BODIES

THE EXHIBITION

TEACHER'S GUIDE

Grades K - 2

Teacher's Guide

Grades K - 2

BODIES...THE EXHIBITION

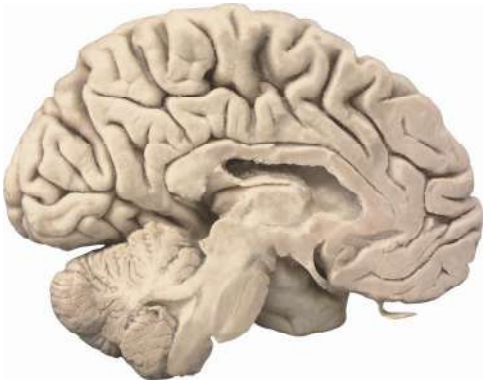

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Table of Contents

INTRODUCTION

In BODIES...THE EXHIBITION, you will see 21 bodies dissected to show various systems throughout nine galleries. You will also see more than 250 individual organs or parts - some healthy, some diseased. You will observe first-hand the effect that disease and unhealthy life choices have on the body – what happens to the lungs, for example, when people smoke. You will understand how positively *amazing* the body is – how the pulleys, fulcrums and levers we know as muscles, joints and bones let us function continuously without even thinking about it.

BODIES...THE EXHIBITION celebrates the human body and its inter-related systems and functions. By learning how the body works, we believe you can better care for your body and keep it healthy. By studying the systems of the body, you will come away with a new appreciation for life.

BODIES...THE EXHIBITION provides an unprecedented opportunity for learning human anatomy, physiology, and chemistry. BODIES ...THE EXHIBITION enables you and your students to speak with ease about the body, dispelling some preconceived ideas and fears.

This Teacher's Guide is divided into two sections and applies to academic content across the curriculum. First, you will find the Guide to Student Learning with experiential activities aligned to both National Academic Standards and Washington State Academic Content Standards. Next is the Guide to Exhibition Galleries, a road map to follow when you visit the exhibition with your students.

THE POLYMER PRESERVATION PROCESS

To help you see what a body really looks like on the inside, this exhibition uses real human bodies that have been preserved so they do not decay.

A human specimen is first preserved according to standard mortuary science. The specimen is then dissected to show whatever it is that someone wants to show. Once dissected, the specimen is immersed in acetone, which eliminates all body water. The specimen is then placed in a large bath of silicone, or polymer, and sealed in a vacuum chamber. Under vacuum, acetone leaves the body in the form of gas and the polymer replaces it, entering each cell and body tissue. A catalyst is then applied to the specimen, hardening it and completing the process.

This method of preservation creates a specimen that will not decay. This offers thousands of unique teaching possibilities for educators at all levels, including medical professionals, archeologists and other scientists.

PREPARING TO VISIT THE EXHIBITION

The setting of this exhibition lends itself to a quiet, respectful viewing of specimens. There are nine galleries – skeletal system, muscle system, nervous system, circulatory system, digestive system, reproductive system, an optional fetal gallery, and a gallery that shows how prosthetic joints and surgical tools are used to restore our health. The ninth gallery invites guests to write comments about their exhibition visit and to thumb through age appropriate books on anatomy.

BODIES...THE EXHIBITION allows students to learn about their own bodies and how to take better care of their health. The exhibition enables students to see and understand medical conditions friends and family members face in a whole new way by highlighting pressing health concerns including smoking, cancer, cirrhosis, arthritis and fractures.

Please prepare your students by discussing what they will be seeing - real, preserved specimens of the human body. The specimens have been dissected to specifically illustrate each body system and function. Male and female reproductive organs are visible in most of the full body specimens. *The fetal room is entirely optional. All embryos and fetuses died of natural causes in utero*.

The specimens are preserved through a process called Polymer Preservation. This process 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 for study for an indefinite period of time. Polymer Preservation provides a closer look at the skeletal, muscular, nervous, respiratory, digestive, urinary, reproductive, endocrine and circulatory systems, unveiling the mysteries of the human anatomy. Human specimens are used instead of models to study individual variations and uniqueness.

The exhibition offers a special children's audio tour, comprehensive Teacher's Guides for Grades K-2, 3-5, 6-8 and 9-12 plus a Post-Secondary Guide for advanced students.

SAMPLE PERMISSION SLIP

Permission slips from parents or guardians are required from the teacher for each student who views BODIES...THE EXHIBITION.

By signing this form, you are giving your child permission to view BODIES...THE EXHIBITION on a school fieldtrip with their teacher and chaperones.

Thank you for granting permission so that your son or daughter is able to participate in this unique opportunity to gain a better understanding about their body.

My child, _____, has my
(Please print your child's name)

permission to view BODIES...THE EXHIBITION with his / her teacher and

chaperones.

_____
Parent or Guardian Name (please print)

_____ _____
Parent or Guardian (signature) Date

TEACHER'S GUIDE to STUDENT LEARNING

SKIN

You can thank your skin for protecting you from germs and bad weather when you cut your finger or feel cold. Your skin is the largest organ in your body. It does many things to keep you safe and comfortable. Here are some of the things your skin does for you:

- It keeps you warm when it is cold; it cools you down by sweating when you get too hot.
- Your skin protects you from germs because it covers your body; it heals itself when it gets cut or scraped.

Our bodies are always making new skin. But, what happens to the old skin? Old skin cells make way for new skin cells by just falling off, or shedding (just like your dog probably sheds hair). We shed 30,000 to 40,000 microscopic skin cells in just one minute!

ACTIVITY: The Outer Covering

Students will observe and better understand how the skin protects the body.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

The skin is the largest organ on the body. It does many things. It even protects your entire body. Taking care of your skin is one of the most important things you can do to stay healthy.

MATERIALS (per student)

- 1 orange
- napkins

PROCEDURE for The Outer Covering

1. Look at an orange. Why does the orange have a skin? How similar is the orange peel to our skin?

2. Peel the orange. As you were peeling the orange, did you poke or cut the inside of the orange? Why didn't you cut it before? What happened when you poked the inside of the orange or cut the inside of the orange? Compare this to your skin. If your skin gets cut, what happens? Now eat your healthy snack!

EXPLANATION

The orange peel protects the soft inside of the orange from damage, just like the skin protects our body. When we break the protective skin barrier, blood may leak out and harmful things like germs may get inside the body.

EXTENSION

1. Use a magnifying glass to get a closer look at your skin.

2. Make a skin print. Give each student a 2" piece of scotch tape. Have students press the tape against the pad of their thumb. Gently pull the tape away and examine using a magnifying glass to see your skin print.

SKELETAL SYSTEM

Without the bones inside your body, you would look like a water balloon or a blob on the floor -- unable to move or do anything. Luckily, you have a collection of bones called the skeleton that gives your body shape and protects important organs like your heart, brain and lungs.

Your Bones are Alive!
The bones in your body are made with a combination of hard minerals like calcium to give them strength and lots of living cells that build new bone and repair broken bones. Like other cells in your body, bone cells need blood to keep them alive.

Different Bones for Different Jobs
By the time you grow up, you have 206 bones in your body. All of these bones have jobs to help keep your body safe and sound. The bones in your skull protect your brain like a helmet. The spinal column is made with 26 bones running down the center of the back and lets you twist and bend (and helps you stand up).

No "lazy bones" here
When two bones meet, they form a joint or articular surface. Movement occurs wherever there is a joint in the body. If there were no joints, there would be no movement. Your shoulders, elbows and thumbs all have different kinds of joints that let you move your arms in a circle, bend your elbows or swirl your thumb around.

DID YOU KNOW? The smallest bone in the body is the stirrup bone inside the eardrum. It is smaller than a grain of rice. Your femur, sometimes known as the thighbone, is the longest, strongest bone in the body.

ACTIVITY: Peanut Head

Students will understand the function of the skull.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY for Peanut Head

Divide students into five groups of six. The skeletal system is the framework of your body, holding everything together and giving it shape. Your bones are designed to be light, yet powerful enough to support weight many times more than your own. People can live longer, healthier and more active lives just by taking care of their bones.

MATERIALS for Peanut Head

- 30 roasted peanuts in the shells
- 5 bike helmets

PROCEDURE

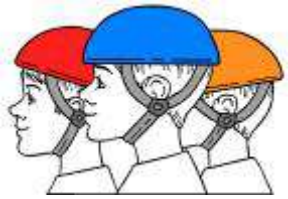
1. Examine the peanut shell. How does it feel?

2. Crack the peanut open. What is in the inside? How is this same as your brain in your skull? What part of the peanut is like the skull? What part of the peanut is like the brain? What does the skull do?

3. Examine the bike helmet. Why is it important to wear a helmet?

EXPLANATION

The skull is hard and protects the brain from injury, just like the peanut shell. If you fall on the playground or while riding a bike, you could crack your skull and hurt your soft brain.



EXTENSION

1. Identify the bones in the body using their scientific names. Sing the song:

DEM BONES ARE ALIVE! (sung to the tune of "Dem Bones")

Chorus
Dem Bones, Dem Bones, Dem Strong Bones
Dem Bones, Dem Bones, Dem Healing Bones
Dem Bones are alive!

Chorus
The metatarsals are connected to the tarsus
The tarsus is connected to the fibula
The fibula is connected to the patella
Dem Bones are alive!

Chorus
The patella is connected to the femur
The femur is connected to the pelvis
The pelvis is connected to the sacrum
Dem Bones are alive!

Chorus
The sacrum is connected to the vertebral column
The vertebral column is connected to the occipital bone
The occipital bone is connected to the cranium
Dem Bones are alive!
Chorus

2. Draw a model of the skeleton on black construction paper using chalk or white crayons.

MUSCULAR SYSTEM

When we think of superheroes, we think of them with powerful muscles that make them able to lift cars and leap over buildings. But there is more to muscles than meets the eye. Muscles are the action heroes of your body. They help you do just about everything. Muscles help you breathe, eat, and sing. Your heart, that hard working organ beating in your chest, is a muscle that keeps you alive without you having to tell it anything.

We have three kinds of muscles in our body:

Skeletal muscles. Skeletal muscles let us move our bodies and make funny faces. Skeletal muscles are attached to the bones and create movement by pulling (they can't push) bones into different positions. You can control what a skeletal muscle does, so we call them voluntary muscles.

Smooth muscles. You cannot control smooth muscles, but they are not out of control. Smooth muscles are busy at work digesting your food, focusing your eyes, and controlling your bladder to urinate. Because they work automatically, they are sometimes called involuntary muscles.

Cardiac muscle. The walls of the heart are made from cardiac muscle. It is a special muscle because it can work hard to pump blood through the body without getting tired. Cardiac muscle, like smooth muscles, is an involuntary muscle.

ACTIVITY: Lion Face, Lemon Face

Students will observe how muscles control movement.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

Your body is capable of performing all sorts of tasks, and your muscles make almost all of them possible. Find out what makes your muscles do what they do and where they are found throughout the body. What muscles do the most work in your body?

MATERIALS (per student)

- mirror

PROCEDURE for Lion Face, Lemon Face

1. Stand in front of a mirror, look at your face, and roar like a lion.

2. Now, pucker your lips and squish your face as though you ate something really sour.

3. Observe how the muscles in your face change the way your face looks.

4. Put your hands on your face and roar like a lion. Feel the muscles in your face move as you make the lion face.

5. Keep your hands on your face and make a sour face. Feel how the muscles change as you switch faces.

EXPLANATION

Our nervous system controls our muscles to make them move. The muscles in your body and face are responsible for all movement in the body. When muscles contract they change shape and allow us to make funny faces.

EXTENSION

1. Make silly faces and observe which muscles in your face move.

2. Some people can move muscles so that their ears wiggle. Try to wiggle your ears, nose and lips.

NERVOUS SYSTEM

Think about something. Anything -- just put your brain to work. Besides thinking, your brain also runs things like your emotions (anger, happiness and surprise). For your brain to make decisions for the body, it has to know what is happening. How does the brain do this? By using the nervous system to collect information from other parts of your body, including your senses.

Getting on Your Nerves

The nervous system is divided into the central nervous system and the peripheral nervous system.

Central Nervous System

The central nervous system includes the brain and the spinal cord. Its main job is to collect information from the body and send out instructions.

Peripheral Nervous System

The peripheral nervous system is made up of all of the nerves that work like wires by passing tiny electrical signals or messages from the brain to the rest of the body.

DID YOU KNOW? A newborn baby sees the world upside down because it takes some time for the baby's brain to learn to turn the picture right side up. Can you find out how long it takes the baby to see the world right side up?

ACTIVITY: Yum, Yum -- Sweet, Sour, Salty and Bitter

Students will compare different tastes of food -- salty, sour, bitter, and sweet.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

Sense organs gather information about your surroundings and then send it to your brain through the nerves. There are five senses – touch, sight, smell, hearing, and taste. All five senses work together to let you know what is going on outside your body. The sense of touch is found in the skin. Your skin can feel heat, cold, pressure, and pain. The sense of smell and the sense of taste work together in your body. In fact the sense of smell is more responsible for how food tastes to you than the sense of taste. There are four basic types of taste – salty, bitter, sweet, and sour.

MATERIALS for Yum Yum, Sweet, Sour, Salty, Bitter (per student)

- 4 cups
- 4 spoons
- water
- 1 tablespoon lemon juice
- 1 teaspoon salt
- 1 teaspoon white, table sugar
- 1 teaspoon baking soda

PROCEDURE

1. Fill all four cups half full of water.

2. Add a teaspoon of sugar to the first cup, a teaspoon of salt to the second cup, a teaspoon of baking soda to the third cup and a spoonful of lemon juice to the last cup. Stir each cup using a different spoon for each cup.

3. Drink the lemon water. How does your mouth feel after drinking this cup? Lemons taste SOUR. Rinse your mouth.

4. Drink the baking soda water. How does it taste? Baking soda is BITTER. Rinse your mouth.

5. Drink the salt water. How does it taste? It tastes SALTY.

6. Drink the sugar water. How does it taste? It tastes SWEET.

EXPLANATION

Taste buds on our tongue help identify the different flavors of the food we eat. Our sense of taste affects what we like to eat. Many of the foods that we eat are a combination of different tastes. As we get older our tastes change, so it is important to always try new and different foods.

EXTENSION

1. Try this activity with the different foods that you eat. Try to identify the prominent taste in the food. Which kinds of taste do you like best?

2. Go on a food scavenger hunt. Get lots of different kinds of bite size foods. Cover your eyes with a blindfold. Use your sense of smell, taste and touch to help you identify the food.

