STUDENT GUIDE

Where do the bodies come from?

Our suppliers certify to us that the bodies in this Exhibition are those of people from China who died of natural causes with no known next of kin. Local plastination laboratories then received these specimens from medical schools throughout China. We do not know the identities and personal histories of the bodies.

What is Polymer Preservation?

Polymer Preservation, the process used to preserve the specimens for **BODIES...The Exhibition**, is a revolutionary technique in which human tissue is permanently preserved using liquid silicone rubber. This prevents the natural process of decay, making the specimens available to study for a very long time.

How does it work?

Anatomists treat a specimen with chemicals to temporarily halt the decaying process. Then they dissect it to expose important structures.

All of the bodily fluids are removed from the specimen and replaced with a liquid called acetone.

In a vacuum, the acetone is removed and slowly replaced with plastic.

Lastly, the plastic silicone polymer hardens the body parts. The end result is a dry, odorless, permanently preserved specimen containing no toxic chemicals. It retains the look of the original but functions as if it were rubber.

How long does it take to complete the preservation process?

Preparation time varies; a small organ may take only a week while a full body specimen may take up to one year to prepare.

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Complete these questions as you move through the Galleries.

- Some questions can be answered by reading the **signs and labels**, some will be answered by **looking at the specimens** themselves, and some will require you to use **context clues**.
- Don't forget to use the process of elimination, apply what you may have seen or learned earlier, and use a good dose of healthy **common sense**!
- If you get stuck, find a person in a lab coat with an "**Ask Me**" button.

SKELETAL GALLERY

1. What makes bones lighter and distributes force over a wide surface area?
a. Marrow
b. Spongy bone tissue
c. Compact bone tissue
d. Cartilage

2. The fontanelle is the soft spot on _____that will eventually harden.
a. an adult's skull
b. an infant's stomach
c. an infant's skull
d. None of the above

3. What is the difference in the total number of fetal bones and the total number of adult bones?
a. 94
b. 0
c. 4
d. 206

4. Which of these is an auditory ossicle?
a. Malleas
b. Anvil or Incus
c. Stapes
d. All of the above

5. Two bones found in the skull are the _____.
a. tarsus and metatarsal
b. scapula and clavicle
c. sphenoid and temporal
d. xiphoid and zygomatic

6. Examples of a ball and socket joint are your _____.
a. Shoulder and hip
b. Neck and spine
c. Elbow and knee
d. Toe and finger

7. Explain why infants have more bones than adults.

8. Describe the function of the auditory ossicles.

9. Name the three kinds of joints.

10. Describe the specific range of motion for the three kinds of joints.

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MUSCULAR GALLERY

1. The muscular system is attached to which other system with tendons and ligaments throughout the body?
a. Respiratory
b. Circulatory
c. Urinary
d. Skeletal

2. The tongue is made up of _____ muscles.
a. 2
b. 100
c. 16
d. 30

3. About how many muscles are there in the human body?
a. >600
b. <600
c. 1000
d. 60

4. What are the names of the types of muscle tissue?
a. Voluntary and involuntary
b. Cardiac, smooth, and skeletal
c. Motor, core, and dynamic
d. Supinator and pronator

5. What is the largest muscle in the body?
a. Heart
b. Gluteus maximus
c. Sartorius
d. None of the above

6. How many muscles control the movement of the hand?
a. One
b. About 40
c. About 20
d. About 10

7. When a muscle is not used and it grows smaller, that is called _____.
a. Muscular atrophy
b. Contraction
c. Teres major
d. Sternocleidomastoid

8. What is the difference between the supinator muscle and the pronator?

9. Where in the body are these kinds of muscles found?

10. Explain the difference and give examples of voluntary and involuntary muscles.

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NERVOUS SYSTEM GALLERY

1. The brain weighs _____ pounds.
a. 0.6
b. 3
c. 12.6
d. 6

2. Girls' brains account for 2.5% of their body weight. Boys' brains account for ____%.
a. 3
b. 2.5
c. 2
d. 1.5

3. What is the word for a place on the body where there is a dense network of peripheral nerves that come together in one spot?
a. Plexus
b. Cerebellum
c. Cranial
d. Autonomic

4. What is the longest nerve in the body?
a. Spinal column
b. Femur
c. Synapse
d. Sciatic

5. The function of the cerebellum is to control _____.
a. equilibrium and muscular movement
b. vital body functions, such as breathing and digestion
c. connections between the right and left hemispheres
d. All of the above

6. What is Dura Mater?
a. Autonomic nerves that regulate the body's fight response.
b. Outer covering of the brain and spinal column.
c. Area of the lumbosacral plexus.
d. The anterior root of the spinal nerve.

