

Science 5

for Young Catholics



SCIENCE 5

FOR YOUNG CATHOLICS

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CHAPTER 1:

BONES AND MUSCLES

- I. The Skeletal System**
- II. Primary Functions of the Skeletal System**
- III. Helping Bones Move**
 - A. Joints, Ligaments, Tendons
 - B. Kinds of Joints
 - C. Other Types of Synovial Joints
- IV. Bones in General**
 - A. Kinds of Bones: Compact Bones and Cancellous Bones
 - B. Inner Part of Large Bones
 - C. Bone Development
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- V. Major Bones**
 - A. The Skull
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- VI. Bone Health and Natural Healing with Vitamin D**
- VII. The Muscular System: Kinds of Muscles**
 - A. Skeletal Muscles
 - B. Smooth Muscles
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- IX. Muscle Shapes and Contractions**
- X. Muscles: Healthy and Otherwise**
 - A. Keeping Muscles Healthy
 - B. Skeletal Muscle Injuries
 - C. Muscle Disease

CHAPTER 1

BONES AND MUSCLES

I. The Skeletal System

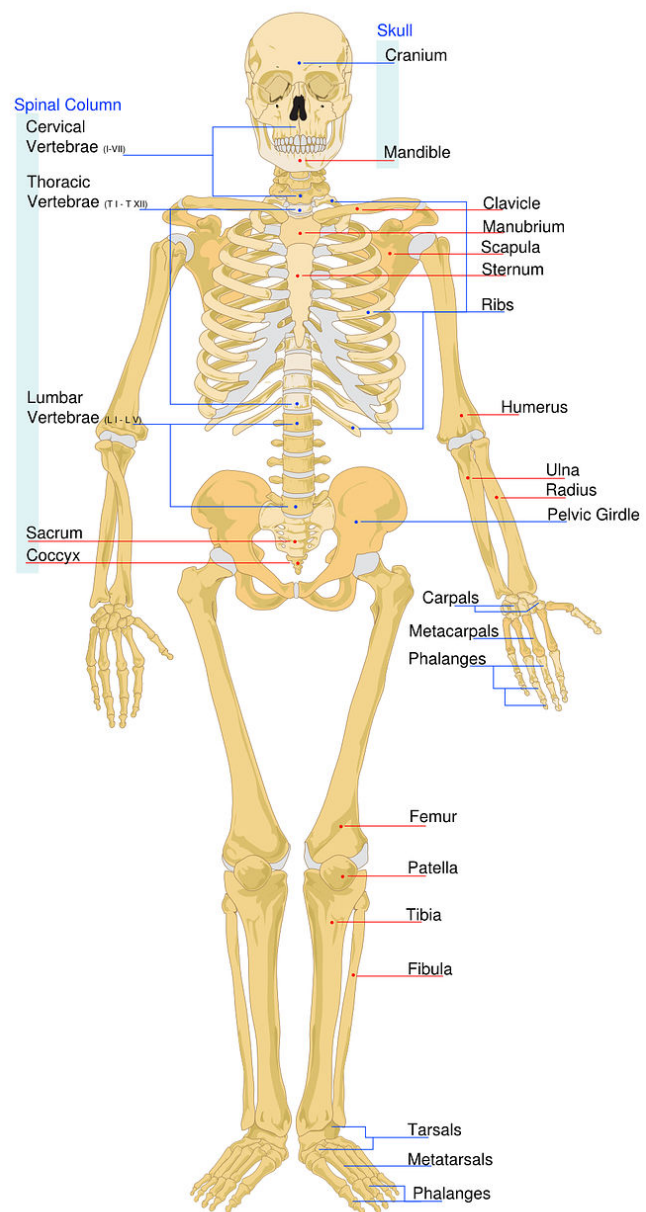
Every building structure has a foundation to give it support and strength. The human body is no different. God created the human body with a strong bone foundation. Unlike a building, though, the body's bone foundation can move, grow, and even heal itself! The amazing foundation that God has designed for the human body we call the skeletal system.

