

TEACHER GUIDE

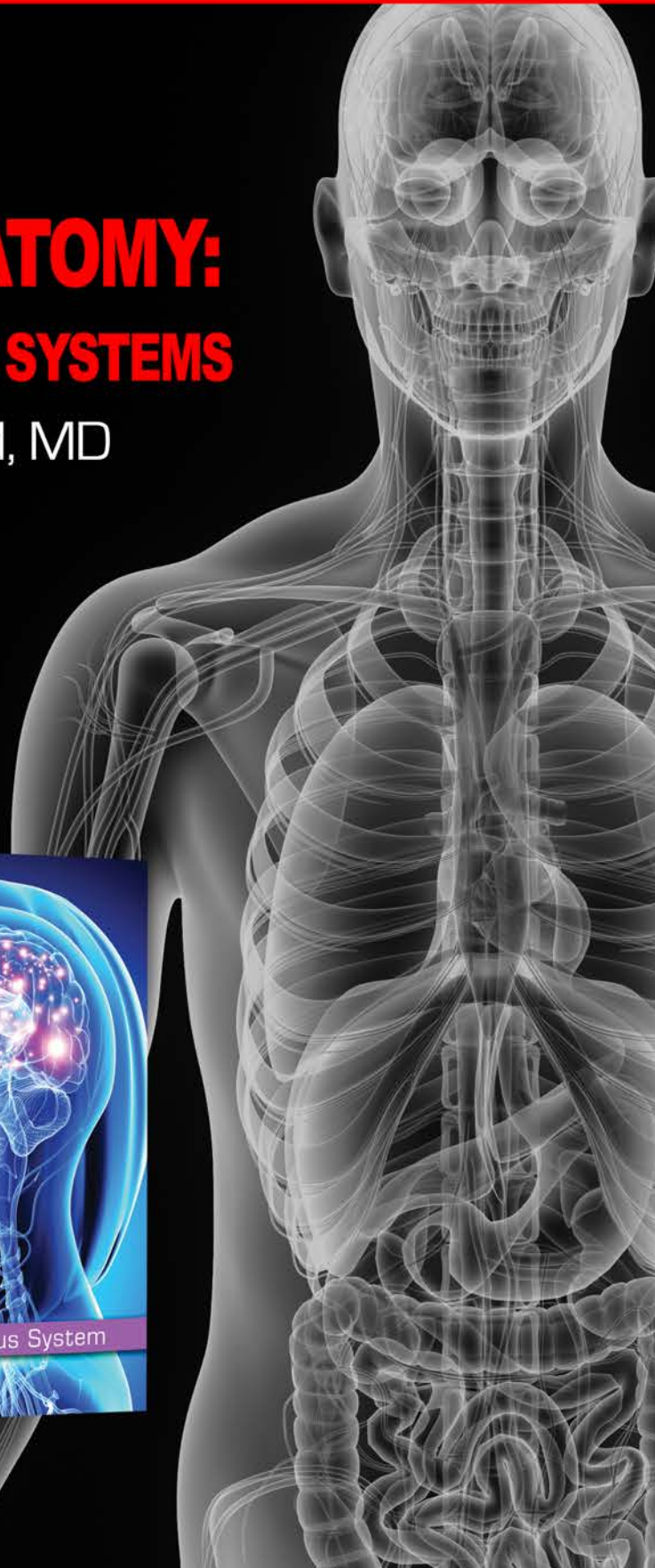
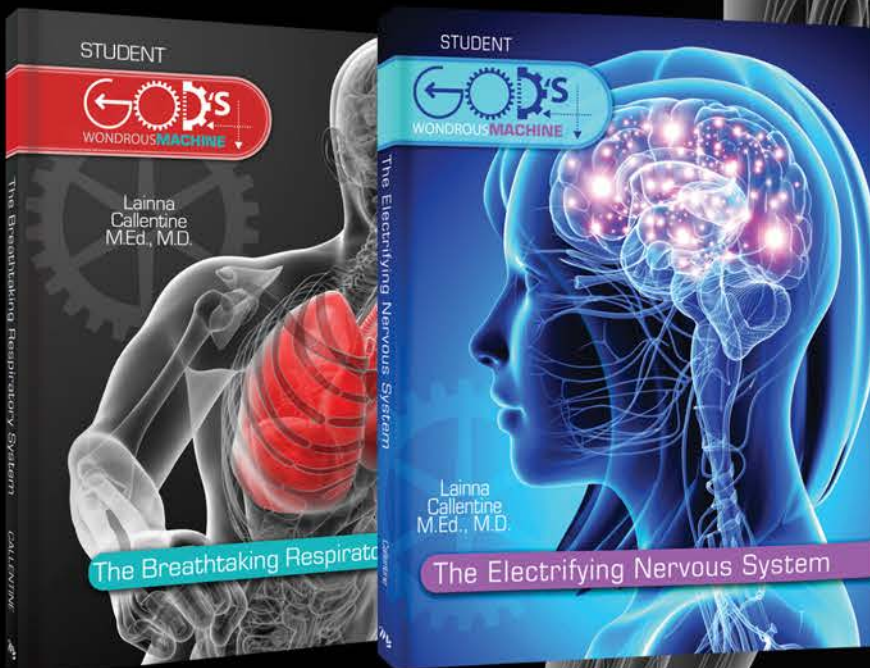
3rd-6th grade

1 year anatomy

-  Weekly Lesson Schedule
-  Worksheets & Exams
-  Activities & Supply List
-  Answer Keys

