The Mug Test

How four tissue types work together in your hand

HS-AP1-3 "Compare and contrast the relationships among the various tissue types as well as the molecular and cellular composition of these tissues."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline a cell or molecule named for each tissue type, circle what each tissue does, and number two places where one tissue depends on another.

What Happens When You Hold a Mug?

1. When you lift a warm ceramic mug, your fingertips do more than hold its weight. The outer layer of skin is epithelial tissue, made of tightly packed keratinocytes. These cells produce keratin, a protein that helps the surface resist wear. Below the epithelium, the dermis is connective tissue. Its fibroblasts make collagen fibers for strength and elastin fibers that let skin stretch and spring back. Unlike the crowded cells at the surface, dermal cells sit among abundant extracellular fibers and other material. Small blood vessels in the dermis deliver nutrients that diffuse to the epithelium, which has no blood vessels of its own.

2. A mug that is too hot activates temperature-sensitive endings of sensory neurons in the skin. These neurons belong to nervous tissue; they carry electrical signals toward the spinal cord and brain. Neurons work alongside support cells that protect and maintain them. When you decide to set the mug down, signals travel to skeletal muscle in the forearm and hand. Muscle fibers are long cells packed with actin and myosin proteins. As those proteins slide past each other, the fibers shorten and pull. Nervous tissue rapidly communicates information, while muscle tissue turns that information into force.

3. Force reaches the finger bones through tendons, a kind of dense connective tissue rich in parallel collagen fibers. A tendon is not a muscle: its fibers transmit a muscle's pull rather than actively shorten. As your fingers release the mug, epithelial tissue still shields the fingertip, and the flexible dermis supports the layers above it. These tissues share a task but differ in structure. The epithelium has closely joined cells and little space between them; the dermis and tendon have more extracellular material. Neurons specialize in signaling, and muscle fibers specialize in contraction. Their different molecules and cells make coordinated movement possible.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the cells and material between cells in the epithelium and dermis. How does the dermis supply something the epithelium needs?

2. When the mug is too hot, how do nervous tissue and muscle tissue perform different but connected jobs? Name a cell or molecule involved in each.

3. A tendon and a muscle both help move a finger. Compare what each is made of and how each contributes to movement.

4. The dermis and a tendon are both connective tissue. How do their molecules and jobs differ?

3 YOUR TURN

Your own words

Imagine pulling a stuck zipper on your jacket. In five sentences, explain how epithelial, connective, nervous, and muscle tissues work together, comparing the cells or molecules of at least two tissues.

The Mug Test

PART 1 · READ AND MARK

Underline a cell or molecule named for each tissue type, circle what each tissue does, and number two places where one tissue depends on another. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare the cells and material between cells in the epithelium and dermis. How does the dermis supply something the epithelium needs?	**The epithelium has tightly packed keratinocytes and little space between cells. The dermis has fibroblasts among abundant extracellular material, and its blood vessels supply nutrients that diffuse to the epithelium.**
2	When the mug is too hot, how do nervous tissue and muscle tissue perform different but connected jobs? Name a cell or molecule involved in each.	**Sensory neurons carry signals about heat toward the spinal cord and brain. Signals then reach muscle fibers, where actin and myosin slide to produce a pull.**
3	A tendon and a muscle both help move a finger. Compare what each is made of and how each contributes to movement.	**A tendon is connective tissue rich in parallel collagen fibers that transmit a pull to bone. Muscle contains fibers packed with actin and myosin that slide to produce the pull.**
4	The dermis and a tendon are both connective tissue. How do their molecules and jobs differ?	**The dermis contains collagen for strength and elastin for stretch. A tendon is rich in parallel collagen fibers that transmit a muscle's pull.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

As I pull a stuck zipper, sensory neurons in my fingertip detect pressure and send signals toward my brain. My brain directs skeletal muscle fibers in my hand and forearm to contract as actin and myosin slide. Tendons carry the pull to my finger bones because their parallel collagen fibers resist tension. The dermis also contains collagen, but its elastin lets the skin stretch as I adjust my grip. Unlike the fiber-rich dermis and tendons, the epithelium has closely packed keratinocytes that produce keratin and protect my fingertip from rubbing against the zipper.

Accept accurate comparisons that connect tissue composition to function. For the open task, look for all four tissue types, an interaction among them, and a comparison of cells or molecules.