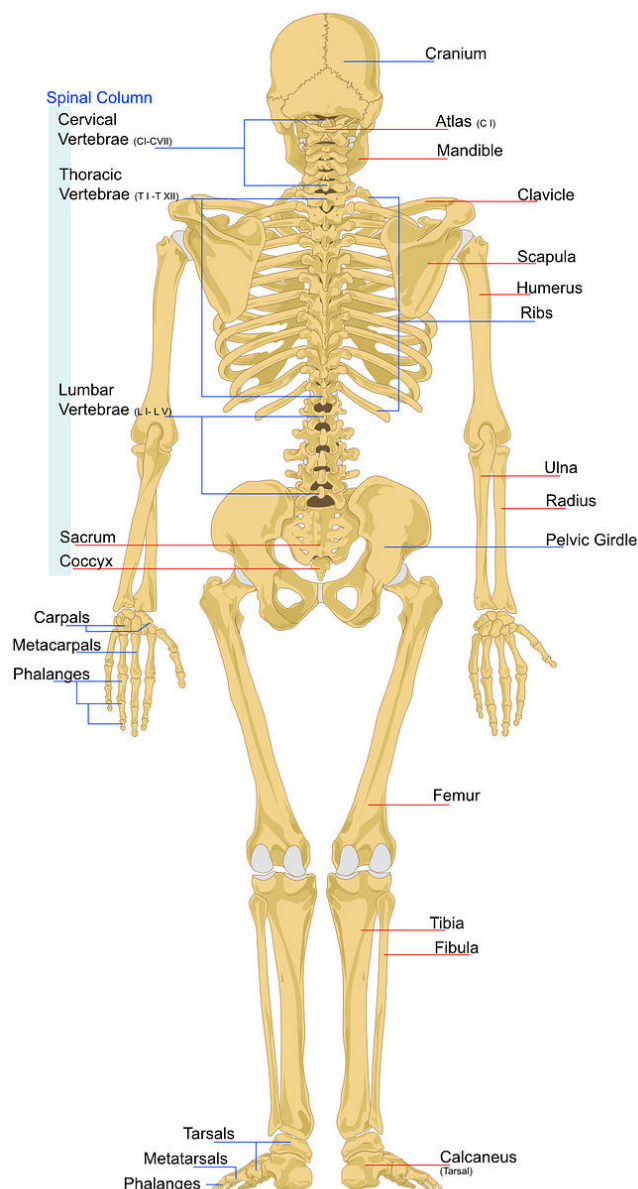
Perhaps you think of a Halloween costume when you think of a skeleton! The skeleton is supposed to be something fun, or funny, and in the dark, a little scary! If you have seen a model of a human skeleton in a museum, it may have looked like an elaborate, three-dimensional puzzle, maybe something you would rather avoid.

Actually, your own body's skeleton is much more than anything we can imagine. The human skeleton is totally miraculous, as any doctor who has studied the human skeleton will tell you. The adult human skeleton is made up of about **206 bones!** That in itself is hard to believe! Each bone God has designed to serve a specific function. God has an important purpose for each part of our skeleton.

The bones of the human skeleton are classified as either axial (AX-ee-uhl) or appendicular (app-en-DICK-you-lar). Now we are going to get a little scientific here, and learn something really special about our bones! The **axial** bones make up our head, neck, and trunk (chest and back bones). These are the bones that are along the *axis* of the human skeleton. The **appendicular** bones make up our limbs (that is, our arms and legs), as well as the shoulder blades and the pelvis. Thus, these bones include our *appendages* and those parts (shoulder blades and pelvis) that connect them to the axial part of the skeleton.

Axial and appendicular may be new words for you, but this is a science book, so we are going to discuss scientific terms! If you write those words down in a notebook, as well as any new vocabulary words you find in this book, your brain and your fingers will help you to remember the spelling and the pronunciation of new scientific words.





II. Primary Functions of the Skeletal System

Much like the stem of a plant, one of the **primary functions of our bones** is to **support** our body and **give shape** to our body. Many bones, such as the skull and rib cage, are vital for **protecting** fragile organs like the brain and the heart. In addition, the bones work together with the muscles to give us the **power** to move. One thing we often forget is that our bones **create blood cells** and **store minerals** our body needs. Most of us forget that the tiny bones in our ears allow us **to hear!** If you have grandparents who have trouble hearing,

you should be able to appreciate the importance of those tiny bones in your ears!