7. What protects the spinal cord?
a. Vagus nerve
b. Medulla oblongata and cerebellum
c. Skull and vertebral column.
d. Meninges and vertebrae

8. Describe Carpal Tunnel Syndrome.

9. Describe the "pathway" used to innervate your pinky finger.

10. What causes a stroke? Describe the brain specimen that has had the stroke.

STUDENT GUIDE

CIRCULATORY SYSTEM GALLERY

1. There are _____ miles of blood vessels in the adult human body.
a. 10
b. 100
c. 1,000
d. 100,000

2. When you feel your pulse, you are feeling a/an _____.
a. vein
b. artery
c. ventricle
d. alveolus

3. No cell in the body lies more than a few _____ from one of the body's blood vessels.
a. inches
b. centimeters
c. millimeters
d. micrometers

4. What happens in your circulatory system once every minute?
a. Every drop of blood passes through the heart.
b. Every platelet becomes a white blood cell
c. Filaments of fibrin enmesh red blood cells as part of the clotting process.
d. None of the above.

5. What prevents blood from flowing backwards?
a. Veins have valves
b. The dorsal venous arches
c. Lymphocytes
d. Ventricles

6. Of the 100% of the body's blood supply, how much is required by the brain?
a. 0%
b. 2%
c. 20%
d. 100%

7. Your heart is about the same size as your _____.
a. head
b. fist
c. tongue
d. foot

8. Describe the corrosion casting process used to prepare these specific specimens.

9. What is the difference between your blood vessels that appear to be red and those that appear to be blue?

10. What area of the head and skull has the greatest concentration of vessels? Why do you think this is the case?

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RESPIRATORY SYSTEM GALLERY

1. A pack of cigarettes takes _____ off your life.
a. 3 hours and 40 minutes
b. 7 minutes and 20 seconds
c. 2 years
d. no time

2. What are the small ends of the bronchial tree that branch out like clusters in direct contact with capillary walls of the pulmonary veins?
a. Diaphragm
b. Lobes
c. Alveoli
d. Trachea

3. What organ, featured in this gallery, is the only organ in the body that can float on water?
a. the spleen
b. the heart
c. the lungs
d. the kidneys

4. How many breaths do we take every minute?
a. About 40 for babies and 15 for adults
b. About 50
c. About 40 for adults and 15 for babies
d. About 10

5. What is the connection between the respiratory and circulatory systems?
a. Oxygen from the respiratory system is absorbed into the bloodstream.
b. The blood carries the oxygen to every organ in the body.
c. Both a. and b.
d. None of the above.

6. What is exchanged for oxygen in the lungs?
a. Carbon monoxide
b. Water
c. Pulmonary arteries
d. Carbon dioxide

7. What part of the respiratory system, which you may have also seen in another gallery, pushes and pulls the lungs to draw air in and out?
a. Superior vena cava
b. Thoracic cavity
c. Bronchial tree
d. Diaphragm

8. Compare the quality of the two sets of lungs found in this gallery.

9. What do you think this statement, made over 4000 years ago by the Chinese physician, Hwang Ti, means? "The heart is the king and the lungs are its ministers."

10. Why do you think the bronchial tree segments are functionally separate regions in each lung?

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DIGESTIVE SYSTEM GALLERY

1. What large organ is also the second heaviest organ of the body (not including the skin)?
a. Stomach
b. Lungs
c. Brain
d. Liver

2. How long does it take for food to be absorbed in your small intestine?
a. 4–8 seconds
b. 2–4 hours
c. 3–5 hours
d. 10 hours-several days

3. What causes cirrhosis of the liver?
a. Improper diet
b. Alcohol
c. Drug abuse
d. All of the above

4. Where does the digestive tract begin?
a. Mouth
b. Esophagus
c. Stomach
d. Colon

5. What happens to the rugae when the stomach fills with food?
a. The pancreas secretes juices into the gallbladder.
b. They expand to create more surface area.
c. It produces bile.
d. Arteries harden.

6. What is the longest organ in the digestive system?
a. Esophagus
b. Appendix
c. Large intestine
d. Small intestine

7. What "extra" piece attached to the large intestine serves no discernible purpose and can be removed?
a. Spleen
b. Appendix
c. Duodenum
d. Gall bladder

8. How do you know when we have eaten enough? How does your stomach feel when you are full?

9. How is the surface area of the small intestine increased?

10. What is the "recipe" for digestion?

STUDENT GUIDE

REPRODUCTIVE AND URINARY GALLERY

1. How many eggs, or ova, are contained in the ovaries?
a. More than 250,000
b. About 2,500
c. Less than 250
d. 25

2. What is the largest human cell?
a. The chromosome
b. An egg
c. A sperm
d. The nucleus

3. Which organ is found only in men and not in women?
a. kidney
b. uterus
c. prostate
d. bladder

4. What procedure can detect breast cancer in its early stages when highly treatable?
a. Mammogram
b. Pelvic cavity
c. Lymphatic system
d. None of the above

5. What are the parts of the urinary system?
a. Ovary, uterine tubes, and kidneys
b. Small intestine, kidneys, and urethra
c. Ureter, bladder, and prostate
d. Kidney, ureters, and bladder

6. What is the smallest human cell?
a. An egg
b. The nucleus
c. The chromosome
d. A sperm

7. How much blood per minute do your kidneys filter? Make a comparison to an everyday object of the same size. (For example, is it like a gallon of milk? A can of soda?)

