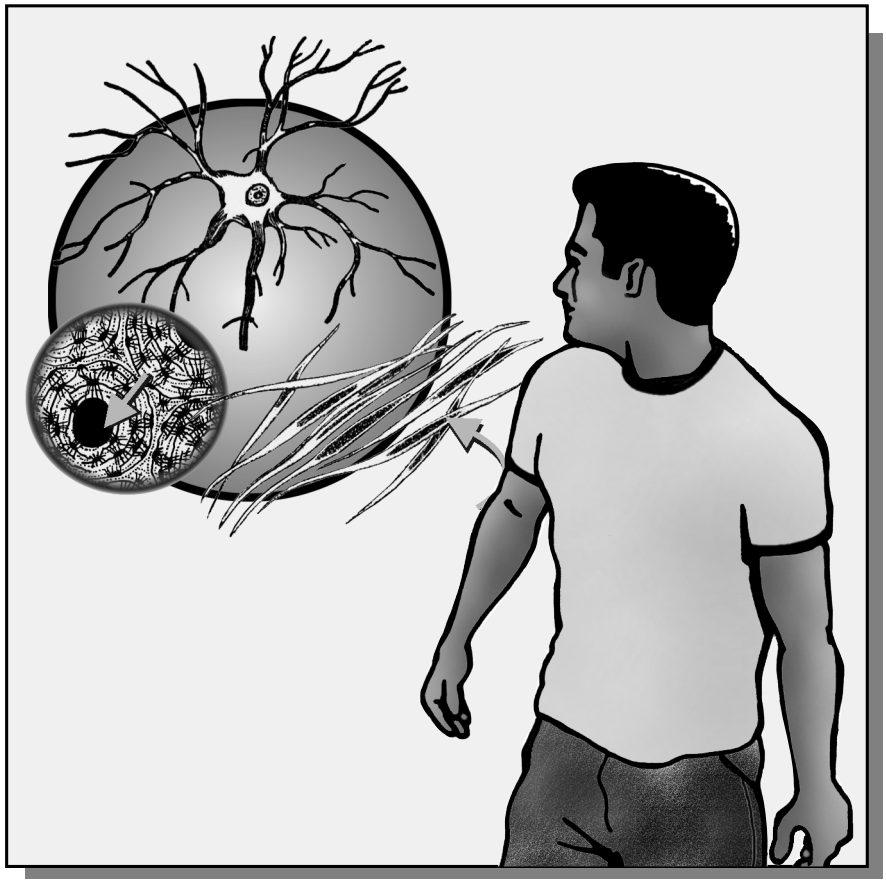
Basic Science Mysteries



Chapter 1

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CHAPTER 1
TABLE OF CONTENTS

PAGE

SECTION 1

1. LIFE PROCESSES 3-5
   Organisms

2. RESPONDING TO SURROUNDINGS. 7-10
   The Nervous System

3. GROWING 11-14
   The Endocrine System

4. MOVEMENT 15-17
   The Muscular/Skeletal Systems

5. HUNGER 19-21
   The Digestive System

SECTION 2

6. BLOOD 23-25
   The Circulatory System

7. TAKE A BREATH 27-29
   The Respiratory System

8. PROBLEM SOLVING 31-33
   The Scientific Method

PAGE

9. USING YOUR SENSES 35-37
   The Five Senses

10. WHAT A WASTE 39-41
    The Urinary System

SECTION 3

11. INTERACTIONS 43-45
    Ecosystems

12. THE SAME KIND 47-50
    The Reproductive System

13. TRAITS 51-54
    Genetics

14. STAYING ALIVE 55-58
    The Immune System and Disease

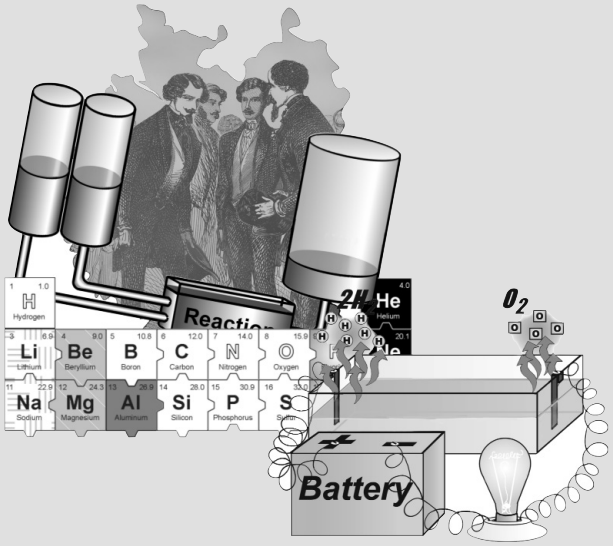
15. A HEALTHY FUTURE 59-62
    Lifestyle Factors



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"By knowledge, understanding and wisdom the true mysteries of life unfold as they are studied line by line and precept upon precept." —Ronald E. Johnson, C.Ph.D.