III. Helping Bones Move

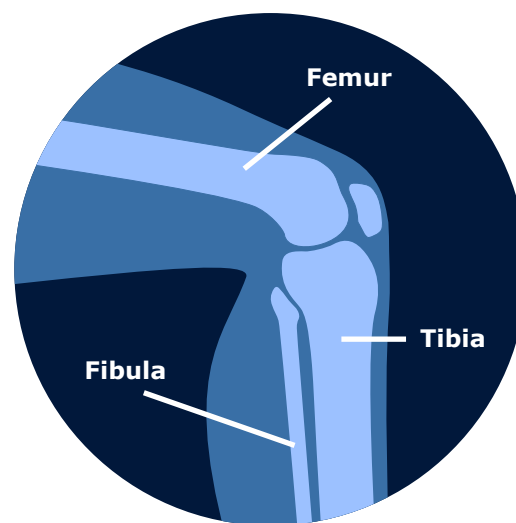
A. Joints, Ligaments, Tendons

The most important function of the skeletal system is to help people move their bodies. However, most bones are stiff and inflexible, they cannot move by themselves. God has given our bodies help to move our bones. Joints are strong connections that join a bone to another bone; without joints, we could not move our bones at all! Ligaments are tough bands of tissue that fasten bones together. Tendons are connective tissues that connect bones to muscles.

B. Kinds of Joints

There are numerous types of joints in the human body that facilitate movement, known as synovial (sih-NOH-vee-uhl) joints. Three well-known types of synovial joints are hinge joints, pivot joints, and ball-and-socket joints. Our bodies also have fixed joints that do not move, such as many joints in our skulls.

Hinge joints allow movement only along one plane. Examples of hinge joints are the knee and elbow joints, which allow the arms and legs to bend back and forth in one direction.



The bones of the upper and lower leg come together at the knee in a hinge joint.



Pivot joints allow for rotation. An example of a pivot joint is at the top of your spine, where it meets the skull. It allows you to rotate your head from side to side.

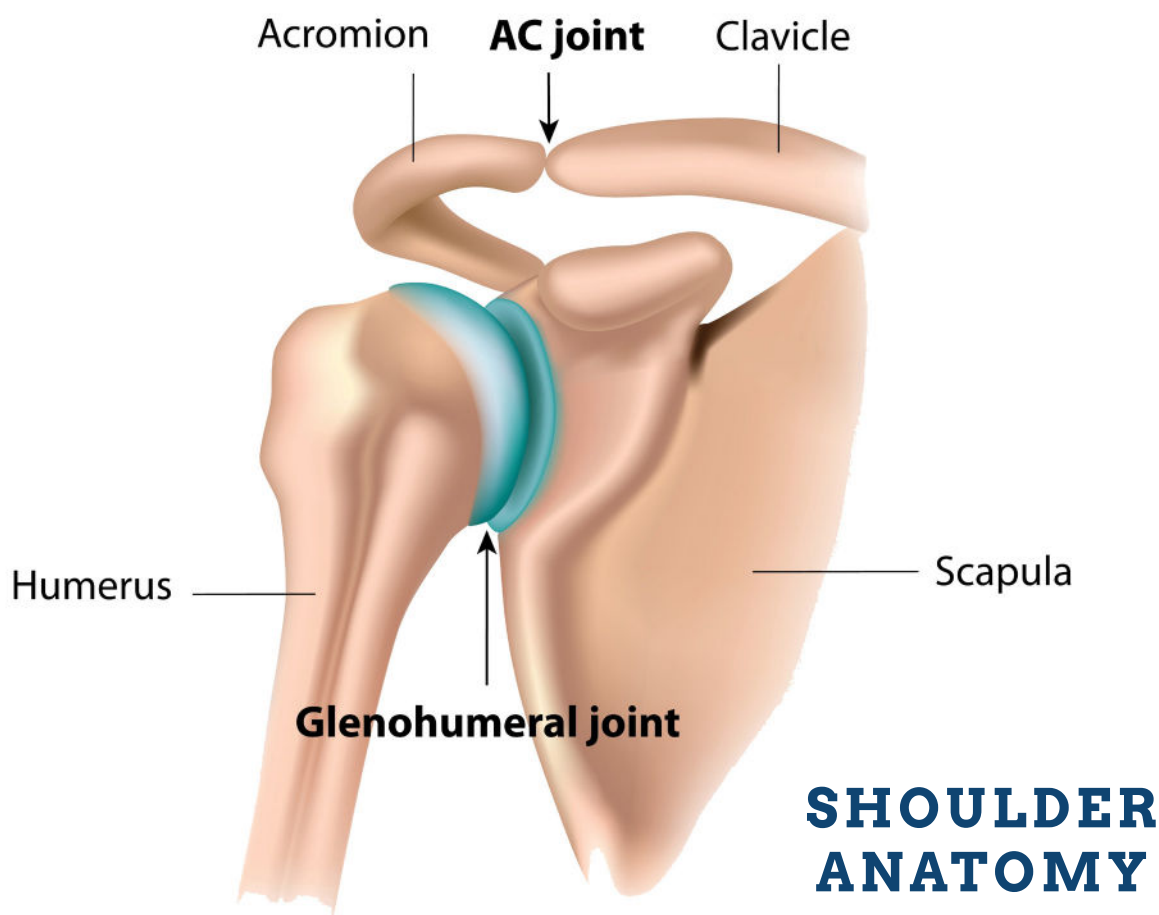
Ball-and-socket joints allow for a much wider range of movement. In a ball-and-socket joint, a rounded part of one bone fits into the hollow part of another bone. Move your shoulder around slowly in as many directions as you can. It has a much greater range of movement than your knee or elbow. The shoulder is an example of a ball-and-socket joint.