8. Describe how the urine gets from the kidneys to the bladder.

9. What is the function of the prostate gland?

10. What is the function of the fallopian tubes?

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FETAL GALLERY

This assignment is optional depending on your level of sensitivity to this part of the Exhibition. Please write 1–2 paragraphs on your reaction to this gallery.

TREATED BODY GALLERY

Now that you have seen many examples of the Polymer Preservation Process, explain it in your own words.

Explain how the specimen with sliced sections demonstrates an MRI.

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DISCUSSION AND REFLECTION

Take some time to record your reflections about your experience at BODIES...The Exhibition. You should fill at least the back of this page or use separate paper.

1. What was your first reaction when you entered the Exhibition? How did your reactions change by the time you got to the end, if they changed at all?

2. How did the bodies look different from what you've seen in textbooks?

3. Which gallery did you react to the strongest? Which gallery was most memorable? Why?

4. List 5 things you saw that you learned about in class.

5. List 5 things you saw that you never heard of before and found interesting.

6. What are 3 questions you still have about the human body and want answered when we return to class?

7. Would you recommend this Exhibition to other people? Why or why not?

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Skeletal

1. b 2. c 3. a 4. d 5. c 6. a
7. The skull bones, among others, fuse with age.
8. malleus = hammer, incus = anvil, stapes = stirrup; connected by the smallest movable joints in the body, these bones transfer sound vibrations from the surface of the eardrum to the inner ear
9. hinge, ball & socket, pivot
10. hinge allows the joint to swing in 2 directions; ball & socket allows some

Muscular

1. d 2. c 3. a 4. b 5. b 6. c 7. a
8. They are opposite, or antagonistic, because they work in opposite motions.
9. In the forearm, the supinator helps you rotate and turn your palm upward; the pronator lets you turn your palm down. (also in the foot)
10. voluntary: movements under your control, quadriceps; involuntary: muscles that work without any direction from you, heart

Nervous

1. b 2. c 3. a 4. d 5. a 6. b 7. d
8. numbness and pain in the thumb and middle finger, occurs when tendons become inflamed and press on the median nerve where it passes though the carpal tunnel to the wrist
9. brain to spinal cord through brachial plexus to ulnar nerve to little finger
10. blockage or rupture in one or more blood vessels, blood supply to the brain is interrupted' stroke brain has black areas

Circulatory

1. d 2. b 3. d 4. a 5. a 6. c 7. b
8. Blood vessels are injected with a colored polymer, which then hardens. The remaining body tissues are then chemically removed to reveal the matrix that transports blood.
9. blue for veins, red for arteries
10. face, eyes/nose/mouth

Respiratory

1. a 2. c 3. c 4. a 5. c 6. d 7. d
8. healthy, pinkish white lung vs. smokers black lungs
9. The lungs serve the heart by bringing it oxygen, like the ministers served the king. The lungs also surround the heart.
10. It is nature's way of ensuring that breathing will continue if other parts of the lung become damaged.

Digestive

1. d 2. c 3. d 4. a 5. b 6. d 7. b
8. You feel "full". Your stomach feels stretched and tight. Nerve receptors in the stomach send a message to the brain telling it that the rugae are already stretched out far enough.
9. with villi (or microvilli)
10. Ingest, chew (10–30 times), swallow (4 seconds), churn (2–4 hours), absorb (3–5 hours), compact (10 hours–several days), eliminate

Reproductive & Urinary

1. a 2. b 3. c 4. a 5. d 6. d
7. about 2 liters of blood, or 3 pints; about the size of a big soda bottle
8. Urine travels by muscular contractions through the ureters one drop at a time to the bladder where it is stored.
9. supplies semen with 25% of its fluid—mainly an alkaline solution that neutralizes the vagina's acidity, allowing the sperm to live
10. transports egg cells from the ovaries to the uterus

Treated Body

Preservation Process:

1. the human specimen is temporarily preserved to stop decay
2. the specimen is dissected to feature specific systems and structures
3. the dissection is immersed in acetone to evacuate all body water
4. dehydrated, the specimen is placed in a silicone polymer bath and sealed in a vacuum chamber
5. under vacuum, the acetone leaves the body in gas form, replaced by silicone polymer
6. the silicone polymer hardens in curing
7. the permanently preserved specimen is ready for study

MRI:

Explanation should include concept of how magnetic resonance allows the body to be seen in "layers."