CIRCULATORY SYSTEM

Why do doctors carry stethoscopes around their necks? A stethoscope is a tool used by doctors to listen to the beating of your heart. It is important to listen to the heart because the heart pumps blood all over the body. The blood contains oxygen and materials needed to keep your body alive and healthy.

Our heartbeat is the movement of the heart as it pumps blood. You can count the number of times your heart beats by placing your fingers on the sides of your neck or on your wrists. This is known as your pulse. The average pulse of a person is 70 beats per minute.

DID YOU KNOW? The heart beats more than 2.8 billion times over an average lifetime of 75 years, without ever pausing to rest.

ACTIVITY: Change of Pace

Students will simulate a heartbeat.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

Everyone has a heartbeat, let's find yours. Your heart beats faster or slower depending on what you are doing and how much oxygen your body needs. Show students what makes that beating sound and why it's important to the body.

MATERIALS (per student)

- drum or tabletop

PROCEDURE

1. Play a pattern on a drum that resembles a heartbeat. Thump, thump... thump, thump...

2. Have others join in and follow the pattern. Most people's heart rates beat at a similar rate.

PROCEDURE for Change of Pace Activity (cont'd)

3. Slow down the pattern of beats and have the others follow the changes. At rest, our heart beats slow down.

4. Speed up the patterns and have others speed up the beats as well. When you are active, your heart needs to pump more blood to carry oxygen through your body.

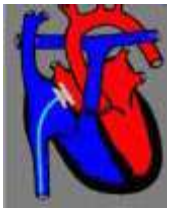
EXPLANATION

Our muscles need oxygen to work. Our blood carries oxygen. The heart pumps blood through arteries and veins that carry blood through our entire body.

EXTENSION

1. Play the drums while others dance. Play slow and have others dance slowly.

2. Speed up the beat and have the dancers begin to move more quickly. Place your hand on your chest and feel your heartbeat.



RESPIRATORY SYSTEM

All animals, just like humans, need oxygen to live. Without oxygen in the air, we cannot survive more than a few minutes. To humans, the job of breathing happens automatically without us having to think about it. Our lungs allow us to breathe in order to take oxygen into our bodies and get rid of carbon dioxide. Oxygen is carried in the blood to all of the cells in the body.

We breathe with our nose and mouth through a tube called the trachea. The trachea delivers air to the lungs. The lungs fill with air into small branches known as bronchi where red blood cells in our blood can carry the oxygen to all the cells in our body.

DID YOU KNOW? The brain uses more than one quarter of all the oxygen used by the human body.

ACTIVITY: Blowing the Race

Students will test their ability to control their breathing.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

Everyone wants to breathe a little easier and your lungs are designed to do the job. Discuss what kinds of things are vital to keeping your lungs clean and healthy. Your lungs are one of the most delicate, and yet important, parts of the body. They provide the necessary oxygen to all the rest of your systems, especially your brain.

MATERIALS

- 30 wadded pieces of paper
- 30 clean straws
- 10 ping-pong balls
- 1 roll of masking tape

PROCEDURE for Blowing the Race

1. In an open area in the room, use the tape to mark a starting line and a finish line on the floor.

2. Get a straw and a wadded piece of paper and line up on your hands & knees with the other students at the starting line.

3. When the teachers says go, blow through the straw to move your paper across the room to the finish line. Do not touch the paper with anything except the blown air or you will have to go back to the starting line. The student that crosses the finish line with the paper is the winner.

4. What do you have to do to blow the wadded paper across the room?

5. Try racing a ping-pong ball.

EXPLANATION

The ability to control your breathing is the key to winning the race. Deep regular breathing is better for muscle control than rapid, quick bursts.

EXTENSION

1. Blow into a brown paper lunch bag and see how big you can inflate it. Try it several times and see if the volume changes.

2. Try to breathe through a straw. Is it easier or harder than breathing normally? Some people have lung diseases that make breathing difficult. They feel like they are breathing through a straw all the time.

DIGESTIVE SYSTEM

When we think of food, we usually think of how good it tastes. But food is needed to keep our body alive. The job of taking apart food and using it to feed the entire body is known as digestion. Digestion begins when we put food in our mouths. After food goes down our throat, the brain controls the rest of digestion automatically. Here are the steps of digestion:

1. Food is passed to the stomach through a tube called the esophagus.

2. The stomach grinds ands churns the food with digestive juices that help digest the food.

3. Once the food has been broken down into a paste, it gets passed into the intestines.

4. The small intestine is a long tube that absorbs the nutrition; the parts of the food important to the body.

5. After passing through the small intestine, the large intestine absorbs water from the food before passing it to the rectum.

6. The rectum holds whatever the body does not want from the food and gets rid of it as feces.

DID YOU KNOW? It takes approximately 12 hours to fully digest your food.

ACTIVITY: Cracker Barrel

Students will learn the role of the teeth, esophagus and stomach in digesting food.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspectives

INTRODUCING THE ACTIVITY

Just like a car, your body needs fuel and a way to process it. When you eat, food takes an amazing journey through your digestive system. Follow your "fuel" from your mouth, down the esophagus, into the stomach, and through the intestines as it is broken down into the nutrients and energy that keep us going.

MATERIALS (per student) for Cracker Barrel

- small or medium size zip lock baggie
- 2-3 crackers
- 1/8 - 1/4 cup of cola
- permanent marker

PROCEDURE

1. Use the marker to draw teeth across the top of the zip lock bag (mouth), two lines down the center of the bag (esophagus) and a circle at the bottom of the bag (stomach).

2. Get a cracker and hold it over the opening of the bag. Use your hands to crumble the crackers into the bag. Zip the bag up to prevent spills.

3. Push the food down the middle towards the bottom of the bag.

4. Open the bag and pour some cola inside. Zip up the bag to prevent spills.

5. Observe the mush in the bag. How does it feel?

6. To get a closer look, cut a small piece off of the corner of the bag and push some of the food in the bag through the opening into a cup.

EXPLANATION

Digestion starts the moment food enters the mouth. The teeth break food into smaller pieces. The esophagus uses powerful muscles to push the food down into the stomach where strong acids break the food down even more.

Cola is a weak acid that is similar to the acids found in your stomach. It will help break down the cracker crumbs. Breaking down food allows our body to recycle the nutritious parts of food and keep us healthy. The parts of the food that the body can't use are removed as waste when we go to the bathroom.

EXTENSION

1. Chew one cracker thoroughly and spit it out into a cup. Chew another cracker just a little bit and spit it into another cup. Compare the two. What's the difference?

2. Drink water and gently feel your throat. Can you feel muscles working to push the water down your throat towards and into your stomach?

URINARY SYSTEM

When we urinate, we remove unwanted waste and water from our body. It is like taking the trash out at home. Urinating is the final step of a process that begins when our kidneys do their job of filtering out waste from our blood.

DID YOU KNOW? Urine contains ammonia, the same ingredient found in many household cleaners.

ACTIVITY: Blood Filters

Students will understand that urine carries substances and waste out of the body.

National Science Standards: Standard A Science as Inquiry, Standard C Life Science, Standard F Science in Personal and Social Perspective

INTRODUCING THE ACTIVITY

The kidneys filter waste out of the blood and create urine. The urine carries the dissolved substances out of the body. These substances are so small that they are not visible unless the liquid is evaporated out.

MATERIALS (per student)

- cup
- 5 ounces of water
- 2 teaspoons of salt
- spoon
- black construction paper (8-1/2 x 11")

PROCEDURE

1. Fill the cup half full of water.

2. Add a spoonful of salt to the water and stir. If all the salt disappears in the water, add a little more salt to the cup until a few grains are visible after stirring.

3. Place the construction paper in the sun and pour some of the saltwater on it. Just pour the saltwater, not the salt left in the bottom of the cup.

4. After 1 hour, look at the paper. What do you see?

EXPLANATION of Blood Filters Activity

The salt dissolved in the water. The heat from the sun evaporated the water away leaving the salt crystals behind on the paper. Urine carries dissolved substances out of the body. The kidneys act as blood filters that pull the waste out and allow the blood and nutrients to continue through the blood stream. Liquid urine is created in the kidney and carries the waste out of the body.

EXTENSION

1. Dissolve sugar in water and then allow the water to evaporate in the sun. What do you see?

BODIES...THE EXHIBITION **Washington State Standards, EALRs and GLEs**

Level	Content Area	Standards		
K-2	Science	1.1.6 1.2.6 1.2.8 1.3.8	2.1.1 – 2.1.5 2.2.1 2.2.3	3.1.2
	Health/Fitness	1.3 1.4	2.1 2.3	4.1 4.2
3-5	Science	1.2.1 1.2.3 1.2.8 1.3.8 1.3.10	2.1.1 – 2.1.5 2.2.1 2.2.3 2.2.5	3.1.2 3.1.3
	Health/Fitness	1.3 1.4	2.1 2.3	4.1 4.2
6-8	Science	1.1.6 1.2.1 1.2.6 1.2.8 1.3.8	2.1.1 – 2.1.5 2.2.1 – 2.2.5	3.1.1 3.1.2
	Health/Fitness	1.3 1.4	2.1 2.3	4.1 4.2
9-12	Science	1.1.6 1.2.1 1.2.6 1.2.8 1.3.8	2.1.1 – 2.1.5 2.2.1 – 2.2.5	3.1.2 3.1.3
	Health/Fitness	1.3 1.4	2.1 2.2 2.3	4.1 4.2

ORGANIZATION OF THE EXHIBITION

BODIES...THE EXHIBITION is presented, primarily by function and by system, in the following nine galleries:

1. skeletal
2. muscular
3. nervous
4. circulatory
5. respiratory
6. digestive
7. reproductive
8. fetal (optional)
9. treated body

The information in each exhibition gallery is designed to provide answers to the following questions, among others:

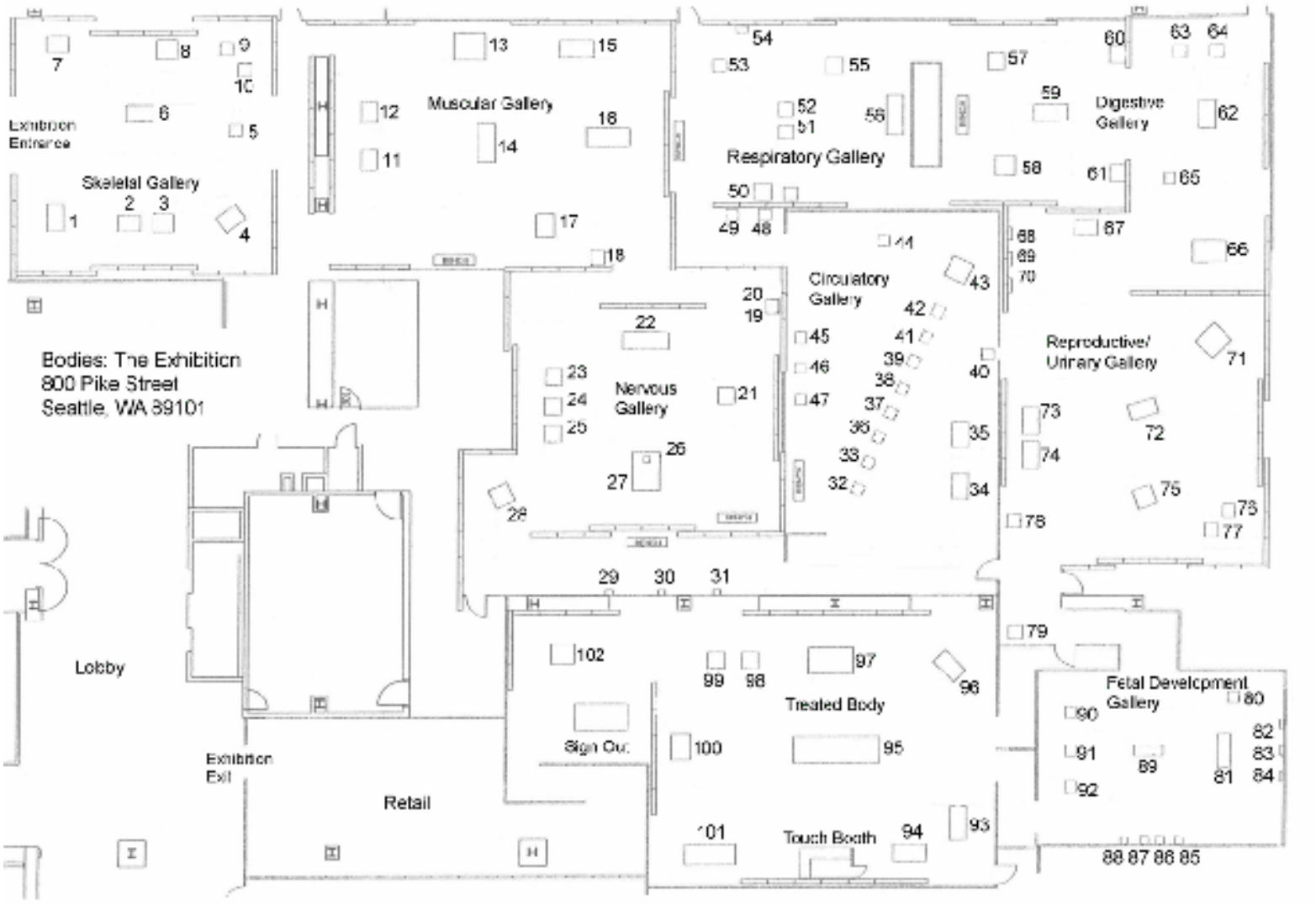
1. What are the systems of the human body?
2. How does each system of the body function?
3. How are the body's systems inter-related?
4. What can be done to improve and extend the life of the body?

Students are encouraged to work with these questions before they arrive and to form some questions of their own. As a writing exercise, answers may be written in a journal prepared before your visit or upon return to your school.

Upon viewing the exhibition, teachers and students will...

1. appreciate the sanctity and integrity of human life;
2. learn about the anatomy and complex systems of the human body;
3. learn how medical technology enhances one's quality of life;
4. become interested in their own body, how and why it works;
5. appreciate what it takes to care for the human body;
6. discover how daily choices affect the human body's health and well-being;
7. initiate conversations with friends and family about what it takes to sustain a healthy human body;
8. respect the human body in life and death;
9. understand that, regardless of how different we appear to be, the human body and its systems are much the same inside; and
10. explore careers in science, medicine and healthcare.