C. Other Types of Synovial Joints

There are three other types of synovial joints that help us move our bones. **Plane joints**, or gliding joints, allow for gliding or sliding movements. Most of these allow for movement only along one plane. **Condylloid** (KON-dil-oyd) joints, such as

those found in the knuckles of our fingers, allow for movement along two planes. **Saddle joints** are shaped like a saddle and also allow movement along two planes. The joint at the base of the thumb is a saddle joint.

Joints are a critical part of the skeletal system. With 206 bones connecting to make up the “puzzle” of our skeleton, God created our joints with the same precision He used to create our bones. Each bone and joint is specially designed to fulfill its specific purpose. Our skeleton gives us an amazing ability for all kinds of movement; it is truly a testimony to God’s love for us! Think about acrobats and their amazing ability to stretch their joints to the utmost! Think about your own gymnastic tricks and how so many of your joints help you to do amazing gymnastic tricks as well as play various sports!





REVIEW QUESTIONS

1. How many bones make up the skeletal system?

2. In what two groups are bones classified?

3. Name three functions of the skeletal system.

4. What are joints?

5. What are the three main types of synovial joints that allow movement?

Optional: How do you use your bones, muscles, and joints for any sports activities?

IV. Bones in General

As mentioned in the last section, the skeletal system is primarily made up of bones. What are the different kinds of bones. What exactly are bones? What are they made of? How do they grow? What are their different shapes?

A. Kinds of Bones: Compact Bones and Cancellous Bones

Bones are the hard parts of the skeleton of the body. The bones of the human body contain two layers. **Compact bone** is the dense outer layer of

a bone, and **cancellous bone** is the spongy inner layer of a bone. Bones are made up mostly of two materials: collagen and calcium phosphate. The **collagen** gives the bone a soft framework, while the **calcium phosphate** gives it strength and hardness. Bones are actually an important source of calcium for the whole body. Bones release calcium into the blood stream whenever it is needed. We often don't think about the importance of milk! Milk provides the calcium needed not only for strong bones, but also for the calcium needed in our blood which is provided by our bones!



CHAPTER 4:

BRAIN AND NERVES

- I. Introduction**
 - A. The Nervous System
- II. Central Nervous System**
 - A. The Brain
 - B. The Spinal Cord
- III. Parts of the Brain**
 - A. Cerebrospinal Fluid
 - B. Cerebrum
 - C. Cerebral Cortex
 - D. Hemispheres
 - E. Cerebral Lobes
 - F. Cerebellum
 - G. Brain Stem
 - H. Hypothalamus
 - I. Pituitary Gland
- IV. Nerves**
 - A. Neurons
 - B. Sensory Nerves and Motor Nerves
 - C. Autonomic Nerves
 - D. Cranial Nerves
- V. Peripheral Nervous System**
 - A. Somatic Nervous System
 - B. Autonomic Nervous System
 - C. Reflexes
- VI. Nervous System Disorders**
 - A. Brain Tumor
 - B. Epilepsy
 - C. Stroke
 - D. Parkinson's Disease
 - E. Meningitis
- VII. Nerve Damage**
 - A. Concussion
 - B. Pinched Nerves
- VIII. Mental Illness**
 - A. Chemical Imbalance
 - B. Traumatic Brain Injury
 - C. Dementia
 - D. Healthy Activities
 - E. Diet
 - F. Prayer
- IX. Keep a Healthy Nervous System**
 - A. Diet
 - B. Consistent Exercise
 - C. Avoid Injury to Spinal Cord
 - D. Avoid Injury to Head
 - E. Keep Brain Stimulated
 - F. Daily Prayer

CHAPTER 4

BRAIN AND NERVES

I. Introduction

We use computers for many things. Computers manage data, navigate airplanes, control automobile systems, and much, much more. With all the amazing things computers can do, none can even begin to compare with the greatest super-computer ever designed: the human brain. All the mechanical computers we use were designed and built by humans using their brains. God Himself designed the amazing human brain.

A. The Nervous System

The **brain** is the most important part of the body's nervous system. The nervous system is responsible for regulating all the other parts of the body. **Nerves** are another part of the nervous system. A system of nerves sends messages from all the parts of the body to the brain, and then messages are sent back again from the brain.

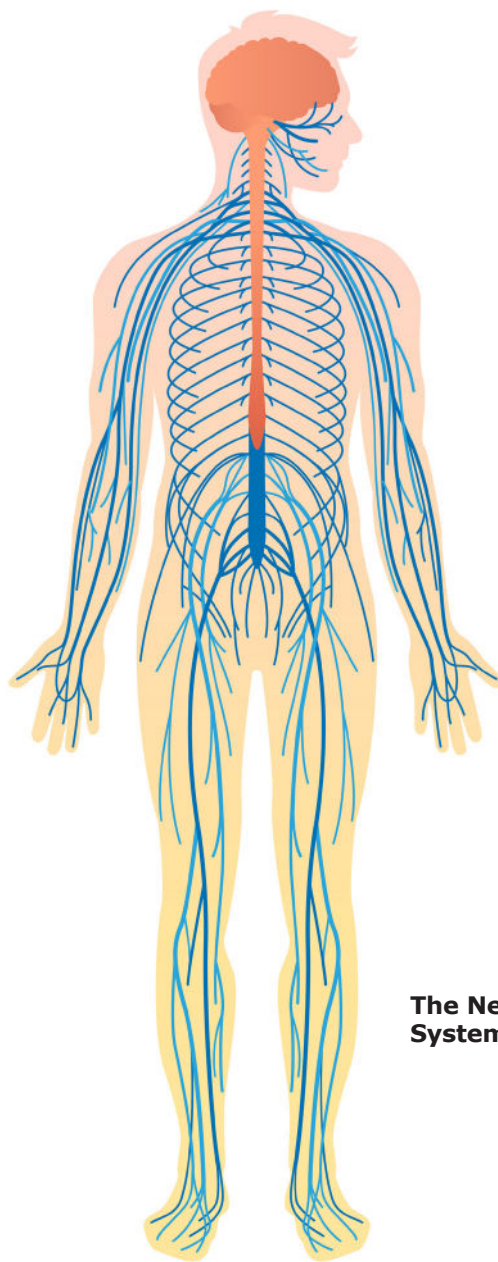
We use our nervous system for both voluntary and involuntary actions. Every time we walk, or move any body part, the nervous system is involved. We use our nervous system to speak, as well. When we get hurt, we feel pain because of the messages our nerves send to the brain.

Even our spiritual faculties make use of our nervous system. The intellect with which we think and the will with which we make decisions are both faculties of the invisible soul. Yet, we use our bodies to exercise what we think with the intellect and what we decide with the will. Thinking and decision-making take place in the brain.

You may have heard someone say, "Use your brain." We use that amazing bodily organ, the brain, to perform functions that essentially come from the soul. For example, when you pray a Rosary, you are doing something very spiritual, and yet you need

your brain to hear and remember the prayers and to speak the words. Your body and soul work together.