ELEMENTARY ANATOMY: NERVOUS & RESPIRATORY SYSTEMS

Lainna Callentine, MEd, MD



TEACHER GUIDE

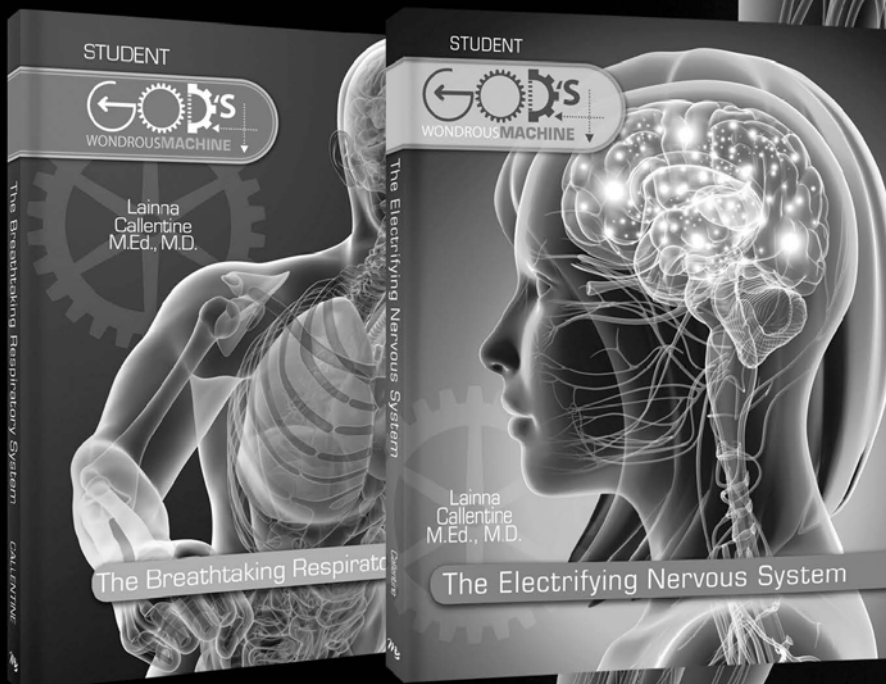
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Psalm 11:3 NKJV

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*But sanctify the Lord God in your hearts, and always be ready
to give a defense to everyone who asks you a reason for the hope
that is in you, with meekness and fear.*




1 Peter 3:15 NKJV

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Lessons for a 36-week course!







Overview: This *Elementary Anatomy: Nervous and Respiratory Systems Teacher Guide* contains materials for use with *The Electrifying Nervous System* and *The Breathtaking Respiratory System*. Materials are organized by each book in the following sections:

	Worksheets and Activities
	Semester Tests
	Answer Keys

Features: Each suggested weekly schedule has two to three easy-to-manage lessons that combine reading, worksheets, vocabulary-building, and activity opportunities. Worksheets and other Teacher Guide pages are perforated and three-hole punched — materials are easy to tear out hand out, grade, and store. As always, you are encouraged to adjust the schedule and materials as you need to in order to best work within your educational program.

Workflow: Students will read the pages in their book and then complete each section of the course materials. Space on the schedule has been given to record each worksheet, activity, and test grade. Younger students may be given the option of taking open-book tests. In addition, the teacher can determine what type of assessments they wish to utilize — from traditional tests to a compilation of activities into a portfolio.

Lesson Scheduling: Space is given for assignment dates. There is flexibility in scheduling. For example, the parent may opt for a M-W schedule rather than a M, W, F schedule. Each week listed has five days, but due to vacations the school work week may not be M-F. Please adapt the days to your school schedule. As the student completes each assignment, he/she should put an “X” in the box.

	Approximately 30 to 45 minutes per lesson, two to three days a week
	Includes answer keys for worksheets and tests
	Includes supply lists organized by activity
	Flashcards are included for vocabulary development and understanding
	Designed for grades 3 to 6 in a one-year course
	Supports active learning with fun and educational challenges

Then the Lord God formed a man from the dust of the ground and breathed into his nostrils the breath of life, and the man became a living being.

— Genesis 2:7

May your mind be open to discovering God’s handiwork and recognizing the majesty that is reflected in the human body. It will truly take your breath away.

Dr. Lainna Callentine, MEd, MD, is a physician, instructor, writer, speaker, and creator at Sciexperience, as well as volunteering her services at a clinic that serves the uninsured in the Chicago suburbs. She affirms the clinic’s motto from Galatians 5:13, “serving one another in love” and left formal medicine in the ER to homeschool her three children and pursue her passion in teaching.

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First Semester Suggested Daily Schedule

Date	Day	Assignment	Due Date	✓	Grade
First Semester–First Quarter					
Week 1	Day 1	Read Pages 7-9 of <i>Electrifying Nervous System</i> (ENS)			
	Day 2				
	Day 3	Read Pages 10-11 (ENS) • <i>practice sounding out the words and reviewing the vocabulary flash cards</i> ; Activity A1 (Pages 33-40)			
	Day 4				
	Day 5	Read Pages 12-13 (ENS) “Let’s Start at the Beginning”			
Week 2	Day 6	Read Pages 14-15 • Complete Worksheet WS21 (Pages 137-138)			
	Day 7				
	Day 8	Read Pages 16-19 (ENS) “Let’s Start at the Beginning,” continued • Bonus Activity: Back in Time (Page 89)			
	Day 9				
	Day 10	Bonus Activity: How did it happen? Short Story Challenge (Page 89)			
Week 3	Day 11	Complete Worksheets WS1–WS3 (Pages 97-102)			
	Day 12				
	Day 13	Complete Activity A3: Supercilious (Page 49)			
	Day 14				
	Day 15	Read Pages 20-21 (ENS) • Complete Worksheet WS4 (Page 103)			
Week 4	Day 16	Complete Activity A4: Techy (Page 50)			
	Day 17				
	Day 18	Read 22-23 (ENS) • Complete Worksheet WS5 (Pages 105-106)			
	Day 19				
	Day 20	Complete Worksheet WS6 (Page 107) • Complete Activity A2 (Page 41-43)			
Week 5	Day 21	Review Pages 22 and 23 and vocabulary cards • Complete Activity A7 (Page 53) or A8 (Page 54)			
	Day 22				
	Day 23	Read Pages 24-27 (ENS) • Complete Worksheet WS22 (Major Regions of the Brain Word Scramble) (Page 139)			
	Day 24				
	Day 25	Complete your choice of Worksheets WS7 (Page 109), WS8 (Pages 111-112), or WS9 (Pages 113-114)			
Week 6	Day 26	Complete your choice of Activities A9 (Page 55), A10 (Page 56), A22 (Page 69), or A24 (Pages 71-72)			
	Day 27				
	Day 28	Read pages 28-30 (ENS) • Complete your choice of Worksheets WS10 (Page 115), WS11 (Pages 117-118), or WS12 (Page 119)			
	Day 29				
	Day 30	Complete your choice of Activity A13 (Page 60) or A14 (Page 61)			