Floor Plan of BODIES...THE EXHIBITION



TEACHER'S GUIDE TO EXHIBITION GALLERIES

The nine galleries use full-body specimens to teach about the system or systems around which that gallery is designed. In addition, each gallery contains several cases featuring individual organs and sections of the body that relate to these systems. Refer to the floor plan as you review the material; it indicates the location of the cases and specimens. *Please note that all specimens on display are subject to change.*

Take time to view the projected images that appear on the walls of the galleries. These are artists' representations of cells and tissues, enlarged thousands of times!

There are 200 types of cells in the body; 75 trillion cells total.

THE SKELETAL GALLERY

CASE 1

Sphenoid Bone
This butterfly-shaped bone is called the "keystone" of the cranium because it connects with every bone of the skull except the lower jawbone or mandible. The sphenoid bone also contains the sphenoid sinuses, which help lighten the skull and give the voice resonance. As we age, the sphenoid sinuses enlarge and our voices deepen.

Maxilla
The paired maxillary bones form the upper jaw and create the floors of the orbits (eye sockets), as well as the hard palate, or roof of the mouth. If these bones do not join during fetal development, a cleft palate will result, leaving an opening between the mouth and nasal cavity, which creates great difficulty for nursing infants.

Top of Adult Skull

Internal and External Surfaces of the Base of the Skull
These unusual views of the skull allow you to see the complex composition of bone at the base of the skull and the several openings (foramina) that allow blood vessels and nerves to pass into and out of the cranial cavity. The largest of these openings, the foramen magnum, is the point at which the spinal cord connects with the brain. Notice also the zygomatic (cheek) arches on either side of the skull; they provide the bony foundation for the cheeks and are points of attachment for some of the muscles of mastication and facial expression.

Fetal Skull
This specimen demonstrates that the skull is made up of many flat bones, which do not fuse fully before birth. Instead, they are joined by fibrous connective tissue at the fontanelles, or gaps, between them. These fontanelles allow the baby's head to change shape to accommodate its passage through the birth canal. Most bones of the skull fuse into immoveable joints, known as sutures, during the first two years after birth. The mandible (lower jawbone) is the only moveable joint of the adult skull.

CASE 2

Elbow Joint (Hinge joint)

The elbow joint is formed of three bones: the humerus, and the radius and ulna (bones of the forearm). The humerus widens to connect with the radius and ulna, forming the elbow joint. The elbow is a hinge joint, allowing you to flex and extend your forearm. Immediately below the elbow, another joint is formed between the radius and ulna, allowing you to rotate your palm upward (supination) and downward (pronation).

Knee Joint (Hinge Joint)

The knee is the most complex joint in the body. It forms where the convex end of the femur meets the flattened end of the tibia (shinbone). The third bone of the knee, the patella (kneecap), is imbedded within the tendon of a powerful thigh muscle and helps stabilize the knee. The knee joint allows the tibia to move back and forth with some rotation.

Knee Joint Cartilage

The dense cartilage rings, visible at the top of this specimen, are found within every healthy knee joint. Known as menisci, these rings absorb shock and reduce wear to the bone ends. They also deepen the surface of the tibia, making the knee more stable, while allowing for a small amount of rotation. The menisci can sometimes be torn from the bone following a blow to the knee, particularly when the joint is over-rotated or the leg is fully extended. This often results in debilitating pain.

Knee Joint with Sagittal Cut

CASE 3

Hip Joint (Ball and Socket Joint)

One of the strongest and most stable joints in the body, the hip joint, forms where the ball at the head of the femur (thighbone) fits into the acetabulum (socket) of the hipbone. This joint structure allows for rotation, as well as forward, backward, and side-to-side movement. Held in place by five ligaments and tough connective tissue deep in the joint, the hip joint often withstands 400 pounds of force in everyday activity.

Bony Pelvis (Male)

The bony pelvis is a deep, basin-like structure formed of the hipbones and sacrum. It provides a strong and stable support for the spinal column and protects the reproductive organs. In addition, the bony pelvis connects with the bones of the lower limbs at the hip joints. The bones of the pelvis meet in the front at the pubic symphysis, where they are held together by cartilage; this cartilage softens during childbirth, allowing the pelvis to widen.

Fetal Hip Bone

During fetal development the hipbone begins as three separate bones, which are connected by cartilage. These three separate bones do not fully fuse until the age of sixteen. Genetic factors and multiple dislocations during childhood may lead to hip dysplasia, resulting in a shallow acetabulum that affects mechanics of the lower leg.

CASE 4

Bones, Muscles + Cartilage

Perhaps more than any other example in this Exhibition, this specimen shows you how you are held together and upright. This dissection demonstrates the important relationship between the bones of our skeletons and the cartilage and muscle attached to these bones.

CASE 5

Expanded Skull

Bones of the skull are divided into two types: flat bones and irregular bones. The flat bones of the cranium surround and protect the brain. The irregular facial bones form the bony framework of the face, the orbits surrounding the eye, the nasal cavity, and the roof and wall of the mouth.

CASE 6

Atlas and Axis Vertebrae

The first two vertebrae of the spine, the atlas and axis, allow the head to rotate and nod.

Cervical Vertebra

The seven cervical vertebrae are the least robust of the vertebral column, yet are strong enough to support the neck and allow for a wide range of motion.

Thoracic Vertebra

The 12 thoracic vertebrae are slightly larger than the cervical vertebrae; each connects with one of the 12 ribs.

Lumbar Vertebra

The five lumbar vertebrae are the largest and strongest of all the vertebrae. Called the small of the back, they bear the greatest amount of weight and thus provide the greatest amount of support.

Sacrum

The sacrum is composed of five fused vertebrae. It forms part of the bony pelvis and connects with the coccyx or tailbone.

Intervertebral Discs

The intervertebral discs between each vertebra provide mobility and absorb shock. Composed of dense, fibrous cartilage with a pulpy, hydrated core, these discs change shape under pressure as the spine bends and turns. As we age, our discs become less hydrated, causing us to lose height. In a herniated disc, the outer ring tears and some of the pulpy core is lost, leading to compression of and damage to the spinal cord.

The Vertebral Column
Humans are vertebrates, meaning they have an internal bony skeleton, a distinction shared with all mammals as well as fish, amphibians, reptiles, and birds.

The human vertebral column, or spine, typically consists of 33 vertebrae, which support and stabilize the upper body while forming a strong and flexible housing for the spinal cord. In addition, the spine has three natural curves that help it distribute weight and absorb shock.

CASE 7

Sternum (Flat Bone)
The sternum is a flat bone located at the center of your chest. Like the flat bones of the ribs, skull, and pelvis, the sternum acts as armor to protect vital internal organs. One side of this sternum has been cut to reveal the spongy bone within. Spongy bone distributes the force of impact and contains red bone marrow.

Cross Section of Femur Bone (Long Bone)
The ends of the long bones contain spongy bone tissue, which is visible in the cross-section of femur shown here. Spongy bone tissue makes bones lighter and distributes forces over a wider surface area. The outer layer and shafts of the long bones are made of compact bone tissue, which provides protection and support. The centers of the long bones have hollow spaces that contain marrow. Red bone marrow is the site of red blood cell production and creates more than two billion new blood cells per second.

Tibia (Long Bone)
The tibia, or shinbone, is the second longest and second heaviest bone of the body after the femur.

Epiphyseal Line
An epiphyseal line represents the former location of a growth plate. Located at the ends of a bone, the growth plates are the points at which all long bones grow in length. When you reach your height the epiphyseal growth plates disappear and a thin white line is all that remains.

CASE 8

The Whole Skeleton
The skeleton derives its name from the Greek *skeletos*, which means dry. But the bones of the body are anything but dry; they are dynamic organisms that reinvent themselves in response to repeated stress and repair themselves when broken. Visible on this specimen are the bones and joints of the body.

CASE 9

Shoulder with Open Joint Capsule

Like all moveable joints, the shoulder is a synovial joint, meaning its bones are contained within a capsule lined by a synovial membrane. This membrane secretes synovial fluid, a thick liquid that allows for almost frictionless movement within the joint. Synovial fluid is so effective as a lubricant that scientists are trying to duplicate it for use in machinery.

Shoulder Joint

The shoulder joint is formed by the articulation of three bones: the humerus (arm bone), the clavicle (collar bone), and the scapula (shoulder blade). The clavicle acts as a strut, holding the humerus away from the body, while the free floating scapula, held in place only by muscles, allows the humerus a wide range of motion. Although it is strengthened by the tendons of four important muscles (the rotator cuff), the shoulder joint remains relatively unstable. A sudden force can easily dislocate the humerus from its shallow socket and the rotator cuff muscles can be damaged through extreme movements or strenuous exercise.

CASE 10

Auditory Ossicles

Our skulls include the smallest bones in our bodies. Called auditory ossicles (hearing bones), these bones are located within the temporal bones of the skull and have distinct shapes for which they are named. They are the malleas (hammer), the incus (anvil) and the stapes (stirrup). Connected by the smallest moveable joints in the body, these bones transfer sound as vibrations from the eardrum to the inner ear. This efficient structure allows us to hear even the faintest sounds.

Temporal Bone With Auditory Ossicles

This specimen allows you to see deep into the middle ear cavity where the auditory ossicles are located. The eardrum, or tympanic membrane, marks the edge of the middle ear and the beginning of the ossicles, which transfer vibrations to the much smaller oval window at the edge of the inner ear. Two small muscles attach to the ossicles and contract to protect the eardrum and oval window from loud noises. Also visible is the bony labyrinth which helps tell the brain the position of the head, thus helping maintain balance. Diseases of the inner ear may result in hearing loss, tinninitus, or vertigo.

THE MUSCULAR GALLERY

There are more than 600 skeletal muscles in the human body. When muscles are stimulated, the fibers within them contract, or shorten, to cause movement.

Case 11

The Bones of the Foot and Ankle

The 26 bones in the foot have a very similar arrangement to those of the hand, but serve different purposes. While the hand can manipulate delicate objects, the bones of the foot work as a lever to raise the body and transmit thrust when walking and running. The ankle is comprised of a series of gliding joints like the wrist, but it permits a more limited range of motion and thus more stability.

Deep Anatomy of the Foot

The skin and soft tissue have been removed from this specimen to illustrate the ligaments and several of the tendons that insert to the tarsal (ankle) bones. The tarsal bones, their ligaments, and the muscles that attach to them assist in forming the arches of the foot.

In addition, this specimen shows the ligaments and articular cartilages of the metatarsal-phalangeal joints, which are comparable to the knuckles of the hand.

Muscle of the Top of the Foot

The muscles that extend the foot and toes are primarily located on the front of the leg. The supporting tendons of these muscles cross the back of the foot and are held in place by fibrous membranes.

Muscles of the Sole of the Foot

The sole of the foot has four layers of muscles and tendons that keep us balanced when standing or in motion. This dissection clearly reveals the flexor tendons; these fanning shiny cords, visible at the center, allow us to curl the very ends of our toes.

Joints of the Foot

The bones of the foot and ankle make up a complex array of joints, allowing them to: act as a lever to move us forward; to create arches that distribute weight; and to be in close association in order to keep us stable. On this specimen, the top portion of bone has been removed to illustrate the ankle's articular cavities, ligaments, and cartilage. Connected by these small joints and ligaments, the seven tarsal (ankle) bones help form the arch of the foot and allow for complex motion within the ankle.

CASE 12

Bones of the Hand

Joints of the Hand

The carpal, metacarpal, and phalanges of the hand and wrist are connected through multiple small joints that work together to produce the motion of the wrist and fingers. This relationship of bones helps create the fine motions needed to thread a needle or tie a shoelace. If these joints become affected by arthritis—characterized by the breakdown of protective cartilage at the end of the bones—the actions of daily living can become extremely difficult.

Wrist Joint
The eight small bones of the wrist, the carpal bones, create a series of gliding joints that allow for a wide range of movement. They are held together by a dense band of connective tissue that also covers the carpal tunnel. A U-shaped cavity just below the palm, the carpal tunnel is the area through which several tendons and the median nerve pass to the hand. Swelling within the tunnel, caused by repetitious movement, puts pressure on the median nerve and leads to carpal tunnel syndrome, today's high tech malady.

Muscles of Hand Showing Deep Palmar Arch

Muscles of Hand Showing Superficial Palmar Arch

Muscles of the Hand
Nineteen muscles control the movement of the hand. Four of these muscles, the lumbricals, place the hand in writing position; seven others, the interosseous, help perform movements like typing and playing the piano.

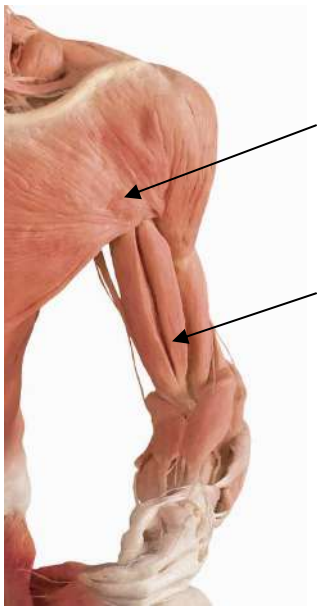
CASE 13

Balance + Muscle Strength
This specimen carrying a football exemplifies the muscular development that can be achieved through exercise and weight training. As they grow, muscles become larger and stronger as the connective tissue around them begins to toughen.

CASE 14

The Skeleton + Its Muscles
This unique presentation, both created from the same specimen, displays the supporting skeleton and the covering of skeletal muscles that were formerly attached to it. These systems would be of no use without the other and each plays an essential role in body movement.

CASE 15



Muscles of the Upper Limb
The numerous muscles of the upper limb constantly work together to perform tasks like writing, lifting, and sipping coffee. These muscles include:

Deltoid. Named for its triangular shape, delta in Greek, the deltoid muscle joins the upper arm to the shoulder. It helps lift the arm away from the side of the body, and allows forward, backward, and side-to-side movement.

Biceps Brachii. The word "biceps" comes from the Latin words bi, meaning two, and cephalon, meaning head. The two heads at one end of the biceps attach to the top of the arm and shoulder. The single head attaches to the forearm.

Supinator and Pronator. These two muscles are named for the actions they perform. Turn your palm upward—that is the supinator muscle working. Turn your palm down—that is the pronator at work. These two muscles are called antagonists because they cause opposite motions.

Muscles of the Lower Limb. The muscles of the lower limb are the largest in the body and make us bipedal and mobile. They include:

Gluteus Maximus. The largest muscle in the body; it helps us keep our balance, and move the thigh.

Quadriceps. This four-headed muscle makes up most of the muscle mass on the front and outside of the thigh and joins into the powerful patellar tendon just above the knee.