The nervous system is truly a mysterious and amazing display of God's loving and wonderful design of the human body. We study the nervous system in more detail in this chapter.



The Nervous System



St. Dymphna

St. Dymphna (DIMF-nuh) is the patron saint of those with nervous-system diseases and mental disorders. Dymphna was born in Ireland in the seventh century to a pagan father and Catholic mother. She grew up as a pious and prayerful child, and consecrated herself to God. When her beloved mother died, however, her father became mentally ill! He decided he wanted to marry Dymphna, his own daughter! Dymphna fled to Belgium to escape her father. When her father tracked her down, Dymphna's refusal to go with him led him to an insane rage, and he killed her, his own daughter!

After Dymphna's death, miracles of healing began to be reported from those who prayed to her, especially for those with nervous-system diseases or mental disorders. People from many countries in Europe started to make pilgrimages, or long trips, to visit Dymphna's burial ground, and ask for her intercession for their illnesses. Because of her holiness and the miracles that were granted to those who prayed to her, the Catholic Church declared her a saint. St. Dymphna is a heroic witness of purity, courage, and devotion to God. Now she prays for us in His presence in Heaven.



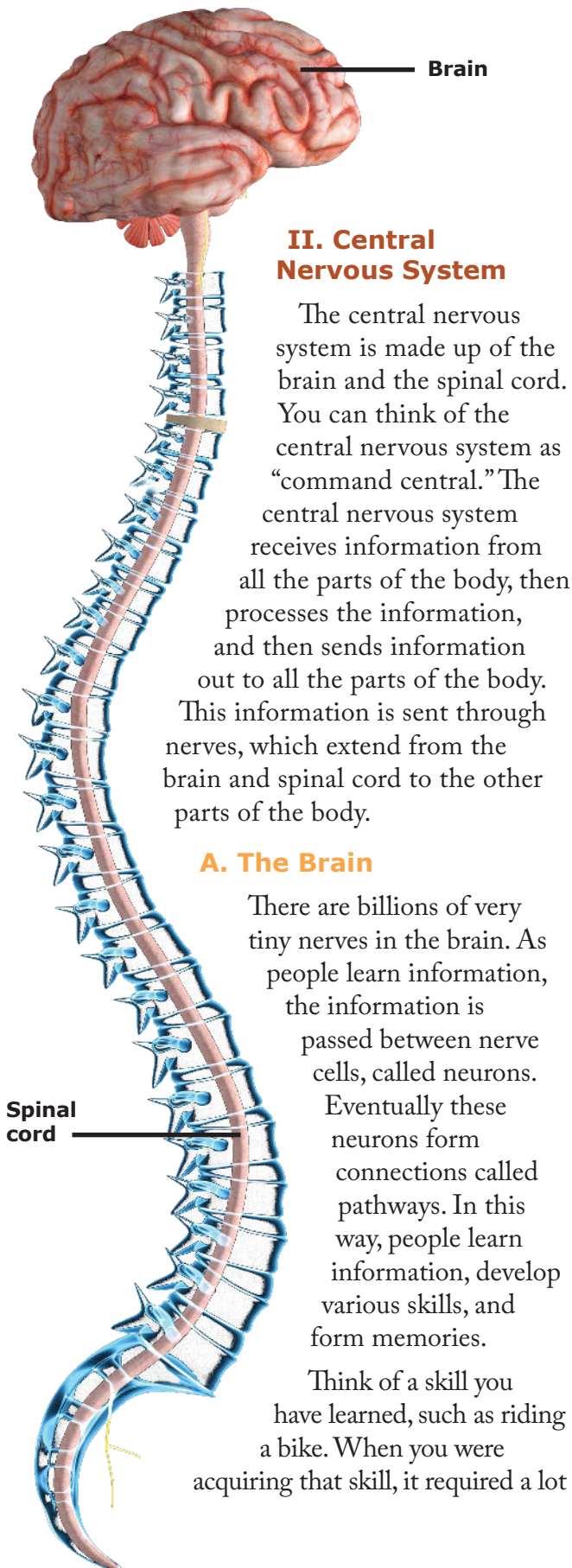
St. Dymphna is the patroness of those with nervous-system diseases and mental disorders.

