.

Complete the following flow diagram by filling in the blanks:

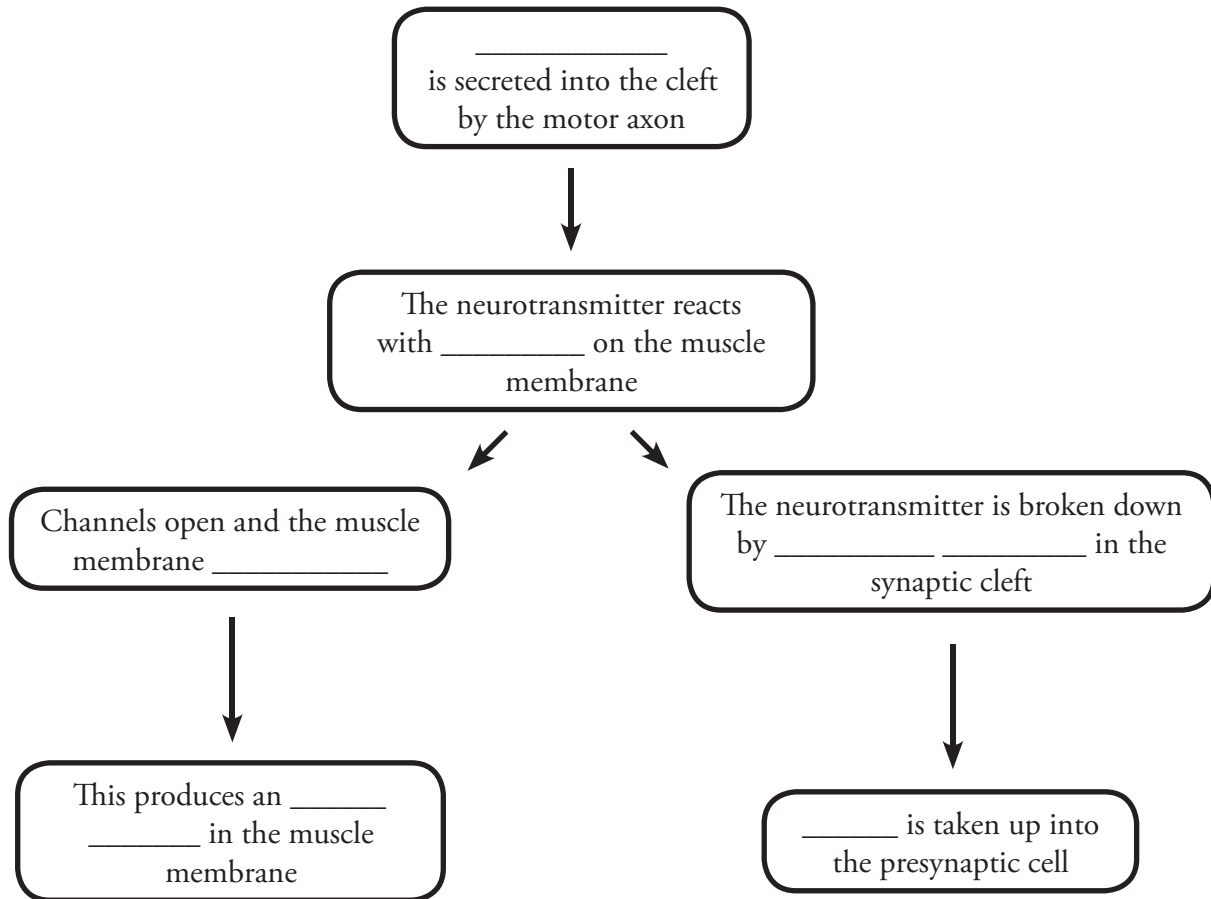


Discuss each of the four stages to see whether halothane *could* alter motor neuron function to produce strong muscle contractions.