Date	Day	Assignment	Due Date	✓	Grade
Week 7	Day 31	Read pages 31-33 (ENS) • Complete your choice of Worksheets WS13 (Pages 121-122) or WS 14 (Page 123)			
	Day 32				
	Day 33	Complete your choice of Activity A15 (Page 62) or A16 (Page 63)			
	Day 34				
	Day 35	Bonus Activity: Penelope's Lost Puppy (Page 94)			
Week 8	Day 36	Read Pages 34-37 (ENS) • Complete Worksheet WS15 (Page 125)			
	Day 37				
	Day 38	Complete the activity of your choice from A17 (Page 64), A18 (Page 65), or A19 (Page 66).			
	Day 39				
	Day 40	Review your word flash cards for words from this section.			
Week 9	Day 41	Read pages 38-41 (ENS) • Complete Directional Worksheet 16 (Page 127)			
	Day 42				
	Day 43	Complete Activity A20 (Page 67)			
	Day 44				
	Day 45	Complete Activity A21 (Page 68)			
First Semester–Second Quarter					
Week 1	Day 46	Read Pages 42-43 (ENS) • Complete Activity A22 (Page 69) or A23 (Page 70)			
	Day 47				
	Day 48	Read Page 44 • Complete Activity A5 (Page 51) or A6 (Page 52) Complete Worksheet W23 (Page 141)			
	Day 49				
	Day 50	Complete Activity A24 (Pages 71-72)			
Week 2	Day 51	Read pages 45-47 (ENS) • Complete Worksheet W24 (Page 143)			
	Day 52				
	Day 53	Complete Activity of your choice • A25 (Page 73), A26 (Pages 74-75), or A27 (Pages 76-77)			
	Day 54				
	Day 55	Bonus Activity: If You Couldn't (Page 90)			
Week 3	Day 56	Read Pages 48-51 (ENS) • Complete Worksheet WS17 (Page 129)			
	Day 57				
	Day 58	Complete the Activity of your choice A28 (Page 78), A29 (Page 79), A30 (Page 80)			
	Day 59				
	Day 60	Bonus Activity: The Scary Stuff Challenge (Page 90)			

INTRODUCTION: How to Use this Guide

Let's face it. We all learn in different ways. I may be naturally talented in playing basketball. Any sport that I pick up I achieve good success . . . however, I can't carry a musical tune. In fact, I believe people would pay me *not* to sing. We all have different talents with which God has blessed us. Some things come easier than other things. As a former classroom teacher, coach, pediatrician, and homeschool mother, I have witnessed the many talents and ways that my students, players, patients, and children are gifted.

We all are gifted. God places those gifts in each of us. Although I was able to meet with a moderate amount of educational success in my formative years, it has been thwarted by many challenges. My teachers did not appreciate my particular learning style. I was not a traditional learner. Just reading a book and doing worksheets never seemed to help me gain a firm grasp on my studies. I learned best by movement, experiencing, and visualizing my lessons. I see the world in pictures. My constant doodling in class was at times not embraced by my instructors. In fact, it was viewed as a distraction and inattentiveness. This is how I learn. All through medical school, I had the "best" illustrated notes. Even to this day, during Sunday morning sermons I take artistic renditions of the pastor's message. It is through my illustrations that I understand and process what is being said to me.

How effectively we process new information determines how successfully we are able to recall that same knowledge later. The layout of this series capitalizes on hands-on activities, experiments, worksheets, and fascinating stories connecting the student to information engaging the many learning styles of children. Educational trends today focus on linguistic and mathematical abilities almost exclusively. The theory of multiple intelligences was constructed by a developmental psychologist named Dr. Howard Gardner. He is a prolific author in educational theory. His most noted work, *Frames of Mind: The Theory of Multiple Intelligences*, suggested that there are at least eight different types of human intelligence or ways of understanding the world around us. In his book, he discusses how most individuals rely on one or two dominant intelligences. In our quest to acquire knowledge to understand our Heavenly Father and the world that lies around us, it is important to strengthen all of our levels of intelligence.