REVIEW QUESTIONS

1. What is the nervous system?

2. Name two parts of the nervous system.

3. How does your brain help you to pray the Rosary?



II. Central Nervous System

The central nervous system is made up of the brain and the spinal cord. You can think of the central nervous system as “command central.” The central nervous system receives information from all the parts of the body, then processes the information, and then sends information out to all the parts of the body. This information is sent through nerves, which extend from the brain and spinal cord to the other parts of the body.

A. The Brain

There are billions of very tiny nerves in the brain. As people learn information, the information is passed between nerve cells, called neurons. Eventually these neurons form connections called pathways. In this way, people learn information, develop various skills, and form memories.

Think of a skill you have learned, such as riding a bike. When you were acquiring that skill, it required a lot

of concentration and you made a lot of mistakes at first. However, as you kept practicing, pathways were created between the nerve cells in your brain. Before long, you could ride a bike without even thinking about it. Riding a bike became “second nature.”

When you were born, you had all the nerve cells you ever will have, but many connections between the nerve cells had not been made yet. Children’s brains are very adaptable and ready to grow and develop. God has designed the brain so that, as it develops, one part can acquire the function that normally belongs to another part, especially if there has been damage done to the first part.

As we age, it is more difficult for one part of the brain to help another damaged part. It is important to continue reading, learning, and stimulating the brain as we grow in different ways so that the brain stays strong, alert, and is able to continue to make new nerve brain pathways more easily.

B. The Spinal Cord

Another part of the central nervous system is the spinal cord. The spinal cord is a thick bundle of nerves that comes from the brain and runs down the spinal column. An adult’s spinal cord is usually



between 17 and 18 inches long and about three-fourths of an inch thick.

The thick bundle of nerves in the spinal cord is protected by the vertebrae, the 33 small bones in the spinal column. The spinal nerves run out from the spinal cord to the different parts of the body. The spinal cord is divided into 31 different segments, out of which nerves emerge to the right and the left of the body.

Besides the bones of the spinal column protecting it, the spinal cord is protected by three layers of tissues called meninges (meh-NIN-jeez). The meninges protect the brain as well as protecting the spinal cord.

The spinal cord is also cushioned by a fluid called cerebrospinal (suh-REE-bro-SPINE-uhl) fluid. Obviously, God's plan is to give great protection to the spinal cord through bones, tissues, and fluid.

If a person's spinal cord is damaged, as sometimes occurs in accidents, paralysis may result. The location of the damage done to the spinal cord may determine how much of the body becomes paralyzed. For example, if the damage happens very low in the spinal column, perhaps the person may lose the use of his legs. If the damage is higher up, more function is likely to be lost. You can see why it is so important to take extra care for the entire central nervous system—the brain and the spinal cord.



The brain contains billions of neurons like these.