Part III—The Chemical Synapse

Halothane does not change motor neuron function; perhaps it affected the neuromuscular junction. Complete the following flow diagram by filling in the blanks:

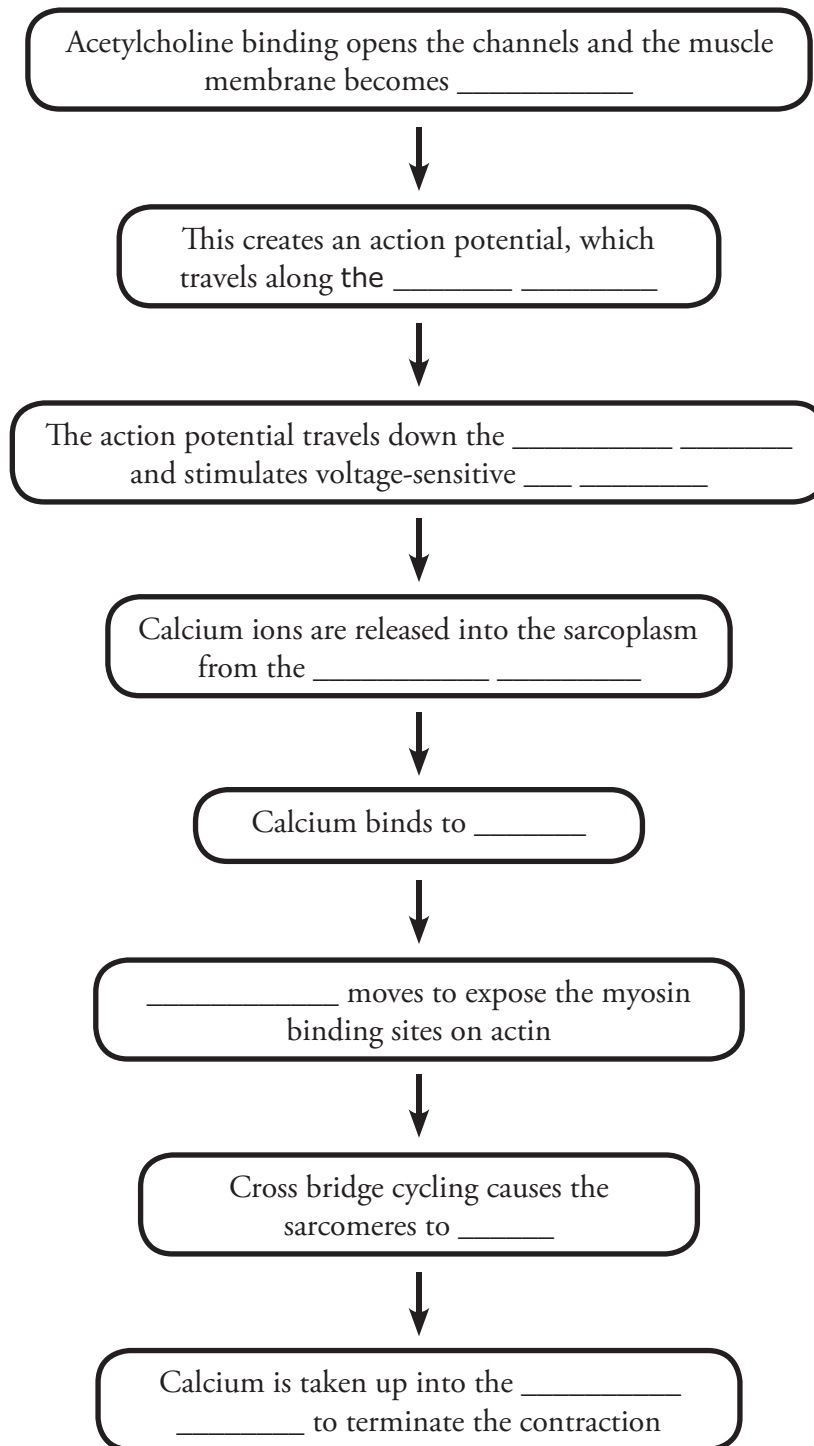


Discuss each of the above six stages to see whether halothane *could* alter synaptic function and cause a **single** action potential in a motor axon to produce strong and prolonged contractions of the muscle fibers it supplies.



Part IV—The Muscle

Halothane does not change the synaptic function; perhaps it affected the muscles. Complete the flow diagram below by filling in the blanks:



Discuss each of the eight stages to see whether halothane could alter muscle function so that a single action potential produces a strong and prolonged muscle contraction.



Part V—Hypothesis

Look again at the three flow diagrams. Within your group decide which step (or steps) are the mostly likely to be affected by halothane. Construct a hypothesis within your group and state how the *antidote* works.

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