The eight areas of intelligence are the following:



INTRAPERSONAL



VERBAL-LINGUISTIC



VISUAL-SPATIAL



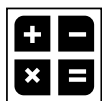
MUSICAL



BODY-KINESTHETIC











INTERPERSONAL



LOGICAL-MATH



NATURALIST

<p>INTRAPERSONAL </p> <p>These are the people who are introspective. They tend to understand themselves well. They analyze their thoughts and feelings. They enjoy individual activities. They are “self wise.”</p>	<p>VERBAL-LINGUISTIC </p> <p>These are the people who love to color the world through their words. They think in words. They learn best by writing, reading, and speaking. They are “word wise.”</p>	<p>VISUAL-SPATIAL </p> <p>These are the people who think in shapes, colors, and images. They can see the spatial relations in things and know that things will fit just by playing with them in their minds. They are “picture wise.”</p>
<p>MUSICAL </p> <p>These are the people who can pick up a tune naturally. They hear it once and instantly “get it.” They are aware of rhythms and learn best with activities that involve music. They are “music wise.”</p>	<p>LEVEL</p>	<p>BODY-KINESTHETIC </p> <p>These people have good physical awareness. They can bound on the playground from apparatus to apparatus like a billy goat scaling the side of a mountain. They are the ones who need to move, and they benefit best through hands-on discovery. They are “body wise.”</p>
<p>INTERPERSONAL </p> <p>These people enjoy working in groups and playing on teams. They enjoy their experiences best with others. They are the “people wise.”</p>	<p>LOGICAL-MATH </p> <p>These people are rational intellectuals. They can see the abstract. They work best with numbers of patterns. They are “logic wise.”</p>	<p>NATURALIST </p> <p>These people are acutely aware of the many patterns in nature. They learn best when activities involve animals, plants, and the outdoors. They are “nature wise.”</p>

You will find activities geared to the particular level of your student. Levels 1, 2, and 3 charts outline activities that pertain to the particular types of intelligences. Each of the activities and worksheets in this guide have been identified by the various learning styles. Many of these activities can be designated in multiple categories. Remember this is just a guide. The activities can be designated in other ways.

It can be very rewarding to capture your student’s interest based on his or her particular learning style and then stretch him or her to develop skills in the other intelligences. God calls us at times to step out of our comfort zone. The more we follow Him and allow that discomfort to occur . . . the more He can use us.

How to Use This Guide

This guide includes designated levels and pacing suggestions. All activities can be used at any level. For example, a kindergartener is capable of observing and participating with a dissection; such activities will need a teacher, parent, or older sibling involved to help the younger learner. Feel free to adapt the activities for your unique learners. Have fun with it.

Kit Components

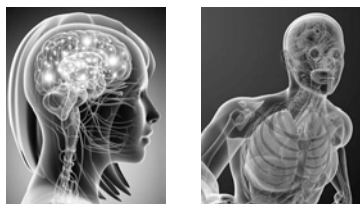
A hands-on science kit is available with each the units. These kits are not mandatory to enjoy the “God’s Wondrous Machine” series. The kits do have dissection specimens and materials to do several of the activities.

Supply Lists

You will find supply lists for the hands-on activities. Simply select the activities you would like to do with your learner, and then use the supply list to gather your materials.

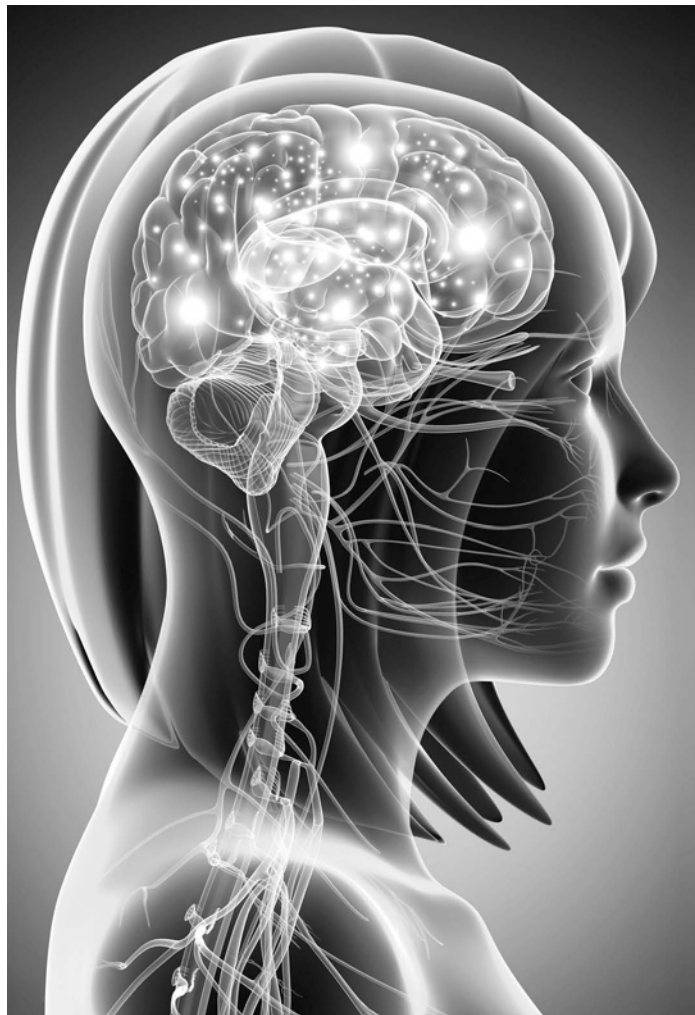
Symbols

You will note two symbols on the pages that follow:



The brain symbol is a designation found on items pertaining to the nervous system.

The respiratory symbol is a designation found on items pertaining to the respiratory system. If both symbols are on the page, then the sheets can be used with either unit.



The Electrifying Nervous System

Activities



The Electrifying Nervous System Flash Cards

Carefully cut the vocabulary cards along the dashed lines. Cards are used in multiple activities, so please store in an envelope or secure with a rubber band.