Gastrocnemius. One of three muscles that form the prominence of the calf, this large muscle connects to the achilles tendon, the strongest tendon in the body and helps us stand upright.

CASE 16

Muscle Attachments + Layering
This unique dissection of a running man allows you to see the relationship of the body's muscle layers and demonstrates the points at which these layers attach to the skeleton.

CASE 17

Muscle Control + Core Muscles
The dynamic pose of this specimen with a basketball illustrates the body's remarkable agility and balance. This is achieved through the precise control of several skeletal muscle groups working together. It takes 19 muscles to move the hand and the wrist, but not all of those muscles are within the hand. Some of these muscles are located in the forearm and are connected to the hand and fingers via tendons, known as extensors and flexors.

CASE 18

Cardiac Muscle Tissue
Cardiac muscle tissue, which causes the movement of the heart, shares characteristics with both skeletal and smooth muscle. In addition, all cardiac muscle cells are controlled by one nucleus which allows them to contract in unison; essential for a proper heartbeat.

Urinary Bladder
The urinary bladder is a hollow, muscular organ, which stores urine. Its smooth muscles change size, shape, and position according to the amount of urine it contains.

Arterial Wall
The arteries possess strong, elastic walls and include smooth muscle cells. They can quickly expand and contract, ensuring fast and efficient blood flow.

THE NERVOUS SYSTEM GALLERY

The nervous system controls and integrates activities of the body. The central nervous system consists of the brain and spinal cord. The peripheral nervous system consists of the spinal nerves and the cranial nerves. Several peripheral (spinal) nerve networks, called plexi, originate from the spinal cord and branch out to eventually reach the skin and muscles of the upper and lower limbs.

CASE 19

Transparent Section of Cerebrum

CASE 20

Brain Stem

The oldest part of the brain and the continuous link between the upper brain and the spinal cord, the brain stem controls several of the body's most vital functions, including heartbeat and respiration. It is divided into three regions as it ascends from the spinal cord:

Medulla Oblongata. The link to the spinal cord. Controls heartbeat, respiration, and blood pressure, as well as sneezing, coughing and hiccups.

Pons. The bridge between the cerebellum and cerebrum.

Mid-brain. Contains reflex centers for vision, hearing and touch. In threatening situations, these reflex centers immediately respond by closing the eyes, tensing the hearing muscles, or pulling away from danger.

Section of Face showing Trigeminal Nerve

Twelve cranial nerves arise directly from the brain to control and monitor the structures of the face. Nine of these nerves originate from the brain stem; these include the vestibulocochlear nerves that control hearing and balance, the facial nerve that controls the muscles of facial expression, and the trigeminal nerve.

The trigeminal nerve, exposed on this specimen, supplies nerve impulses to the skin on the face and scalp, the teeth, the mucous membranes in the nose, mouth, and eye, and to the muscles of mastication (chewing). The trigeminal nerve is mainly composed of sensory nerves. It allows you to feel your skin stretch when you open your mouth wide and is the reason you can feel the texture of the foods you eat. A branch of the trigeminal nerve is also very important to dentists: it is the nerve they numb before dental procedures such as drilling.

Brain Stem with Trigeminal Nerve

CASE 21

Nerves

The intricate nerves of the head are dissected here, as are the nerves that control digestion and respiration. The opened cranial cavity of the back of this specimen reveals the unique blood flow within the brain.

CASE 22

The Central and Peripheral Nervous System
This remarkable dissection offers a nearly complete view of the central and peripheral nervous systems. The brain and spinal cord are clearly visible as are all the spinal nerves. At the base of the spinal cord you can see the lumbar enlargement and the cauda equina —dozens of nerve rootlets that branch from the spinal cord. In addition, both the lumbosacral and the brachial plexi are visible, as are several of the cranial nerves that innervate the face and head.

Like the brain's protective membranes, three layers of the meninges surround the spinal cord. The outer fibrous layer of the meninges is called the dura mater, while the inner and most delicate layer is called the pia mater. An intermediate layer is called the arachnoid because the fibers within it resemble a spider's web.

The specimen is also displayed with its eyes and optic nerves. The size of the eyes does not change between infancy and adulthood, thus children's eyes are large in comparison to their brains and skulls giving them that wide-eyed look.

CASE 23

The Cerebellum
The cerebellum is the cauliflower-shaped organ at the base of the brain. Meaning "little brain" in Latin, the cerebellum controls equilibrium and regulates our muscular movements. It is because of your cerebellum that you are able to stand on one foot, button your shirt, and walk smoothly through this exhibition.

Cerebral Dura Mater with Whole Brain
The brain is surrounded by three meninges, or protective membranes, which supply it with blood and nutrients. The tough and fibrous outer layer, called the dura mater, is shown here. It supports the brain and divides the cranial cavity into smaller compartments.

Insular Lobe

Hippocampus

CASE 24

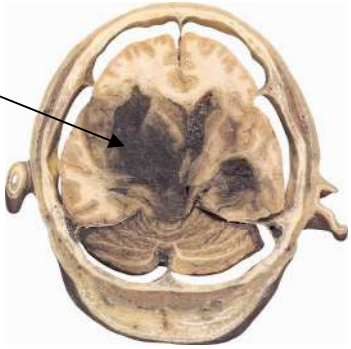
Brain Ventricles and Cerebrospinal Fluid
Inside the brain are an interconnected series of hollow spaces called ventricles that are filled with cerebrospinal fluid. Made within the ventricles, this water-like fluid circulates between the layers of the meninges, cushioning the brain and spinal cord, and removing their wastes. The cerebrospinal fluid is continuously produced, circulated and reabsorbed. If a blockage prevents the cerebrospinal fluid from circulating, the ventricles can enlarge, putting pressure on the brain. This condition is known as hydrocephalus (water on the brain).

Cerebrum with Hydrocephalus

Stroke

The brain requires a massive and continual blood supply. If this blood supply is interrupted, even for a few minutes, brain tissues will begin to die.

This is the case with stroke. It is caused by a blockage (thrombosis) or rupture in one or more of the brain's blood vessels. In the case of a rupture, a broken vessel fills part of the brain with blood, increasing pressure, and causing further tissue death. Those with high blood pressure and arteriosclerosis are at the greatest risk. Symptoms of stroke include paralysis, language and vision impairment. There are 600,000 new cases of stroke annually in the United States. The brain section in this case is an example of a large-scale debilitating stroke.



Top view of cross section of the head

Thrombosis (Blockage of Cerebral Artery)

CASE 25

Half Brain Showing Location of Pituitary Gland

Pituitary Gland

Known as the master gland, the pituitary plays a very important role in the functioning of the glands in the endocrine system. It secretes the hormones that control all the other glands of this delicate and essential system, which influences every cell, organ, and function of our body.

Thyroid Gland

The largest of the endocrine glands, the thyroid, is located just below the voice box. It produces hormones that regulate body metabolism. In certain cases, the thyroid becomes overactive, increasing metabolism and raising blood pressure. Those with this condition, known as Grave's Disease, often appear to have very large eyes. Grave's disease is often treated by removal or destruction of the thyroid. The thyroid hormone is then replaced with a synthetic hormone that is taken daily. In other cases, the thyroid is under-active causing lethargy and weight gain. This, too, is regulated with synthetic hormones.

Thymus Gland

The thymus gland lies underneath the top of the breastbone. A very important gland during childhood and puberty, the thymus produces T-lymphocytes (T-cells), white blood cells responsible for immunity. T-cells help recognize and destroy invading bacteria, viruses, abnormal cells, and foreign tissue. Experiments done on animals have shown that if the thymus is removed before birth, the animal's immune system cannot recognize foreign tissue and cannot fight off cancer cells.

Thyroid Cancer

Thyroid cancer is both a rare clinical disease and a rare cause of death; the gland is more often affected by a benign tumor known as an adenema. These tumors can occur in any age group, but occur more commonly in young adults. Until recently, adenomas were surgically removed upon their discovery to prevent cancerous change. However, current research suggests that the risk of cancerous changes is slight, allowing physicians time to monitor adenomas before deciding upon surgery.

CASE 26

The Whole Brain
The brain is the mysterious organ of the central nervous system and is essential for all bodily functions. Weighing only 2.6 pounds on average, it contains billions of nerve cells, which are in constant communication with each other and the body. Some brain cells make connections with over 10,000 others in a split-second.

CASE 27

The Brain
The exposed brain of this seated figure offers an excellent view of the main organ of the central nervous system, which controls everything we do; every thought, action and emotion. As the main conduit between the brain and the body, the spinal cord transmits millions of nerve impulses per second at speeds exceeding 270 miles per hour.

CASE 28

Creativity + Bodily Control
This specimen of a musical conductor illustrates the nearly countless number of tasks the brain executes, from the most basic to the highly complex. The thickest and longest nerve in the body, the sciatic nerve, is also visible on this dissection.

THE CIRCULATORY SYSTEM GALLERY

Every drop of blood in the body passes through the heart once each minute.

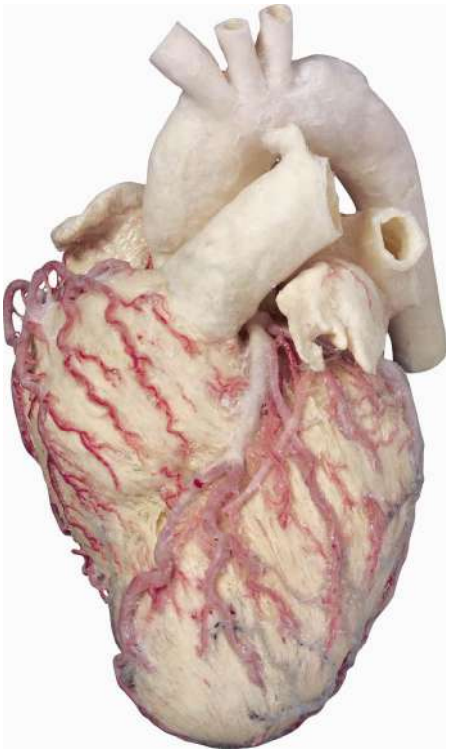
CASE 29
Heart

CASE 30
Chambers of the heart

CASE 31
Heart with Visible Cardiac Valves

CASE 32
The blood vessels of the heart

Case 33
Casting Specimen of Pancreas and Spleen



CASE 34
Arteries of the upper Limb
Arteries and veins of upper Limb

CASE 35
Arteries of the lower Limb
Arteries and veins of the lower Limb

CASE 36
Artery of the Jejunum

CASE 37
Blood Vessels of the Ileum

CASE 38
Arteries of the Stomach

CASE 39
Arteries of the Ileum

CASE 40
The arteries of the thoracic wall

CASE 41
The blood vessel of the iliocecal junction

CASE 42
Arteries of the kidney

CASE 43

Blood Vessels
This specimen was prepared using a special casting method. The blood vessels were first injected with a colored polymer. Once the polymer hardened, the remaining body tissue was removed by a corrosive chemical to reveal the intricate matrix of the blood vessels.

CASE 44
Arteries of the head with skull

CASE 45
The bronchial tree and pulmonary veins

CASE 46
Casting specimen of associated heart and lungs

CASE 47
Bronchial Tree and Pulmonary Artery

CASE 48
The venous valves

THE RESPIRATORY GALLERY

CASE 49

Spleen

Located high in the left side of the abdomen, the spleen helps form blood in a developing fetus and, though not essential to an adult, continues to filter blood and fight disease throughout life. Red blood cells squeeze through narrow pores within the spleen and older, more brittle, cells are destroyed here. The spleen also contains the largest concentration of lymphatic tissue in the body and assists the immune system in isolating and destroying harmful organisms.

Megalosplenia (Enlarged Spleen)

Because the spleen acts as a filter for the blood and the immune system, it may become enlarged due to infections or diseases of the blood. The most common cause of enlargement is malaria, a disease endemic to mosquito-infested tropical and sub-tropical areas, which affects the body's red blood cells. The Epstein-Bar virus, which causes mononucleosis, also leads to swelling of the spleen. If the spleen ruptures due to infection, it must be removed in emergency surgery. Removal of the spleen may lead to a weakened immune system.

CASE 50

Smoker's Lungs with Heart

These shrunken and darkened lungs illustrate the tar build-up and disease that often accompanies cigarette smoking. The tars in tobacco permeate and blacken lung tissue. The accumulation of smoking debris within the lungs leads to the breakdown of the alveoli, greatly decreasing the surface area of the lung and depriving every organ in the body, including the heart, of much needed oxygen.

Section of Lung with Emphysema

Emphysema comes from the Greek word for inflation and refers to an over-extension of the alveoli. This inflation occurs as the thin walls of the alveoli rupture if they are obstructed. The lungs may be obstructed by many different types of debris, but the most common is debris from cigarette smoking. As lung tissue continues to deteriorate, it begins to fill with fluid, leading to a near-permanent state of pneumonia resulting in a chronic cough, loss of appetite, and fatigue.

Lung with Cancer

Bronchogenic carcinoma of the lung most often starts in one of the air passageways and not in the lung tissue itself. These cancers can go undetected for some time and often develop into advanced diseases before they are discovered. Early symptoms include a dry, irritated cough and the slow onset of breathlessness. The leading cause of lung cancer is chronic cigarette smoking.

Lobe of Lung with Cancer

Because the lungs are naturally divided into independent segments, one portion of the lung may be removed without affecting breathing in other regions. In the case of lung disease or cancer, surgeons often remove the compromised section of lung, hoping to keep the disease from spreading. This specimen came from a surgery in which a portion of lung was removed to save the individual's life.

CASE 51

Lungs and Heart of Fetus

During fetal development, oxygen is delivered to the fetus via the umbilical cord. The lungs are not used until birth when the infant takes its first breath.

Healthy Lungs and Heart

These healthy lungs show some dark pigmentation, the normal amount of discoloration resulting from the inhaled pollutants in our air. Special cells within the lungs sweep these pollutants out of the airway and deposit them in the lung tissue, allowing oxygen and carbon dioxide to be exchanged normally.

CASE 52

Tuberculosis of Small Intestine

Tuberculosis of the small intestine is thought to begin when bacteria is coughed up and swallowed. Because it is resistant to gastric acid, the bacteria enters the small intestine and becomes lodged in lymphoid tissue. This can lead to erosion of the intestinal lining.