REVIEW QUESTIONS

1. What two main parts make up the central nervous system?

2. What are “pathways” in the brain?

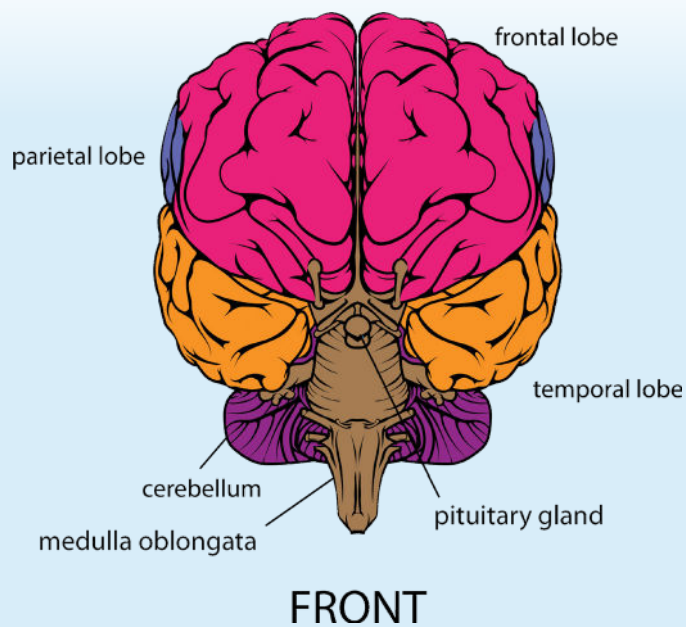
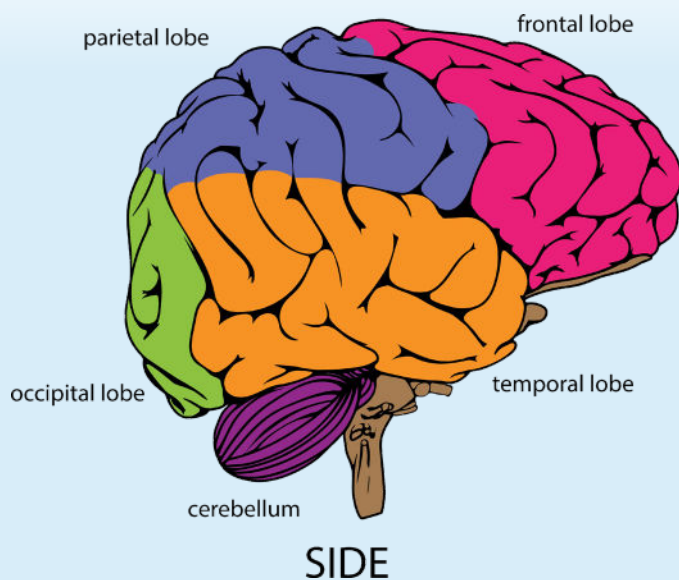
3. What is the spinal cord?

4. What is one possible consequence of a damaged spinal cord?

III. Parts of the Brain

The body’s super-computer, the “captain” of the central nervous system, is the brain. The brain is an organ in the head that weighs about three pounds. The brain contains more than 100 billion nerves,

and trillions of **synapses** (sih-NAP-seez), which are the connections, or “pathways” between nerve cells. The brain is protected by the bones of the skull, and also a layer of tissue called **meninges** and cerebrospinal fluid.





CHAPTER REVIEW ACTIVITY

SECTION A

➤ Use the words in the word box to complete the sentences.

brain	endocrine	exocrine	glands
hormones	hypothalamus	metabolism	pancreas
target cells	thymus		

1. _____ are organs that release fluids or hormones.
2. An _____ gland releases its substance through a duct.
3. An _____ gland releases hormones directly into the bloodstream.
4. Chemical messengers that affect the activities of other parts of the body are called _____.
5. Hormones interact only with their _____.
6. _____ refers to the rate at which a person obtains energy from the food he or she eats.
7. The hormones secreted by the _____ regulate the function of the pituitary gland.
8. The _____ has both exocrine and endocrine functions.
9. The _____ shrinks as a person ages.
10. The pineal gland is located in the _____.



CHAPTER REVIEW ACTIVITY

SECTION B

➤ Fill in the following two tables with the glands from the word box.

adrenal	lachrymal	mammary	pancreas
parathyroid	pineal	pituitary	prostate
salivary	sebaceous	sweat	thymus
thyroid			

Exocrine Gland

Description

- | | |
|-----------|--|
| 11. _____ | Responsible for producing tears |
| 12. _____ | Produces saliva |
| 13. _____ | Produces an oil that protects the hair and forms a water-repellent layer on the skin |
| 14. _____ | Produces a fluid that helps keep a person from overheating |
| 15. _____ | Produces milk for the nourishment of babies |



CHAPTER REVIEW ACTIVITY

Exocrine Gland

Description

- | | |
|-----------|---|
| 16. _____ | Releases human growth hormone |
| 17. _____ | Regulates a person's sleep-wake cycle |
| 18. _____ | Releases hormones that regulate the body's metabolism |
| 19. _____ | Releases a hormone primarily responsible for controlling the amount of calcium in the blood |
| 20. _____ | Aids in the maturing of T cells |
| 21. _____ | Responsible for the production of adrenaline |
| 22. _____ | Helps maintain healthy blood sugar levels |
| 23. _____ | Men should monitor their risk of cancer of this gland |

SECTION C

➤ **Complete the following exercises on the lines provided.**

24. List five foods that doctors think may help protect against pancreatic cancer.

25. Compare and contrast Type 1 and Type 2 diabetes.