Arbor Vitae

Broca's Area

Astroglia

Cerebral Palsy

Autonomic Nervous System

Cerebral Hemispheres

Axon

Dendrites

Blood-Brain Barrier (BBB)

Dermatomes

<p>"Tree of life" located in the middle section of the cerebellum; helps to coordinate movement</p>	<p>Located on the left hemisphere; the area that houses the motor speech region where the ability to form spoken words is housed</p>
<p>A type of brain cell that supplies nutrients to the neuron</p>	<p>A group of disorders that affect the brain and nervous system function</p>
<p>Self-controlling part of the nervous system that does not require conscious thought to operate</p>	<p>The two halves of the brain, right and left</p>
<p>The part of the neuron through which electrical impulses travel away from the body of the nerve cell to other nerve cells. It is wrapped in a white fatty substance called the myelin sheath.</p>	<p>Tentacle-like structures that extend from the a neuron's cell body and reach out to other neuron cells</p>
<p>A special barrier that lies between the brain and the rest of the body. Small blood vessels and cells packed close together act as a filter that blocks unwanted materials from entering the brain.</p>	<p>Regions of skin innervated by certain nerve roots</p>

Cerebellum	Fissures
Cerebral Spinal Fluid (CSF)	Frontal Lobe
Cerebrum	Gray Matter
Corpus Callosum	Gyrus
Diencephalon	Homunculus
Ependymal Cells	Hypothalamus

<p>Located beneath the cerebral hemispheres, this area coordinates movements and contains the arbor vitae</p>	<p>Crevices on the surface of the brain</p>
<p>A fluid manufactured in the ventricles of the brain that helps transport the nutrients, chemical messengers, and waste products.</p>	<p>Lobe of the cerebellum located in the front region of the brain; controls personality, judgment, abstract reasoning, social behavior, and movement in the primary motor cortex</p>
<p>Part of the brain consisting of two large, paired hemispheres where your conscious thought processes occur</p>	<p>The thin, outer rim on the surface of the brain responsible for memory storage, processing, and conscious and subconscious regulation of the skeletal movement</p>
<p>Neurofiber tracks connecting the two hemispheres of the cerebrum</p>	<p>Rounded convolutions of the brain</p>
<p>Connected to the brain stem; contains the thalamus, hypothalamus, and pituitary gland</p>	<p>“Little Man” — a visual representation of the connection between different body parts and the areas in the brain that control them</p>
<p>Neuroglia cells that line the small cavities in the brain and produce cerebral spinal fluid</p>	<p>Located in the diencephalon; regulates body temperature and hormone production and controls feeding reflexes such as swallowing</p>

Medulla Oblongata

Occipital Lobe

Meninges

Oligodendoglia

Mescenphalon

Parietal Lobe

Microglia

Pituitary Gland

Neuroglia

Pons

Neurons

Pyrogen

<p>Area of the brain responsible for the autonomic regulation of the cardiovascular system, respiratory rate, and digestive system activities</p>	<p>Lobe of the cerebrum located in the back region of the brain; controls visual cortex</p>
<p>Tough, fibrous covering that covers the brain and anchors it in position</p>	<p>Neuroglia cells that support and insulate the axons by helping to form the myelin sheaths that protect the neuron</p>
<p>Located under the diencephalon; sorts through the visual and auditory data that are received by the brain</p>	<p>The lobe of the cerebrum located between the frontal and occipital lobes; responsible for conscious perception of touch, pressure, vibration, pain, taste, temperature, and memory, as well as conscious and subconscious regulation of skeletal muscle</p>
<p>Neuroglia cells that eat micro-organism invaders and waste products that invade or are produced by the neurons</p>	<p>Located in the diencephalon; secretes hormones that oversee growth during childhood and the onset of puberty</p>
<p>"Neuron Glue" — four types of cells that "glue" neurons together, including astroglia, ependymal cells, microglia, and oligodendroglia</p>	<p>"Bridge" located in front of the cerebellum; connects the cerebellum with the thalamus and helps relay sensory information between structures</p>
<p>Most fundamental unit of the nervous system; communicates by electrical impulses</p>	<p>A substance released to cause the hypothalamus to dial up the internal thermostat, causing a fever</p>

Shingles

Ventricles

Temporal Lobe

Wernicke's Area

Thalamus

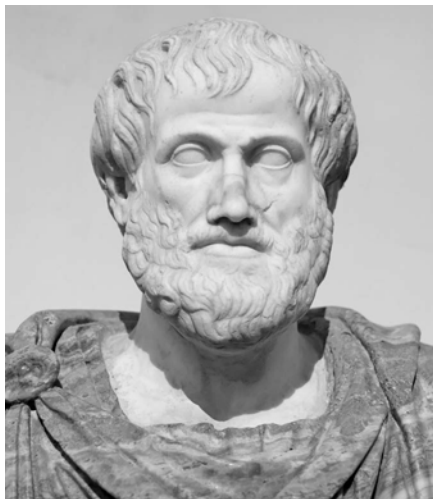
White Matter

<p>A disease caused by the chicken pox virus that goes dormant in a spinal nerve root and is reactivated from time to time, causing problems in that particular dermatome</p>	<p>Produces cerebrospinal fluid in the brain</p>
<p>The lobe of the cerebrum located in the side region of the brain; controls auditory cortex, olfactory cortex, and language comprehension</p>	<p>Located in the temporal region; interprets what one hears and makes sense of spoken communication</p>
<p>Located in the diencephalon; relays and processes sensory information to various destinations</p>	<p>Located beneath the gray matter; houses the neurological nerve tracts</p>



Timeline Shuffle

Cut out the following images and paste them in the appropriate spot on the timeline (page 45-47).