Tuberculosis of Kidney

Tuberculosis of the kidneys arises almost always from a blood-borne spread of tuberculosis from the lungs. In advanced stages of tuberculosis, the kidney becomes a hollow sac-like structure. Occasionally, the original site of infection (e.g., the lungs) will heal, but the kidney will remain infected. Renal tuberculosis can lead to death either from uremia (kidney failure) or from chronic wasting and loss of kidney function from the uncontrolled tuberculosis infection.

Section of Lung with Tuberculosis

Pulmonary Tuberculosis

CASE 53

Cancer of the Larynx

Although it is not common form of cancer, carcinoma of the larynx occurs directly upon the vocal cords. This accounts for the progressive hoarseness and difficulty swallowing associated with this cancer. When they do occur, however, tumors of the larynx have a high mortality rate.

Front of Larynx

Back of Larynx

Vocal Cords

The lower segment of the larynx contains the vocal cords, two ligaments of elastic tissue covered with gathered mucous membrane that enable speech. We speak by pushing air from the lungs into the larynx and vibrating the vocal cords; the closer the vocal cords draw together, the higher the pitch of your voice. The tongue and lips convert the vocal cords' vibrations into speech.

Segmental Bronchi

As its name suggests, the bronchial tree branches into smaller and smaller segments as it enters the lungs. These branches eventually end at one of millions of alveoli where carbon dioxide is exchanged for oxygen. The lung is actually divided into only 20 segments. These segments are functionally separate regions in the lungs, which receive their own blood supply and can continue to operate if another segment is removed. This is nature's way of insuring that breathing will continue if other parts of the lung become diseased.

Alveoli

The bronchial tree ends in air sacs, or alveoli, that branch out like clusters of grapes. Only one cell thick, the walls of the alveoli are in direct contact with the capillary walls of the pulmonary veins. It is across this fragile membrane that life-supporting gas exchange occurs; here carbon dioxide is diffused from the bloodstream and exhaled, while oxygen is absorbed into the bloodstream and circulated to every organ in the body. The lungs contain approximately 300 million of these alveoli that, if stretched out, would cover half a football field.

CASE 54

The Respiratory System

The respiratory system consists of a number of successive, interconnected, structures (air passageways) that begin in the nose and end in millions of alveoli deep in the lungs. The conducting division of the respiratory system includes the nasal cavity, nasopharynx, larynx, trachea, bronchi, and bronchioles, which cleanses, humidifies, and directs the air we breathe into the lungs. In most instances, the walls of the conducting division contain cartilage, which prevents the air passageways from collapsing.

Once inhaled, air enters the respiratory division of the respiratory system. It passes into the alveoli where oxygen and carbon dioxide are exchanged across a thin blood-air membrane: red blood cells absorb oxygen from the inhaled air and release carbon dioxide that is then exhaled.

CASE 55

The Mediastinum

The central portion of the thoracic cavity is called the mediastinum, a thick partition that contains the heart, esophagus, trachea, and the thymus gland. It lies in the midline of the chest, dividing it into two smaller compartments: the pleural cavities that hold the lungs.

Diaphragm

The diaphragm, visible at the top of this specimen, is essential for life. This strong, flat muscle divides the thoracic and abdominal cavities and is the main muscle used in breathing. When at rest, the diaphragm forms a high dome; when the diaphragm contracts, the dome moves towards the abdomen creating a vacuum, expanding the chest cavity, and making room for outside air. The average adult takes 15 breaths per minute; babies take 40.

CASE 56

Respiration + Circulation

This dissection of a man throwing a baseball displays many of the body's major arteries. In particular, it demonstrates the delicate interior architecture of the lungs.

THE DIGESTIVE GALLERY

CASE 57

Muscles of Mastication, the Tongue and Taste Buds

Digestion of food begins in the mouth, with the teeth and tongue. The teeth tear, bite, and grind food (mastication), mixing it with saliva. The tongue moves food between the teeth to assist with chewing and swallowing. When food is swallowed, a cartilaginous flap of tissue, called the epiglottis, closes off the airway to prevent us from choking. Food then enters the esophagus, a ten-inch long muscular tube, where it is transported to the stomach by peristalsis (muscular contractions).

Taste buds lie between the grooves on the surface of the tongue and tell the brain what the body is ingesting and what enzymes it needs to break it down. Each person has between 2000 and 5000 taste buds, with women generally having more than men

Muscles of Mastication

Pharynx

The pharynx is commonly known as the throat. It is the passage for air and food, and contains the larynx (voice box). Its opening from the mouth is protected by the tonsils, which have open pits to catch bacteria and viruses. The pharynx also contains the epiglottis, a leaf-shaped flap of tissue just behind the tongue that prevents food or liquid from entering the airway when swallowing.

Section of Head Showing Location of Parotid Gland

The Ducts of the Parotid Gland

These delicate glands carry saliva from the parotid gland, the largest of all salivary glands, and deliver it into the mouth. Saliva begins breaking down carbohydrates in food as soon as it enters your mouth. The major ducts of the parotid gland open into both sides of the mouth opposite the upper second molars. Because it they are constantly being bathed by saliva, the upper second molars often accumulate more plaque than any of the other teeth within the mouth.

CASE 58

Normal Gallbladder

The gallbladder attaches to the lower surface of the liver and stores bile, a greenish-brown fluid that is essential for digestion. Bile breaks down fats and also helps carry certain toxic wastes created by the liver out of the body.

Adenocarcinoma of the Gallbladder

Cancer of the gallbladder is a common disease in the gastrointestinal tract. In its early stages, the cancer has few symptoms, but later symptoms include pain, nausea, vomiting, intolerance to fatty foods, jaundice, and weight loss. The lack of early symptoms often leads to a delayed diagnosis and a low curability rate for the disease. Only 20 percent of such cancers are surgically treatable.

The Liver

The heaviest single organ in the body, weighing close to 3.5 pounds (1.58 kilograms) in an average adult, the liver serves several metabolic functions. It produces bile, key to the proper digestion of fats, stores vitamin A, and creates several proteins essential to blood flow and clotting. The liver also receives glucose-rich blood returning from the digestive tract. It converts much of this glucose into glycogen, the sugar your body's cells use for energy.

Cirrhosis of the Liver

Along with storing sugars, the liver also removes and destroys ingested toxins, including alcohol, drugs, and microbes. Improper diet that often accompanies alcohol and drug abuse can lead to the death of liver cells and to their replacement by scar tissue. This disease is known as cirrhosis and is visible on this specimen. Other diseases, such as liver cancer and hepatitis, can severely damage the liver as well. A liver transplant is often the only way to treat these conditions.

Canal System of Liver

This special dissection reveals the hepatic portal venous system, one of the pathways that blood takes through the liver. This pathway receives blood from the capillaries of the small intestine and delivers the absorbed nutrients in that blood to the sinusoidal capillaries of the liver for processing.

Healthy Liver

Liver Cancer

The liver is a common site for secondary cancers to occur because of its high blood flow. Tumors arising in the colon, pancreas, stomach, lung or breast can spread to the liver as their cells become more prevalent in the blood.

On this specimen, you can clearly see cancer's devastating effects in two ways: cancer cells both destroy the liver's healthy cells and take much needed blood for their own growth. On this specimen, you can see the larger blood vessels that correspond to the tumor's development in the liver.

CASE 59

The Stomach

In the stomach, three layers of muscle churn partially digested food with powerful gastric juices, turning the food into a paste-like substance and killing many bacteria that might otherwise bring disease to the body.

Stomach with Rugae

The stomach contains many rugae (folds), which expand to create more surface area as the stomach fills with food. Cells within the rugae produce both mucus and digestive juices. We feel full from eating when nerve receptors in the stomach tell the brain that the stomach has stretched to capacity. Ignoring this feeling can lead to overeating and destructive weight gain.

Stomach and Duodenum

After food is broken down in the stomach, it enters the duodenum, a one-foot long, C-shaped section at the beginning of the small intestine. Here food is mixed with bile from the liver and enzymes from the pancreas to further digest it into carbohydrates, nucleic acids, proteins, and fats--the four nutrients needed for life. These nutrients are then absorbed into the bloodstream as the digested food travels through the small intestine. The pancreas also plays a vital role in controlling blood sugar levels in the body, secreting the hormone insulin when blood sugar levels are high and the hormone glucagon—a sugar the body uses for energy—when they are low.

Small Intestine with Mesentery

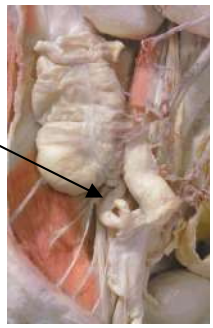
The small intestine attaches to the body wall with a connective tissue called mesentery. It wraps around the intestine like a sling and holds it in place. Blood vessels, visible as dark lines on this specimen, travel through the mesentery to reach the intestine, carrying oxygen and nutrients to the intestine and wastes and absorbed molecules away from it.

Section of Small Intestine

The small intestine performs most of the digestion and absorption of nutrients in the digestive tract. Over ten feet long, it contains several million villi and microvilli. These microscopic, finger-like projections reach into the hollow spaces of the intestine and increase the small intestine's surface area over one thousand times. Through these projections, digested molecules pass into the bloodstream and are carried to the liver for further processing.

Cecum and Vermiform Appendix

The cecum marks the very beginning of the colon (large intestine). Unlike the walls of the small intestine, which have permanent folds, the colon's inner wall is smooth. The small piece of tissue at the bottom of this specimen is the vermiform (worm-like) appendix. Once needed by our ancestors when they ate rougher foods, it is now an evolutionary relic.



Section of Colon

The colon (large intestine) is the end of the digestive tract. It converts digested food into feces for excretion. Digested food moves through the colon by peristalsis (muscular contractions) in the colon walls. In some cases, due to stress, the walls in one area of the colon contract more intensely, causing discomfort and flatulence, a condition known as irritable bowl syndrome or spastic colon.

Rectum and Anal Canal

As it leaves the lower portion of the colon, undigested food and other body waste pass into the rectum where they are stored until the body discards then as feces through the anal canal. The rectum and the lower portion of the colon are sometimes the site of constipation, which occurs when the feces hardens and becomes too dry to pass out of the anal canal. This is generally caused by lack of exercise plus insufficient fiber and liquid in the diet.

Gastric Cancer Invading the Spleen
Cancerous tissue in the stomach lining results in a breakdown of the stomach's rugae, which are then replaced by hard, smooth cells. While gastric cancer may feel much like an ulcer, it can be fatal if not treated. The best way to detect stomach cancer is through the use of a long flexible tube called an endoscope, which is swallowed by the patient allowing physicians to examine the lining of the stomach. Milk, fresh vegetables, vitamin C and frozen foods all appear to reduce the risk of stomach cancer.

CASE 60

The Whole Viscera
The vital organs of respiration, digestion, circulation, and reproduction are contained within the body's thoracic, abdominal, and pelvic cavities. They are aligned within us in an amazing, compact, and efficient relationship, performing hundreds of functions simultaneously, while continuously maintaining and remaking themselves.

CASE 61

The Alimentary System (Digestive Tract)
A fibro-muscular tube that runs from mouth to anus, the digestive tract is one of the world's most efficient dis-assembly lines. It uses a combination of mechanical and chemical processes to break down the foods we eat, converting them to nutrients the body can use for fuel. Once swallowed, food moves through the digestive tract by the process of peristalsis, waves of muscular contractions that propel food from the esophagus to the rectum. On average, it takes 24 hours for food to pass through the canal.

CASE 62

The Vital Organs
This dissection provides a rare view into the compact and complex relationships that exist between many of the body's major organs. This specimen was cut into right and left halves along the midline of the body.

CASE 63

Gastric Polyps
Polyps, benign tumors that develop in the digestive tract, can signify changes in the tissue that may lead to cancer. They are very small and usually develop singly. Polyps occurring in large numbers are termed polyposis.

Ascariasis
Ascariasis is an infection caused by the parasitic roundworm *Ascaris lumbricoides.* Poor sanitation and poor personal hygiene are contributing factors to this disease. Early signs of its presence include lack of appetite, fatigue, and weight fluctuations. Adult worms live in the intestine and when infestation is great can cause abdominal discomfort, intestinal obstructions, and malnutrition. As part of their life cycle, larval worms migrate through the lungs of their host causing a cough and discomfort while breathing. Effective medications are available, but in severe cases surgery may be necessary to clear internal blockages.

The relationship of liver, stomach, pancreas, and spleen
This view of the close positioning between the stomach, liver, spleen, and pancreas helps demonstrate how each organ depends upon the other during the process of digestion.

CASE 64

Greater Omentum
The greater omentum secures and supports the stomach and part of the small intestines, supplying them with nerves and blood vessels. A connective tissue, it is also one of the areas where the body stores fat. The omentum is known as the "guardian of the abdominal cavity" because it contains cells that help guard against infections.

CASE 65

Aorta with Atherosclerosis
Atherosclerosis (hardening of the arteries) develops when plaques (fatty deposits) form in the lining of the arteries. These plaques narrow the affected blood vessels, sometimes causing aneurysms, a bulge on the aorta, which may rupture. Smoking and high cholesterol increase the risk for this disease. Atherosclerosis is the main cause of death in developed nations.

Normal Aorta
The aorta is the largest artery in the body. It carries oxygenated blood away from the heart and branches into many smaller arteries that supply the head, neck, and arms, as well as the organs in the chest, abdomen, pelvis, and legs. Like all arteries, the aorta has thick and muscular walls that can expand or contract to accommodate the volume of blood passing through them. The health of the arteries' walls is a contributing factor to blood pressure.

CASE 66

Adipose Tissue
This specimen displays the distribution of fat in an overweight female. Excess weight aggravates conditions such as high blood pressure and diabetes. The greatest health risk posed by obesity is a shortened life span.

THE REPRODUCTIVE AND URINARY SYSTEM GALLERY

CASE 67

The Kidneys
These specimens reveal some of the kidney's inner structure, including the renal artery, which delivers blood for filtering, and the renal cortex where the actual filtration of blood occurs. The hollow space within the kidney is the renal sinus. It marks the beginning of the ureters, which carry urine drop by drop to the bladder.

The whole kidney specimen also exhibits an adrenal gland. Located on top of the kidneys, the adrenal glands produce hormones that influence metabolism and the body's response to stress. These hormones are sometimes called adrenaline after the gland that creates them.

Horseshoe Kidney
The term "horseshoe kidney" refers to a condition in which both kidneys are fused in early embryonic life giving them the appearance of a horseshoe. A fairly common condition, it occurs in approximately one of every 400 births. The kidneys will continue to function under this condition, but may suffer from a lack of blood supply. Those with a horseshoe kidney sometimes have other genetic disorders of the skeletal, digestive, and cardiovascular systems.

