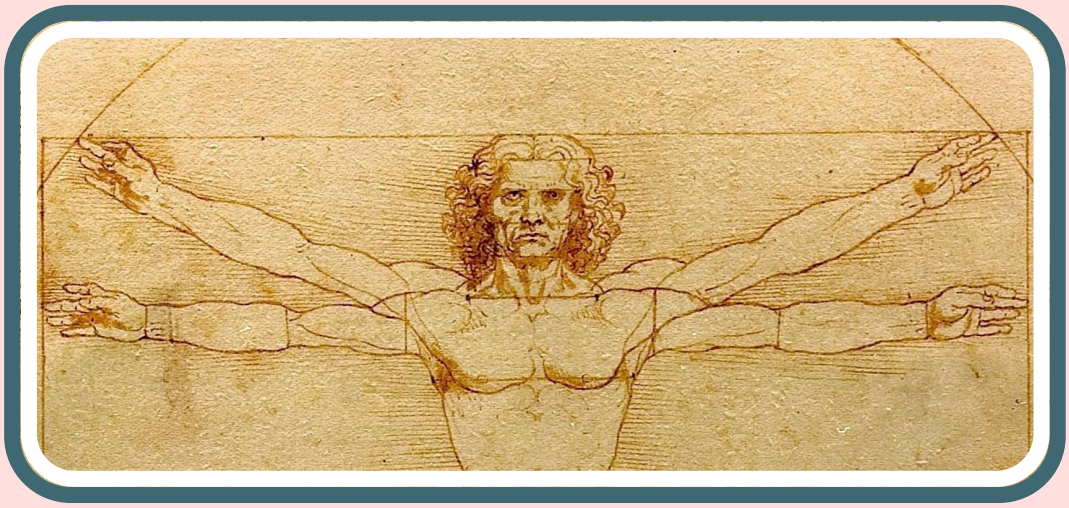
STEM Sims™

Physiology



Physiology

Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Muscles allow us to walk, run, sit, stand, breathe, and do just about everything else. Without muscles, life would not be possible. Take the following brief quiz to see how much you already know about muscles. See the bottom of page 4 to check your answers.

1. Which muscle in the human body can exert the *most* pressure?
   a. masseter (jaw)
   b. gluteus maximus (rear)
   c. quadricep (thigh)
   d. bicep (arm)

2. Which muscle in the human body is the *largest by volume*?
   a. masseter (jaw)
   b. gluteus maximus (rear)
   c. quadricep (thigh)
   d. bicep (arm)

3. Which muscle in the human body is the *largest by mass*?
   a. masseter (jaw)
   b. gluteus maximus (rear)
   c. quadricep (thigh)
   d. bicep (arm)

4. About how many muscles are in the typical human body?
   a. 100
   b. 220
   c. 450
   d. 600

5. About how many muscles are in the typical human hand?
   a. 3
   b. 13
   c. 23
   d. 30

Hand Tricks

The movement of body parts is made possible by the combination of muscles, tendons, ligaments, and the skeleton. The palm and the forearm contain the muscles that allow the fingers of the hand to bend. Tendons connect these muscles to the bones of the hand to provide the hand's variety of motions. Get started now investigating the wonders of the hand.

Materials Required

None

Procedure

Hand Trick #1

1. Hold your left hand straight out in front of your body with your arm bent at 90 degrees at your elbow.
2. Place your hand in the palm down position.
3. Fully extent the all the fingers of your hand away from your body. Allow a gap between each finger so the fingers do *not* touch each other.
4. Holding your hand in this position and with the other fingers steady, curl the pinkie of your left hand into a fist position.
5. Describe in Table 1 if you were successful and what happened to your hand when you made this motion.

Hand Trick #2

1. Curl only the middle finger of your right hand.
2. Place your right hand with the middle finger curled on a flat surface, such as a tabletop.
3. The fingertips of the other fingers must rest on the surface as well as the knuckle of the middle finger.
4. With your hand in this position, try to lift the ring finger of your right hand off the surface without moving any other finger on your hand.
5. Describe in Table 1 what happened when you tried to complete this action.

Table 1. Observations

Tricks	Observations
Hand Trick #1	
Hand Trick #2	

Questions

1. Propose a reason for the results of Hand Trick #1.

2. Propose a reason for the results of Hand Trick #2.

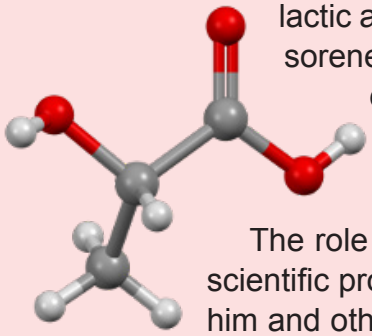
Physiology

Feel the Burn!

One of the most common misconceptions about working out is that the burning sensation and soreness post-workout is due to a lactic acid buildup in the muscle tissue due to your muscles experiencing anaeribic conditions. This condition, called acidosis is caused by the body producing energy without having an adequate oxygen supply to the muscles. This explanation is based on investigations conducted by Dr. Otto Meyerhof during the early 1920's.

Meyerhof experimented with frogs and showed that lactic acid was formed in the muscles of the frog legs when muscle glycogen during anaerobic conditions. This led to the theory that muscle fatigue is caused by a buildup of lactic acid, which further inhibits the muscles from contracting and ultimately leads to muscle soreness.

Newer research has found that lactic acid is actually an important source of fuel for muscles and its presence can enhance rather than inhibit the ability of muscles to contract. Additionally, the cause of muscle soreness post-workout being caused by the presence of higher levels of lactic acid was also debunked in the 1980's. Researchers found that muscle soreness was instead caused by microscopic trauma of the muscle tissue during intense exercise. This tearing of the muscle tissue leads to inflamation of the tissue, and the pain and soreness so many people feel after a particularly hard workout.



The role of lactic acid in muscle fatigue also highlights the importance of the scientific process. Even though Meyerhof's work on lactic acid and muscles won him and others the Nobel Prize, the results of his studies served as a temporary explanation of muscle fatigue until others extened his research and found other, better explanations for why soreness occurs after vigoroous exercise. Science is viewed as a continuous process of refining ideas based on new observations and information.

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Answers: Page 2 Answers: 1) a, 2) b, 3) c, 4) d, 5) d. **Page 3 Answers:** Hand Tricks 1) About 67% of people cannot bend the pinkie without also bending the ring finger. This is due to both fingers being connected to the same tendon. 2) For most people, since the middle and ring fingers are connected to the same tendon, they cannot lift the ring finger. A very small percentage of the population has independent tendons to each finger that allows this action.