Aristotle



Christ



Andreas Vesalius's
De humani corporis fabrica



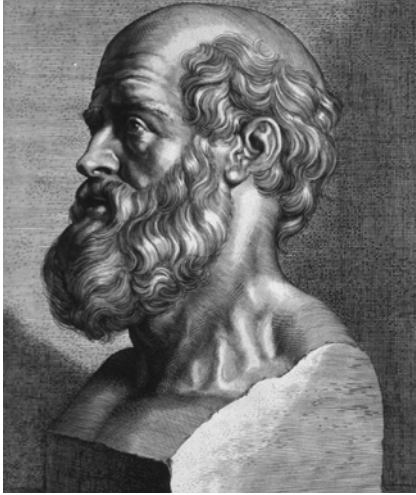
Dr. Alice Hamilton
Lead Poisoning



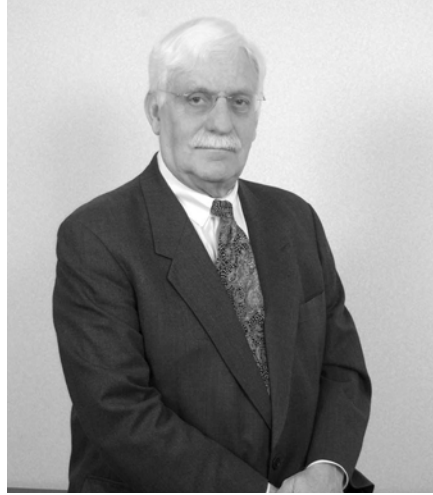
Edwin Smith Papyrus



Dr. Paul Broca



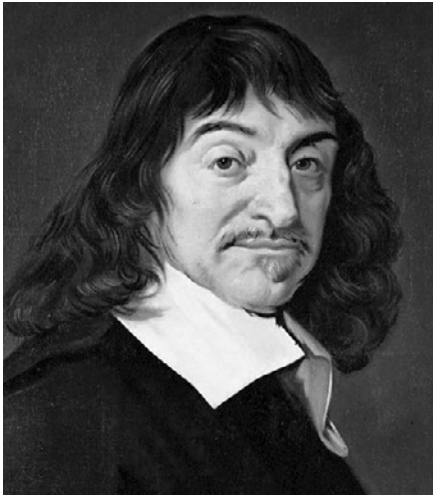
Hippocrates



Dr. Raymond Damadian



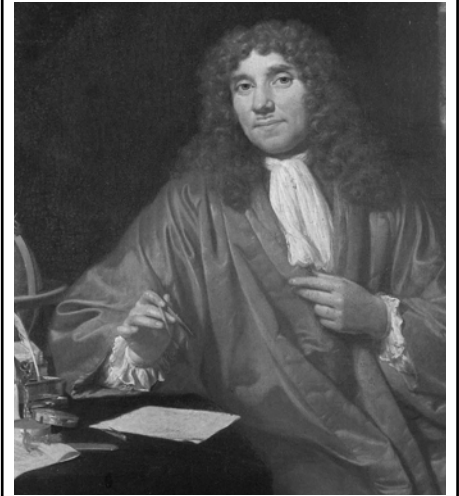
Dr. Wilder Penfield



Rene Descartes

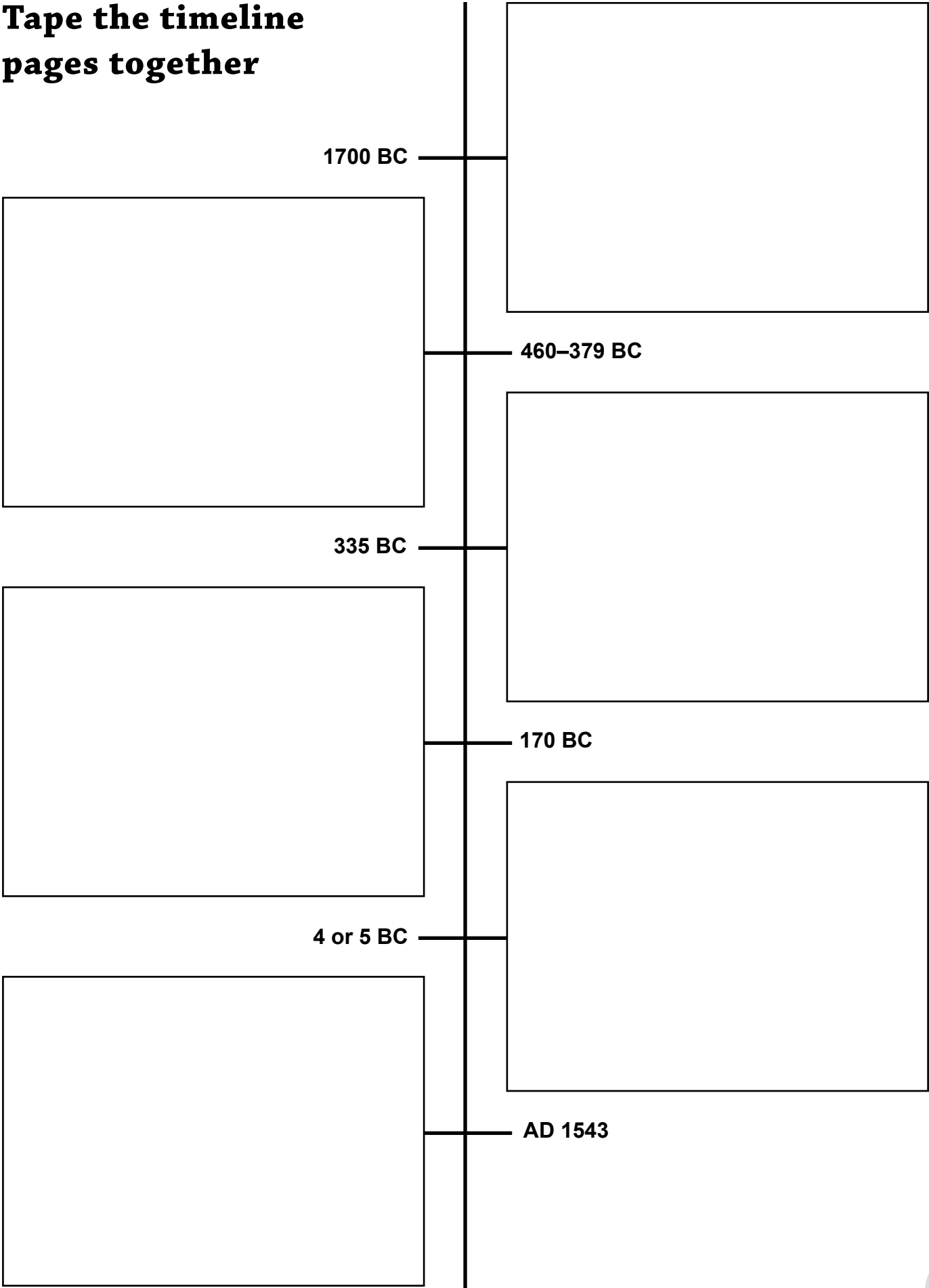


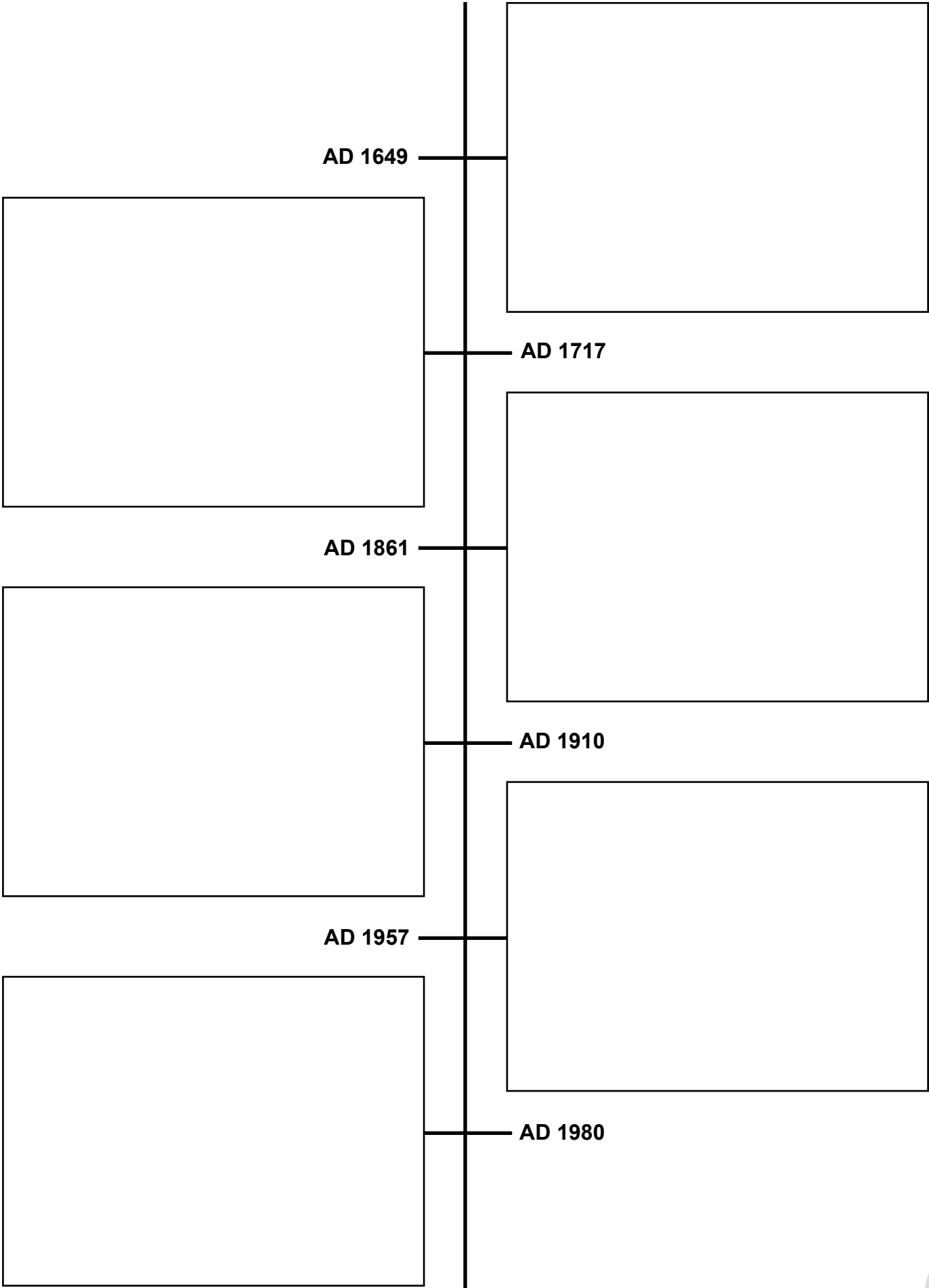
Galen