Left and Right Kidneys
This unique specimen exhibits a double ureter on its right kidney. A double ureter does not seem to affect the amount of urine that flows to the bladder.

Blood Vessels of Kidney
This special dissection reveals the amazing network of blood vessels within the kidneys. Blood enters the kidney through the renal artery (visible in the center of this specimen) and passes into ever-smaller blood vessels until it reaches one of over one million nephrons (filtering units). Here great pressure forces blood and proteins through a fine membrane leaving waste materials, water, electrolytes, and salts behind.

Filtered blood returns to the body, while the captured material moves toward the bladder. However, most of the water, electrolytes and salts are re-absorbed into the bloodstream before they reach the bladder. If this did not occur, we would produce almost 50 gallons of urine per day. In your lifetime, however, you will urinate 12,000 gallons.

Kidney with Hydronephrosis
Hydronephrosis is a condition that develops when the normal flow of urine leaving the kidney is somehow obstructed. When such an obstruction occurs, urine backs up into the kidney causing it to swell. If the condition progresses unchecked, it can eventually destroy the kidney tubules. When both kidneys are affected, total kidney failure may result.

Cross Section of Kidney

Kidney Cancer (Carcinoma of the Kidney)
Very little is known about the causes of kidney cancer, but it is very rare for it to occur in both kidneys. Research has shown that cigarette smoking increases the risk of developing cancer of the kidney, as does exposure to cadmium, asbestos and lead paints. Diabetes, obesity, chronic kidney failure, and high blood pressure, may also increase the risk of developing cancer of the kidney. Those with a family history of kidney cancer should be checked regularly for this disease.

CASE 68
Transverse Section of Thorax at Level of Lung

CASE 69
Transverse Section of Abdomen at Level of Liver

CASE 70
Transverse Section of Abdomen at Level of Kidney

Male sperm are the smallest cells in the human body.

CASE 71

The Male Body
This specimen exhibits the organs of the male reproductive system.
Female Reproductive and Urinary Systems

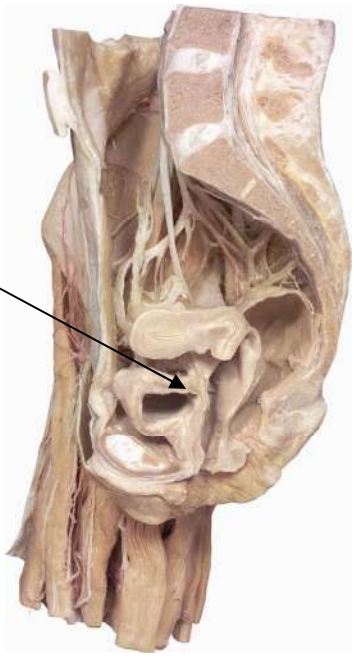
CASE 72

Symmetry
This specimen helps us understand the relationship between the surface of the body and the bones and organs beneath it.

CASE 73

The female reproductive systems stores, releases, and incubates the egg, or female sex cell, which creates new human life when joined with a male sperm cell.

1. Ovaries. Contain more than 250,000 ova, or eggs. All the eggs an ovary will ever have are present at birth. Alternating between left and right, ovaries release an egg each month by a process called ovulation.
2. Uterine (Fallopian) Tubes. Capture the egg when it is breaks through the wall of the ovary and transport it to the uterus. Most pregnancies begin in the uterine tubes.
3. Uterus (Womb). The site where a fertilized egg implants and develops. It has a blood-rich lining that is shed each month (menstruation), if fertilization does not occur.
4. Cervix. Lower portion of the uterus that opens into the vagina. It softens prior to delivery for easier passage of the fetus into the birth canal. Cervical cancer is one of the most common cancers in women and can often be detected with a yearly Pap test.
5. Vagina (Birth Canal). A fibro-muscular tube that connects the uterus and external genitalia. It is capable of expanding during delivery to allow for easier childbirth.
6. External Genitalia. Consists of several protective folds of skin that surround the openings of the vagina and urethra. One of these folds corresponds to the male scrotum, while another surrounds the clitoris, the female equivalent of the male penis.



Female Urogenital System

Median-Sagittal Section of Female Pelvic Cavity

Superior View of Female Pelvic Cavity

The Female Internal Genital Organs (With IUD)

CASE 74

The Male Reproductive and Urinary Systems

The male reproductive system creates and delivers sperm, the male sex cell, which when joined with the egg or female sex cells, causes fertilization. Its organs include:

1. Testis (Testicle). Where sperm and hormones are produced. They are contained within the scrotum outside of the main body cavity because they best produce sperm at 2 degrees below normal body temperature.
2. Spermatic Cord. Carries sperm out of the testes. It also contains the testicular artery and the cremaster muscle, which lifts the testes closer to the body in cold weather.
3. Seminal Vesicle. Small glands that lie behind the urinary bladder, which secrete most (75 percent) of the seminal fluid.
4. Prostate Gland. A single gland, shaped like an inverted pyramid; it surrounds the urethra as it leaves the urinary bladder. Its secretions account for approximately 25 percent of the seminal fluid.
5. Penis. Contains erectile tissue and a portion of the urethra, which carries urine and seminal fluid out of the body.
6. This specimen also exhibits one of the adrenal glands. Located on top of the kidneys, the adrenal glands produce hormones that influence metabolism and the body's response to stress. These hormones are sometimes called adrenalin after the gland that creates them.

Male Urogenital System

Superior view of Male Reproductive System

Median-Sagittal Section of Male Pelvic Cavity

The Cavenous Body of Penis

CASE 75

The Female Body

This specimen illustrates features of the female reproductive system. Women have a bell-shaped pelvis and wider hips to assist in childbirth.

Female eggs are the largest cells in the human body.

CASE 76

The Breasts with Glandular Milk Ducts

Breast Cancer
Breast cancer affects approximately five per cent of the female population and is thought to be caused by high estrogen levels. These tumors can go undetected for some time because they are usually not painful. Because the later stages of breast cancer can be extremely fatal, women over 50, or with a family history of breast cancer, should have a yearly mammography to detect the disease in its earliest stages when it is highly treatable.

CASE 77

Teratoma
Teratomas are rare tumors composed of multiple tissues such as skin, teeth, and hair that develop in abnormal locations. Such abnormalities within the ovary (dermoid teratomas) mainly occur during reproductive life and sometimes develop during pregnancy. In almost all cases, these teratomas are curable.

Dermoid Cyst of Frontal Lobe
A dermoid cyst is a type of teratoma, a benign tumor that originates from some of the cells that later form the skin. These tumors most often occur close to the body's midline, sometimes growing in the spine and, rarely, in the midline of the brain. Dermoid cysts in the brain and spine are sometimes found in children who have experienced episodes of meningitis. Treatment normally involves their surgical removal.

Ovarian Cyst
Ovarian cysts are relatively common and can occur in females of all ages. These hollow fluid-filled structures are usually small and asymptomatic. Complications can occur, however, including an enlarged ovary, a disturbed menstrual cycle, damaged ovarian blood supply, and infertility.

Intramural Uterine Fibroid
A fibroid within the uterus is a benign tumor consisting of a sphere of muscle and fibrous tissue. It may occur in the uterine smooth muscle (intramural) or within the uterine lining (submucosal).

CASE 78

Benign Prostatic Hyperplasia
The prostate gland secretes some of the fluids that create semen. As men age, the prostate may increase up to five or six times its normal size, a condition known as benign prostatic hyperplasia. This sometimes leads to an obstructed urinary flow, as was the case with this specimen, which also resulted in swelling of the urinary bladder. While enlargement of the prostate does not lead to cancer of the prostate, men over 50 should have regular screening for prostate cancer.

Prostate and Seminal Vesicles
Shaped like an inverted pyramid, the prostate gland supplies semen with 25 percent of its fluid, mainly an alkaline solution that neutralizes the vagina's acidity allowing sperm to live. The urethra passes through the prostate and carries both sperm and urine out of the body.

The seminal vesicles are coiled tubes at either side of the prostate through which sperm pass before reaching the prostate. Here sperm mixes with a fructose-based secretion, which provides 60 percent of the fluid that creates semen.

CASE 79

Blood Vessels of Placenta

NOTE: If you wish to tour The Fetal Development Gallery, continue with the exhibition notes. If you do not wish to view the Fetal Development Gallery, please turn to Page 54 of this guide.

OPTIONAL: THE FETAL GALLERY

NOTE: All embryos and fetuses died of natural causes in utero.

CASE 80

Placenta (fetal side)
The placenta acts as a lung for the developing fetus receiving deoxygenated fetal blood from the fetus and delivering oxygen-rich blood to it.

Placenta (Uterine Side)
The placenta forms within the wall of the uterus from a combination of uterine and fetal tissue. There is no mixing of embryonic and maternal blood in the placenta. Instead, all exchange between these two separate circulations takes place across a very thin cellular barrier. However, the placental barrier cannot stop harmful chemicals. If such substances are ingested during the embryonic period, they can cause birth defects and have other serious consequences on the process of normal development.

CASE 81

Fetus (9 weeks)
Fetus (13 weeks)
Fetus (16 weeks)
Fetus (24 weeks)

CASE 82
Transparent Fetal Section

CASE 83
Transparent Fetal Section

CASE 84

Transparent Fetal Section

CASE 85

Fetal Bone Development (20 weeks)

CASE 86

Fetal Bone Development (16 weeks)

CASE 87

Fetal Bone Development (14 weeks)

CASE 88

Fetal Bone Development (12 weeks)

CASE 89

Embryonic and Fetal Development

The 40 weeks of in utero development are divided into two extended time periods; the embryonic period that runs through the end of the eighth week; and the fetal period, which extends from the ninth week until birth. The embryonic period is characterized by the development of the body's organs and, while the fetal period is characterized primarily by their increased growth.

Embryo (8 weeks)
Embryo (7 weeks)
Embryo (5 weeks)
Embryo (4 weeks)
Embryo (18 days)

CASE 90

Visceral Hernia

A visceral hernia occurs when some or all of the fetus' digestive organs form outside the body.

CASE 91

Anencephalia

Anencephaly occurs when the "cephalic" or head end of the embryo's neural tube fails to close between the third and fourth week of development. This results in the absence of a major portion of the brain, skull, and scalp. Infants with this disorder are born without a forebrain, the front, thinking and coordinating part of the brain. The remaining brain tissue is often exposed - not covered by bone or skin. The cause of anencephaly is unknown. Although it is thought that a mother's diet and vitamin intake may play a role, scientists believe that many other factors are also involved. Recent studies have shown that the addition of folic acid (vitamin B9) to the diet of women of childbearing age may significantly reduce the incidence of neural tube defects.

CASE 92

Bifid Spine
Spina Bifida develops during the first month of pregnancy. It is a congenital defect in which the embryo's spinal column does not fuse properly, leaving the spinal cord and its protective membranes vulnerable. In some extreme cases, the spinal cord and nerves are exposed at birth. While surgery can repair the opening after birth, the resulting nerve damage is permanent and may lead to paralysis of the lower limbs. With proper care, most children with spina bifida live well into adulthood.

THE TREATED BODY GALLERY

CASE 93

Vertebrates
Humans are vertebrates, a category of animals with an internal bony skeleton. Whales also belong to this class, as do fish, amphibians, reptiles, and birds. Although each type of vertebrate is unique, all have a head, ribs, and a vertebral column with a tail—or remainder of one. In this case are examples of the similarities between the human and the whale's bony structure.

Whale Vertebra
Human Vertebra
Human Costal Bone
Whale Costal Bone

CASE 94

Carcinoma of the Esophagus
Carcinoma of the esophagus accounts for about five percent of all visceral carcinomas found in men, and occurs most often after the age of 50. There are few symptoms in the early stages of the disease and tumors can grow unchecked until they begin to block the esophagus. Because the survival rate is low (less than ten percent), early detection is crucial.

Cancer of the Rectum
Colon cancer frequently occurs at either end of the colon—in the area of your right hip where the colon begins, or near the rectum where it ends. Cancers near the rectum are often detected earlier than those deeper in the colon. Early detection is the key to surviving colon cancer. The most effective method of detection is colonoscopy, in which a fiber optic camera is used to inspect the entire length of the colon. Physicians recommend that anyone over 50 receive a colonoscopy every 3-5 years.

Purulent Osteomyelitis of Tibia
Osteomyelitis is a bone infection often caused by bacteria called Staphylococcus Aureus. Both the bone and the bone marrow are often simultaneously affected. While any bone in the body can be affected, the common sites of localization are the long tubular bones. Bones can become infected in several ways, both via blood-borne bacteria and through direct infection, which occurs after a cut or severe fracture. A bone also may become infected when its blood supply is disrupted. This can happen in older people with atherosclerosis, narrowing of the blood vessels, or in association with diabetes. Most infections of this kind occur in the toes or feet.

Larynx with Multiple Polyps
Polyps are the most common type of benign tumor affecting the larynx and are usually found on the true vocal cords. They often develop in heavy smokers or in individuals, such as singers, who impose great strain on their larynx. In singers these polyps are frequently referred to as "singer's nodes." Because of their location, they characteristically cause changes in the voice and progressive hoarseness. Though benign, polyps must be closely monitored to ensure they do not become malignant.

Osteogenic Sarcoma of Femur
Bone is constantly regenerating itself, but in the case of osteogenic sarcoma, bone cells grow out of control. This type of bone cancer occurs most often in the lower end of the femur. A highly malignant cancer, osteogenic sarcoma is most common in young adults.

Hodgkin's Disease Involving Perigastric Nodes
Hodgkin's disease is a malignant form of cancer that affects the lymph nodes. Hodgkin's sarcoma is the most malignant form of the disease, one that usually leads to death within two years. This form of the disease is most frequent in the middle-aged and elderly and affects males and females equally. It usually manifests with the sudden enlargement of groups of lymph nodes. The disease then spreads to all lymph nodes of the body, particularly those of the GI tract, lung, liver, spleen, pancreas, and bones. It can also affect the central nervous system. Symptoms usually follow a rapid course of progressive weakness and weight loss.

Squamous Cell Carcinoma of Leg
A squamous cell carcinoma of the skin is a form of skin cancer, which is usually the result of long term sun damage to the skin. It enlarges slowly and steadily, sometimes invading neighboring tissue and can also spread to distant parts of the body. If not removed completely, the cancer can go deep into the skin and metastasize to the internal organs causing death. Anyone with a substantial history of sun exposure can develop squamous cell carcinoma. But people who have fair skin, light hair, and blue, green, or gray eyes are at highest risk. Those whose occupations require long hours outdoors or who spend extensive leisure time in the sun are in particular jeopardy.