Anthony Van Leeuwenhoek

Tape the timeline pages together





AD 1649

AD 1717

AD 1861

AD 1910

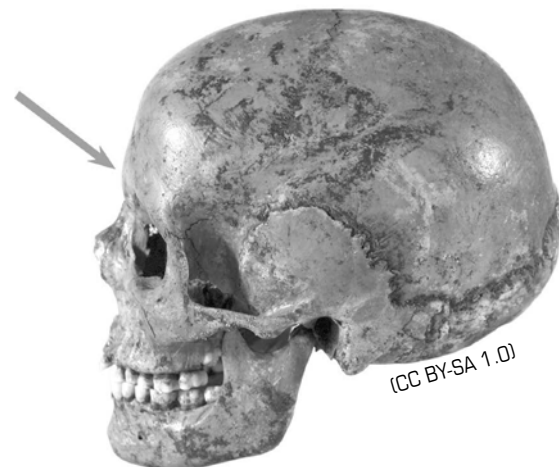
AD 1957

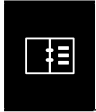
AD 1980



Supercilious

Here is an intellectual play on words. There is a ridge above the eye sockets in the skull called the *superciliary ridge*. What does it mean when someone describes a person as acting in a *supercilious* way? How are these two terms — superciliary ridge and supercilious — related?





Techy

MRI (Magnetic Resonance Imaging), CAT (Computerized Tomography), and PET (Positron Emission Tomography) scans have become valuable tools for peering into the body. Physicians use these tools to diagnose problems inside the brain without performing surgery. Write a report describing the difference between these diagnostic tools and describe how they relate to the brain and the nervous system.



Answer Keys

Elementary Anatomy Worksheet Answer Keys

The Electrifying Nervous System

Activity 2

1700 BC - Edwin Smith papyrus

460-379 BC - Hippocrates

335 BC - Aristotle

170 BC - Galen

4 or 5 BC - Christ

AD 1543 - Vesalius

AD 1649 - Rene Descartes

AD 1717 - Anthony Van Leeuwenhoek

AD 1861 - Dr. Paul Broca

AD 1910 - Dr. Alice Hamilton

AD 1957 - Dr. Wilder Penfield

AD 1980 - Dr. Raymond Damadian

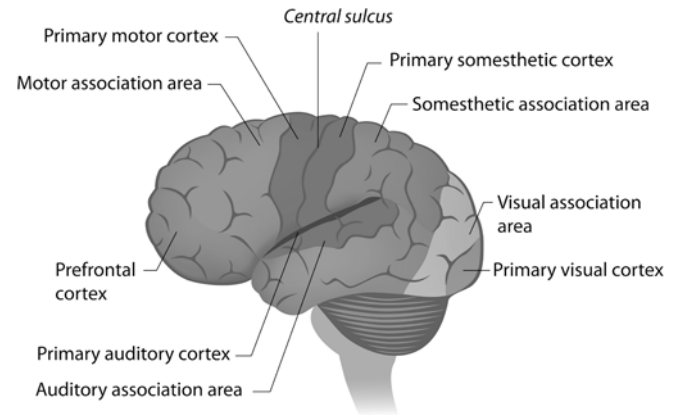
Activity 12

Corpus Callosum	Connects the two hemispheres of the brain
Optic Chiasm	Relays visual signals across the brain
Hypothalamus	Regulates body temperature, sleep, and puberty
Pituitary Gland	Secretes hormones
Medulla Oblongata	Regulates breathing, swallowing, and heart rate
Cerebellum	Coordinates movement, balance, equilibrium, and posture
Parietal Lobe	Memory storage and perception of touch, pressure, vibration, pain, taste, and temperature
Frontal Lobe	Reasoning and Personality
Occipital Lobe	Visual processing
Pineal Gland	Regulates melatonin
Thalamus	Relays and processes sensory information

Activity 15

cerebrum, cerebellum, diencephalon, mesencephalon, medulla oblongata

Activity 18



Activity 27

- Yarn: spinal nerves
Disks: intervertebral disks
Spools: vertebra
Straw: spinal cord
- Disks serve to give support and protection to the spinal cord. Intervertebral disk support and connect the vertebra, helping keep them from rubbing against one another.

Worksheet 1, 2, and 3

Answers will vary according to the Bible version used.

Worksheet 4

Fill in the blanks:

- computerized tomography, bone injuries, lung/chest problems, cancers
- electroencephalogram, electrical activity, brain
- magnetic resonance imaging, scanners, fields, waves
- positron emission tomography, radioactive tracers, active

Worksheet 5

Fill in the blanks:

dendrites; axon; myelin sheath; neuron; Neuroglia

Matching:

3; 1; 4; 2

Name the parts of a neuron:

- central cell body

- dendrites
- axon

Worksheet 6

Fill in the associated boxes. (Nervous System divided into 2 parts.)

Central Nervous System > Brain and Spinal Cord
 Peripheral Nervous System > All the nerves that connect to the Brain and Spinal Cord

What are the four types of neurological cells?

- Astroglia
- Ependymal cells
- Microglia
- Oligodendroglia

Draw a cartoon:

- Store grocer
- Blanket or liner
- Garbage collector
- The protector

Worksheet 7

Color and label the parts of the brain.

- Cerebral Cortex
- Thalamus
- Hypothalamus
- Corpus callosum
- Pituitary
- Spinal cord
- Cerebellum
- Midbrain
- Brain stem

Worksheet 8

Fill in the blanks:

cerebral hemispheres, cerebrum, gray matter, white matter, Corpus callosum

Matching:

2, 4, 1, 3

- (Answers may vary.) The gray matter is the outer rim on the surface of the brain. The white matter lies deeper than the gray matter. It is the area in which neurological nerve tracts are housed. (See page 17.)

- (Answers may vary.) The brain of a child has the ability to reorganize neural connections. If one part of the brain is injured, then other areas of the brain may be retrained to take over the functions of the damaged area.

Worksheet 9

- Answers will vary — but be sure the student specifies the qualities or reasons why he or she feels he or she is either a right- or left-brained person.
- A variety of answers would be acceptable, but they need to be focused on how conflict occurs — for example, a left-brained person uses facts while a right-brained person uses an imaginative explanation.
- Be sure the student has read the verses and can articulate aspects of what they present. For example, Matthew 18:15 speaks of working out conflict privately first and then gives additional steps to follow if the conflict is not resolved.

Worksheet 10

The diary entry should not be just written as a collection of facts — the exercise is designed to give the student an imaginative attempt to step back into history and be part of a big event and then share it from a personal perspective in a diary. So the tone should be personal, but there should be some additional details from the research that help make the scene described more realistic.

Worksheet 11

The drawings will vary per student — but they have to demonstrate or reflect a function. However, each needs to reflect that specific area of the cerebrum and what it controls.

Lobes	Function
Frontal Lobe	Personality, judgment, abstract reasoning, social behavior: location of the primary motor cortex, which controls movement