CASE 95

Transverse Human Sections
These body sections came from one specimen. They show you in actuality what magnetic resonance imaging techniques (MRI) "see" when they scan a human body.

MRI uses a magnetic field created by powerful electromagnets to stimulate hydrogen atoms in the body. These atoms then give off radio signals that are collected by a special scanner and turned into images that look remarkably like the body segments you see here. Transverse body segments such as these, as well as the vertical segments elsewhere in this gallery, can assist physicians as they study relational anatomy, which is essential to reading MRI images.

CASE 96

Medical Prostheses + Surgical Tools
This specimen illustrates techniques used to heal or replace damaged bones, as well as the surgical tools that assist these techniques. Bone has the amazing ability to mend itself when broken. Optimal healing occurs when the broken ends of a bone are properly aligned.

CASE 97

Form + Function
The pose of this specimen illustrates the dynamic beauty of the human body. You can see how the body's operating systems and its supporting organs contribute to the way the body functions with grace and agility.

CASE 98

Aneurysm of Descending Aorta
Blood vessels, both arteries and veins, are susceptible to a variety of different diseases. One of the most striking results of all forms of vascular disease is the formation of an aneurysm. An aneurysm is a localized abnormal dilation of any vessel. Aneurysms may occur in any artery and vein of the body, but are most common and most significant in the aorta. Aortic aneurysms produce serious clinical disease and often cause death by rupture. One of the most common causes of aortic aneurysms is arteriosclerosis.

Cardiac Malformation
In the adult cardiovascular system, the heart is a double pump, delivering blood to the body and lungs. In the developing fetus, however, blood does not receive oxygen from the lungs, but via the umbilical cord and the placenta. For this reason, the heart of a fetus has an opening between its two upper chambers, bypassing the flow of blood to the lungs. Known as the foramen ovale, this opening in the heart wall closes shortly after birth. If it fails to close, deoxygenated blood is returned to general circulation, which makes a baby look blue and deprives it of the oxygen it needs to develop. Openings in the heart can now quickly be corrected through surgery.

Pulmonary Congestion

Mitral Stenosis
Enlarged Heart Cardiomyopathy (Mitral Stinosis)

The mitral heart valve controls blood flow from the heart to the body.

CASE 99

Cerebral Abscess
If the brain becomes infected by a bacteria or fungus, white blood cells will quickly attack the invader and try to contain it. The resulting pus and inflammation can lead to a brain abscess as with this specimen.

Congenital Deformity of Brain

The Brainstem
The brainstem consists of the midbrain, pons, and medulla oblongata. It is overlaid by the cerebellum and is continuous with the spinal cord through the foramen magnum at the base of the skull. Neurological functions located in the brainstem include those necessary for survival (breathing, digestion, heart rate, blood pressure) and for arousal (being awake and alert). Most of the cranial nerves come from the brainstem. The brainstem is the pathway for all fiber tracts passing up and down from peripheral nerves and spinal cord to the highest parts of the brain, in particular to the cerebral hemispheres.

Brain Section with Glioma

The nervous system consists of two different types of cells: nerve cells, which conduct nerve impulses, and neuroglia, which support nerve cells. Neuroglia means "nerve glue". The name is appropriate because these cells are responsible for holding neurons in place. In addition, neuroglia cells protect the nerve cells and produce myelin, which insulates nerve fibers, aiding in the conduction of nerve impulses. Despite all of their supporting roles, neuroglia are also the cells in the brain that can grow out of control and create very invasive brain tumors known as gliomas.

CASE 100

Inside + Out

Each of us is physically unique, from the shade of our skin to the size and shape of our organs.

CASE 101

Skin

Skin acts as a protective shield. The heaviest and largest organ of the body, weighing approximately 11 pounds and covering over 2 square yards, it is comprised of two layers: the dermis and the epidermis. The inner layer, the dermis, contains our nerve receptors, blood vessels, hair follicles, and sweat and oil glands. The blood vessels in the dermis nourish skin cells and help us maintain a constant body temperature, dilating when we are hot and constricting when we are cold. Sweat glands also keep us from overheating, coating the skin with moisture that takes away heat when it evaporates. Oil glands keep the layers of the skin supple, especially the outer layer, the epidermis.

The epidermis is composed of mature skin cells that conjoin and harden, providing our first line of defense, protecting us from dehydration, dampness, radiation, and millions of microbes each day. Our nails and hair are derived from the epidermis. Skin cells regenerate rapidly and are shed constantly; much of the dust in your home comes from these cells.

CASE 102

Your Body

STUDENT GUIDE

Welcome to BODIES...THE EXHIBITION.

Each gallery in this Exhibition represents a different system of the body. You will view both full bodies and individual organs that support the structure and function of that system. You will see first-hand some of the many things you have been studying at school.

Take your time going through the Exhibition. Read and see all that you can. Take notice of the plaques on the walls as they contain valuable information.

Remember that you are viewing real human bodies. Be respectful of them, your classmates and the other guests in the Exhibition. You will be assigned to a specific chaperone before you begin your tour. Keep your voices low and stay with your chaperone throughout each of the galleries. Also, you must turn off your cell phones. Please be aware that food, drink and/or cameras are not allowed at any time. If you are completing a class assignment, we ask that you do not lean on the glass cases to write. Docents in white lab coats are available throughout the galleries to answer your questions. A children's audio tour, recorded for elementary level students, is available to order when you make your reservation. It tells an engaging story of the human body as you move through the galleries in the Exhibition.

You may be surprised to see that the full body specimens are displayed out in the open. You can view them as close as you like but please do not touch any of the bodies. The Interactive Desk at the end of the Exhibition offers you the opportunity to hold a human brain, feel the weight of a real liver and touch other organs from the body.

If you are interested in looking at the items in the retail store, please stay with your chaperone. The same is true for restroom breaks. Some of the more popular items in the store for students (from $4 - $20) include shirts, key rings and magnets; and for teachers ($10 -$40) you will find mugs, Anatomical Flip Books and poseable skeletons.

Enjoy your remarkable journey through the human body.

WHAT STUDENTS WANT TO KNOW

Where do the bodies come from?

The bodies in this Exhibition are those of people from China who died of natural causes with no known family members. Chinese law, like American law, allows that, after a period of time during which no relative or next of kin can be located, unclaimed bodies can be legally given to a medical school who then has permission under the law to use them for an educational or research purpose while seeing to it that issues related to dignity and respect are carefully adhered to. Detailed information about the identities and personal histories of the bodies is strictly confidential.

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.

The Skeletal System

1. Babies have _____ bones.
    a. 206
    b. 300
    c. 94

2. Adults have _____ bones.
    a. 206
    b. 300
    c. 94

3. The auditory ossicles are found in your
    a. throat
    b. foot
    c. ear

4. What is found inside of a bone that makes red blood cells?
    a. Phalanges
    b. Sinuses
    c. Marrow

5. Draw the skeleton of your foot or hand.

The Muscular System

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

2. What is the largest muscle in the body?
    a. Heart
    b. Gluteus maximus
    c. Sartorius

3. About how many muscles are there in the human body?
    a. 60
    b. 600
    c. 6000

4. Muscle in the heart can squirt blood _____ feet.
    a. 2
    b. 100
    c. 30

5. What are the 3 kinds of muscle tissues?
    a. Cardiac, smooth, and skeletal
    b. Skeletal, muscular, and circulatory
    c. Small, medium and large

The Nervous System

1. Your brain weighs _____ pounds.
    a. 2.6
    b. 26
    c. 100

2. What is the longest nerve in your body?
    a. Brain
    b. Femur
    c. Sciatic

3. Look at the back of the seated specimen. What can you see running right down the middle of his back?
    a. Spinal cord
    b. Telephone cord
    c. Cerebellum

4. The part of the brain that controls your balance and your muscles is the
    a. Dura mater
    b. Cerebellum
    c. Skull

5. Draw a picture of your brain.

The Circulatory System

1. There are _____ miles of blood vessels in the human body.
    a. 6
    b. 600
    c. 60,000

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

3. What happens in your circulatory system once every minute?
    a. Your heart stops beating.
    b. Every drop of blood passes through the heart.
    c. You take a breath.

4. Your heart is about the same size as your
    a. fist
    b. tongue
    c. head

5. Draw a picture of your heart. Is it really "heart-shaped"? What kind of shape would you call it?

The Respiratory Gallery

1. A pack of cigarettes makes your life shorter by _____.
    a. no time
    b. 2 hours and 20 minutes
    c. 2 years

2. How many breaths do we take every minute?
    a. About 40 for babies and 15 for adults
    b. About 15 for babies and 40 for adults
    c. About 5 for everyone

3. What part of the respiratory system helps your lungs pull in and push out air?
    a. Stomach
    b. Diaphragm
    c. Liver

4. When we breathe in we take in oxygen. When we breathe out, we get rid of
    a. Oxygen
    b. Water
    c. Carbon dioxide

5. Draw a picture of the healthy lungs next to a picture of the smoker's black lungs.

The Digestive Gallery

1. What large organ is also the second heaviest organ of the body, after the skin?
    a. Stomach
    b. Brain
    c. Liver

2. Where does the digestive tract begin?
    a. Mouth
    b. Esophagus
    c. Stomach

3. "Adipose tissue" is another way of saying
    a. fat
    b. muscles
    c. bones

4. What is the name for a liver that is sick and damaged?
    a. Tuberculosis
    b. Cirrhosis
    c. Arthritis

5. Draw a picture of how food moves through your digestive tract.

The Reproductive Gallery

1. In your lifetime, you will produce _____ gallons of urine.
    a. 120
    b. 1,000
    c. 12,000

2. What are the parts of the urinary system?
    a. Ovary, stomach, and kidneys
    b. Small intestine, kidneys, and ureters
    c. Kidney, ureters, and bladder

3. What is the largest human cell?
    a. A man's sperm
    b. A woman's egg
    c. The chromosome

4. What is the smallest human cell?
    a. A man's sperm
    b. A woman's egg
    c. A nucleus

5. Draw your kidneys. With what vegetable do they share a name? Why?

Fetal Gallery

This assignment is optional depending on your level of sensitivity to this part of the Exhibition. Please write 4 sentences on your reaction to this gallery.

The Treated Body Gallery

This is the first specimen you have seen with skin. Why is your skin so important?

Look at the discus (metal Frisbee) thrower. How many surgical tools do you see?

How many sections of the body do you see laid out in the case in the center of the gallery?

Draw a whale rib next to a human rib.

Which specimens did you touch at the Interactive Desk?

Discussion and Reflection

Take some time to record your reflections about your experience at BODIES...THE EXHIBITION. Write your answers on separate paper if you need more room.

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. Which gallery do you remember the most? Why?

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

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

Answer Key

Skeletal
1. b
2. a
3. c
4. c

Muscular
1. c
2. b
3. b
4. c
5. a

Nervous
1. a
2. c
3. a
4. b

Circulatory
1. c
2. b
3. b
4. a

Respiratory
1. b
2. a
3. b
4. c

Digestive
1. c
2. a
3. a
4. b

Reproductive & Urinary
1. c
2. c
3. b
4. a

Glossary for BODIES...The Exhibition

Alveoli: al-ˈvē-ə-ˌlī: a small cavity or pit: as a: a socket for a tooth b: an air cell of the lungs c: an acinus of a compound gland d: any of the pits in the wall of the stomach into which the glands open

Antagonist Muscle: a muscle that contracts with and limits the action of an agonist with which it is paired

Appendix: narrow blind tube usually about three or four inches (7.6 to 10.2 centimeters) long that extends from the cecum in the lower right-hand part of the abdomen, has much lymphoid wall tissue, normally communicates with the cavity of the cecum, and represents an atrophied terminal part of the cecum

Artery: any of the tubular branching muscular- and elastic-walled vessels that carry blood from the heart through the body

Articulation: a joint between bones or cartilages in the vertebrate skeleton that is immovable when the bones are directly united, slightly movable when they are united by an intervening substance, or more or less freely movable when the articular surfaces are covered with smooth cartilage and surrounded by an articular capsule

Atrium: an anatomical cavity or passage ; *especially* : a chamber of the heart that receives blood from the veins and forces it into a ventricle or ventricles

Autonomic Nervous System: part of the vertebrate nervous system that innervates smooth and cardiac muscle and glandular tissues and governs involuntary actions (as secretion, vasoconstriction, or peristalsis) and that consists of the sympathetic nervous system and the parasympathetic nervous system -- called also *vegetative nervous system*

Birth Canal: the channel formed by the cervix, vagina, and vulva through which the mammalian fetus is expelled during birth

Bone Marrow: a soft highly vascular modified connective tissue that occupies the cavities and cancellous part of most bones and occurs in two forms: a: a whitish or yellowish bone marrow consisting chiefly of fat cells and predominating in the cavities of the long bones

Bone: one of the hard parts of the skeleton of a vertebrate

Bronchi: either of the two primary divisions of the trachea that lead respectively into the right and the left lung

Bronchial Tree: bronchial tree: the bronchi together with their branches

Bronchiole: ˈbräŋ-kē-ˌōl: a minute thin-walled branch of a bronchus

Cardiac Muscle Tissue: named because it is found in the heart. Cells are joined to one another by intercalated discs which allow the "synchronization" of the heartbeat. Cardiac muscle is branched, striated muscle.

Cartilage: a usually translucent somewhat elastic tissue that composes most of the skeleton of vertebrate embryos and except for a small number of structures (as some joints, respiratory passages, and the external ear) is replaced by bone during ossification in the higher vertebrates

CAT Scan: a sectional view of the body constructed by computed tomography

Cecum: ˈsē-kəm: a cavity open at one end (as the blind end of a duct); *especially*: the blind pouch at the beginning of the large intestine into which the ileum opens from one side and which is continuous with the colon

Central Nervous System: the part of the nervous system which in vertebrates consists of the brain and spinal cord, to which sensory impulses are transmitted and from which motor impulses pass out, and which supervises and coordinates the activity of the entire nervous system

Cervix: a constricted portion of an organ or part: as a: the narrow lower or outer end of the uterus b: the constricted cementoenamel junction on a tooth

Colon: the part of the large intestine that extends from the cecum to the rectum

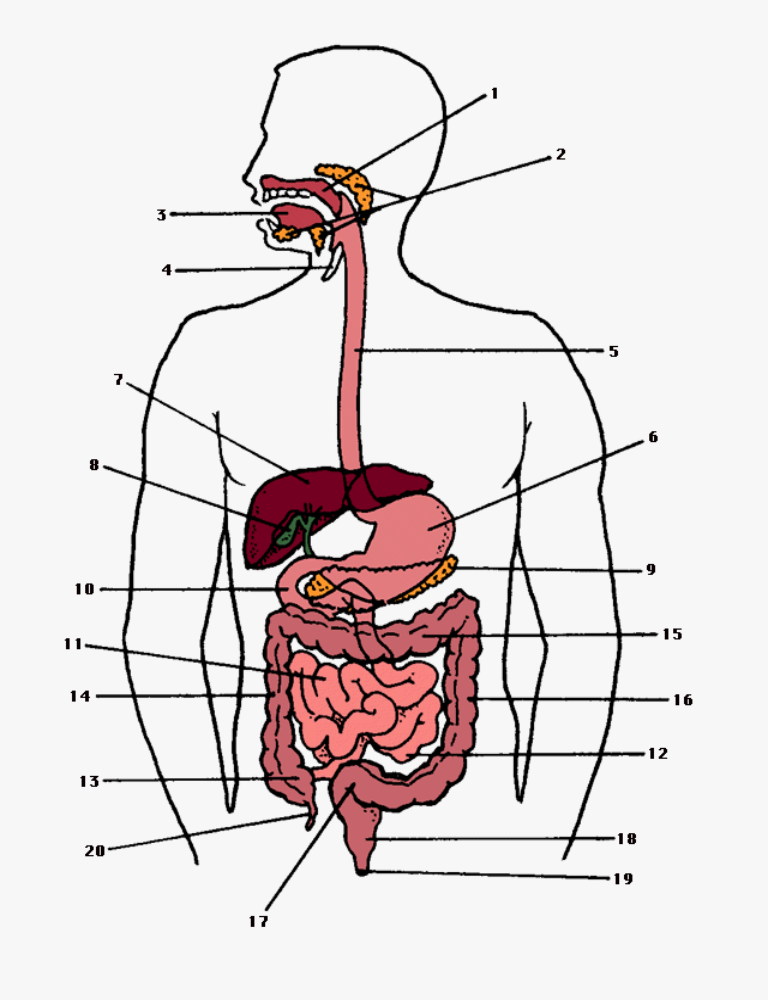
Compact Bone Tissue: The compact noncancellous portion of bone that consists largely of concentric lamellar osteons and interstitial lamellae

Conchae: ˈkäŋ-kə: the largest and deepest concavity of the external ear

Contraction: kən-ˈtrak-shən: the shortening and thickening of a functioning muscle or muscle fiber

Diaphragm: a body partition of muscle and connective tissue ; *specifically* **:** the partition separating the chest and abdominal cavities in mammals

Digestion: 1 palate, 2 salivary glands, 3 tongue, 4 epiglottis, 5 esophagus, 6 stomach, 7 liver, 8 gallbladder, 9 pancreas, 10 duodenum, 11 jejunum, 12 ileum (10, 11, and 12 comprise the small intestine), 13 cecum, 14 ascending colon, 15 transverse colon, 16 descending colon, 17 sigmoid flexure, 18 rectum (13-18 comprise the large intestine), 19 anus, 20 vermiform appendix



Duodenum: d(y)ü-ə-ˈdē-nəm: the first, shortest, and widest part of the small intestine that in humans is about 10 inches (25 centimeters) long and that extends from the pylorus to the undersurface of the liver where it descends for a variable distance and receives the bile and pancreatic ducts and then bends to the left and finally upward to join the jejunum near the second lumbar vertebra

Epididymus: ep-ə-ˈdid-ə-məs:a system of ductules that emerges posteriorly from the testis, holds sperm during maturation, and forms a tangled mass before uniting into a single coiled duct which comprises the highly convoluted body and tail of the system and is continuous with the vas deferens

Foramen (Foramina): fə-ˈrā-mən: a small opening, perforation, or orifice

Glial Cells: glē-əl: of, relating to, or comprising neuroglia

Gray Matter: neural tissue especially of the brain and spinal cord that contains cell bodies as well as nerve fibers, has a brownish gray color, and forms most of the cortex and nuclei of the brain, the columns of the spinal cord, and the bodies of ganglia

Ilium: il-ē-əm: the dorsal, upper, and largest one of the three bones composing either lateral half of the pelvis that in humans is broad and expanded above and narrower below where it joins with the ischium and pubis to form part of the acetabulum

Internal Respiration: the exchange of gases (as oxygen and carbon dioxide) between the cells of the body and the blood by way of the fluid bathing the cells

Jejunum: ji-ˈjü-nəm: the section of the small intestine that comprises the first two fifths beyond the duodenum and that is larger, thicker-walled, and more vascular and has more circular folds and fewer Peyer's patches than the ileum

Ligament: a tough band of tissue that serves to connect the articular extremities of bones or to support or retain an organ in place and is usually composed of coarse bundles of dense white fibrous tissue parallel or closely interlaced, pliant, and flexible, but not extensible

Liver: a large very vascular glandular organ of vertebrates that secretes bile and causes important changes in many of the substances contained in the blood which passes through it (as by converting sugars into glycogen which it stores up until required and by forming urea), that in humans is the largest gland in the body, weighs from 40 to 60 ounces (1100 to 1700 grams)

MRI: magnetic resonance imaging -- a noninvasive diagnostic technique that produces computerized images of internal body tissues and is based on nuclear magnetic resonance of atoms within the body induced by the application of radio waves

Neuroglia: neu·ro·glia: supporting tissue that is intermingled with the essential elements of nervous tissue especially in the brain, spinal cord, and ganglia, is of ectodermal origin, and is composed of a network of fine fibrils and of flattened stellate cells with numerous radiating fibrillar processes

Neuron: one of the cells that constitute nervous tissue, that have the property of transmitting and receiving nervous impulses

Ovary: one of the typically paired essential female reproductive organs that produce eggs and in vertebrates female sex hormones, that occur in the adult human as oval flattened bodies about one and a half inches (four centimeters) long suspended from the dorsal surface of the broad ligament of either side, that arise from the mesonephros, and that consist of a vascular fibrous stroma enclosing developing egg cells

Pancreas: paŋ-krē-əs: a large lobulated gland that in humans lies in front of the upper lumbar vertebrae and behind the stomach and is somewhat hammer-shaped and firmly attached anteriorly to the curve of the duodenum with which it communicates through one or more pancreatic ducts and that consists of (1) tubular acini secreting digestive enzymes which pass to the intestine and function in the breakdown of proteins, fats, and carbohydrates; (2) modified acinar cells that form islets of Langerhans between the tubules and secrete the hormones insulin and glucagon; and (3) a firm connective-tissue capsule that extends supportive strands into the organ

Peripheral Nervous System: the part of the nervous system that is outside the central nervous system and comprises the cranial nerves excepting the optic nerve, the spinal nerves, and the autonomic nervous system

Peristalsis: per-ə-ˈstȯl-səs: successive waves of involuntary contraction passing along the walls of a hollow muscular structure (as the esophagus or intestine) and forcing the contents onward

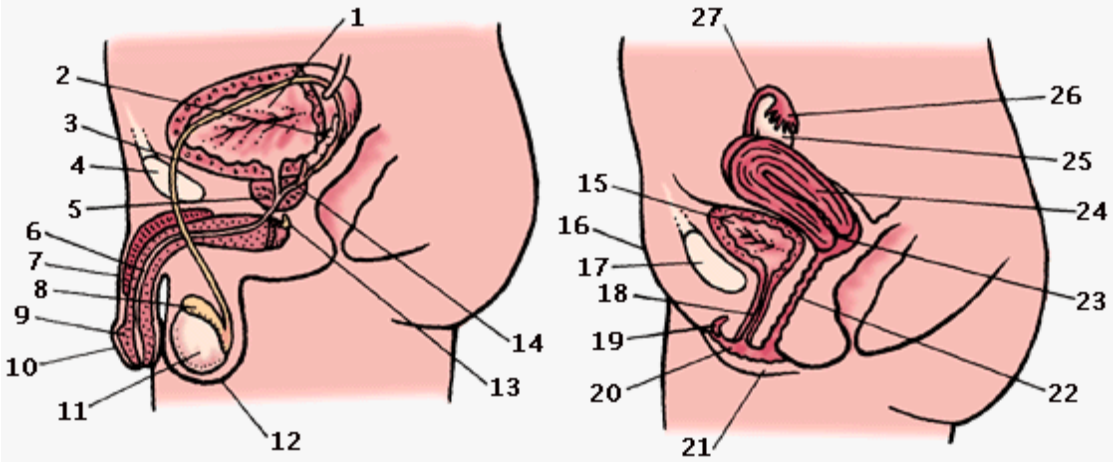
Placenta: the vascular organ in mammals except monotremes and marsupials that unites the fetus to the maternal uterus and mediates its metabolic exchanges through a more or less intimate association of uterine mucosal with chorionic and usually allantoic tissues permitting exchange of material by diffusion between the maternal and fetal vascular systems but without direct contact between maternal and fetal blood and typically involving the interlocking of fingerlike vascular chorionic villi with corresponding modified areas of the uterine mucosa

Prime Mover: a muscle that on contracting is automatically checked and controlled by the opposing simultaneous contraction of another muscle -- called also agonist muscle

Prostate: a firm partly muscular partly glandular body that is situated about the base of the mammalian male urethra and secretes an alkaline viscid fluid which is a major constituent of the ejaculatory fluid

Prosthesis: an artificial device to replace or augment a missing or impaired part of the body

Reproductive System: left male, right female. 1 bladder, 2 seminal vesicle, 3 vas deferens, 4 pubic symphysis, 5 prostate, 6 urethra, 7 penis, 8 epididymis, 9 glans penis, 10 foreskin, 11 testis, 12 scrotum, 13 Cowper's gland, 14 ejaculatory duct, 15 bladder, 16 mons pubis, 17 pubic symphysis, 18 urethra, 19 clitoris, 20 labia minora, 21 labia majora, 22 vagina, 23 cervix, 24 uterus, 25 ovary, 26 fimbria, 27 fallopian tube



Rugae: rü-gə: an anatomical fold or wrinkle especially of the viscera -- usually used in plural <the *rugae* of an empty stomach>

Seminal Vesicle: either of a pair of glandular pouches that lie one on either side of the male reproductive tract and that in human males secrete a sugar- and protein-containing fluid into the ejaculatory duct

Skeletal Muscle Tissue: attached to bones by tendons, is associated with the body's voluntary movements. Skeletal muscle is striated muscle. Unlike cardiac muscle, the cells are not branched.

Smooth Muscle Tissue: muscle tissue that lacks cross striations, that is made up of elongated spindle-shaped cells having a central nucleus, and that is found in vertebrate visceral structures (as the stomach and bladder) as thin sheets performing functions not subject to conscious control by the mind and in all or most of the musculature of invertebrates other than arthropods

Spongy Bone Tissue: Bone in which the spicules form a latticework, with interstices filled with embryonic connective tissue or bone marrow.

Synapse: the place at which a nervous impulse passes from one neuron to another

Synergist Muscle: an organ (as a muscle) that acts in concert with another to enhance its effect

Tendon: a tough cord or band of dense white fibrous connective tissue that unites a muscle with some other part, transmits the force which the muscle exerts, and is continuous with the connective-tissue epimysium and perimysium of the muscle and when inserted into a bone with the periosteum of the bone

Testes: typically paired male reproductive gland that usually consists largely of seminiferous tubules from the epithelium of which spermatozoa develop, that corresponds to the ovary of the female and in craniate vertebrates develops from the genital ridges of the embryo, and that in most mammals descends into the scrotum before the attainment of sexual maturity and in many cases before birth

Trabeculae: trə-ˈbek-yə-lə: one of a pair of longitudinally directed more or less curved cartilaginous rods in the developing skull of a vertebrate that develop under the anterior part of the brain on each side of the pituitary gland and subsequently fuse with each other and with the parachordal cartilages to form the base of the cartilaginous cranium

Trachea: tra·chea: the main trunk of the system of tubes by which air passes to and from the lungs that is about four inches (10 centimeters) long and somewhat less than an inch (2.5 centimeters) in diameter, extends down the front of the neck from the larynx, divides in two to form the bronchi, has walls of fibrous and muscular tissue stiffened by incomplete cartilaginous rings which keep it from collapsing, and is lined with mucous membrane whose epithelium is composed of columnar ciliated mucus-secreting cells

Turbinates: any of three thin bony plates on the lateral wall of the nasal fossa on each side with or without their covering of mucous membrane: a separate curved bony plate that is the largest of the three and separates the inferior and middle meatuses of the nose -- called also *inferior concha, inferior nasal concha, inferior turbinate, inferior turbinate bone, maxilloturbinal*

Urethra: the canal that in most mammals carries off the urine from the bladder and in the male serves also as a genital duct

Uterine Tube: (fallopian tube) either of the pair of tubes that carry the eggs from the ovary to the uterus

Uterus: an organ in female mammals for containing and usually for nourishing the young during development previous to birth that consists of a greatly modified and enlarged section of an oviduct or of the two oviducts united, that has thick walls consisting of an external serous coat, a very thick muscular coat of smooth muscle, and a mucous coat containing numerous glands, and that during pregnancy undergoes great increase in size and change in the condition of its walls -- called also *womb*

Vas Deferens: a sperm-carrying duct especially of a higher vertebrate that in humans is a small but thick-walled tube about two feet (0.6 meter) long formed by the union of the vasa efferentia, is greatly convoluted in its proximal portion, begins at and is continuous with the tail of the epididymis, runs in the spermatic cord through the inguinal canal, and descends into the pelvis where it joins the duct of the seminal vesicle to form the ejaculatory duct

Vein: any of the tubular branching vessels that carry blood from the capillaries toward the heart and have thinner walls than the arteries and often valves at intervals to prevent reflux of the blood which flows in a steady stream and is in most cases dark-colored due to the presence of reduced hemoglobin

Ventricle: cavity of a bodily part or organ: as **a :** a chamber of the heart which receives blood from a corresponding atrium and from which blood is forced into the arteries **b :** one of the system of communicating cavities in the brain that are continuous with the central canal of the spinal cord, that like it are derived from the medullary canal of the embryo, that are lined with an epithelial ependyma, and that contain a serous fluid **c :** a fossa or pouch on each side of the larynx between the false vocal cords above and the true vocal cords below

White Matter: neural tissue that consists largely of myelinated nerve fibers, has a whitish color, and underlies the gray matter of the brain and spinal cord or is gathered into nerves