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Lesson 1
Biology

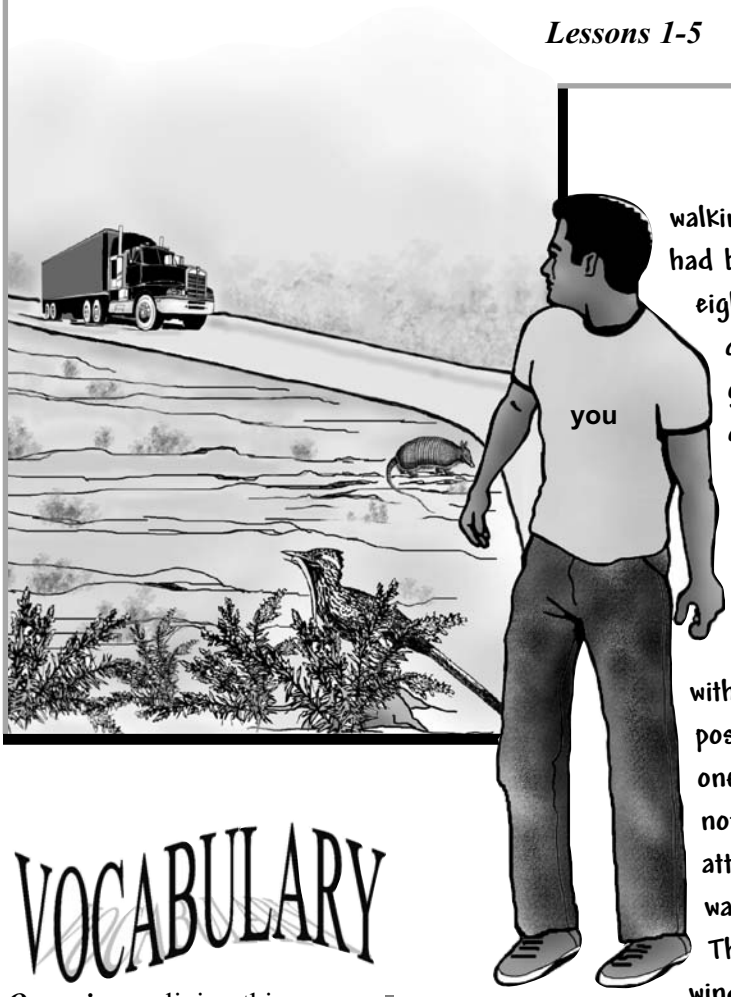
Chapter 1

Organisms

Section 1

Lessons 1-5

LIFE PROCESSES



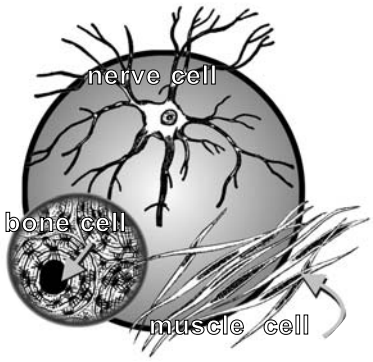
Your study of *Basic Science Mysteries* begins with a fictitious account of you walking along the side of a road. An armadillo had been run over and smashed flat by an eighteen-wheeler. You sidestepped the carcass to avoid the flies which had gathered. As you detoured around the carcass, you saw a small lizard hiding under a piece of sagebrush. Suddenly, a bird clamped its beak around the lizard's tail. The lizard scurried away, leaving its tail wiggling in the bird's beak. You began to wonder if that lizard could live without its tail. You marveled at the possibility that the lizard may grow another one. The tail was still wiggling, but you were not sure it was alive because it was not attached to the lizard's body. Your attention was drawn to the sagebrush near your foot. The plant had been blown there by the wind. The sagebrush had a root system that anchored into the ground. The brush looked old and dry.

Science can answer questions by helping you identify characteristics or traits to distinguish living and nonliving things. The word scientists use for defining living things is the word ***organism***. You are an organism. The lizard is an organism. Every organism may not seem alive all the time. Often, you can hardly determine if something is alive; yet, organisms have specific traits which set organisms apart from nonliving things.

VOCABULARY

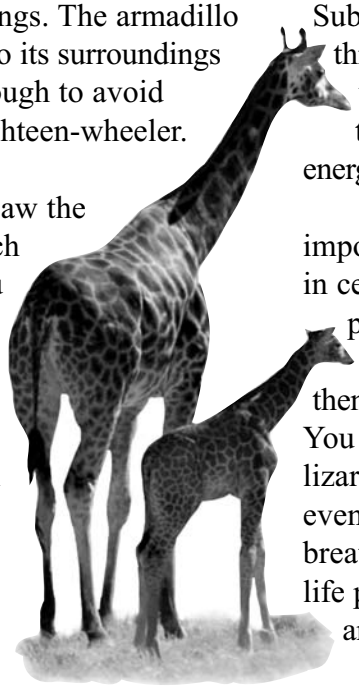
Organism: a living thing
Cells: basic units of all living things
Bacteria: one-celled organisms
Life processes: activities that enable organisms to survive
Metabolism: chemical and physical changes that take place in a living thing to produce energy and maintain life

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All living things, organisms, have the same basic building blocks. Those building blocks are called ***cells***. The cell is the basic unit of all living things. Some organisms, such as ***bacteria***, have just one cell. Larger organisms, such as lizards, armadillos, sagebrush and humans have billions of cells. You and large animal organisms have bone cells, nerve cells and muscle cells, as well as many other kinds of cells. Plants, like the sagebrush, contain a variety of cells as well.

All organisms perform certain tasks that enable the organisms to survive. Those tasks are called ***life processes***. Think of the lizard that tried to escape capture when its tail was pecked off by the bird. The lizard lost its tail to avoid captivity or possible death. That lizard demonstrated one of the life processes, which scientists call *responding to surroundings*. All organisms respond to their surroundings. The armadillo most certainly responded to its surroundings but just was not quick enough to avoid getting flattened by an eighteen-wheeler. You also respond to your surroundings. When you saw the flies and smelled the stench of the dead armadillo, you detoured off the roadway. When you touch something hot, you jerk away your hand. A flower that does not have enough sunlight, will turn toward the Sun. All living things respond to their surroundings.



All living things grow. A giraffe was not tall as a baby. It started small and grew. So did you. Most full-term human babies weigh between six and nine pounds at birth. Premature babies with low birth weights can survive, but need special help. As long as they are supplied with food for energy, organisms grow.



Sunflowers start as tiny seeds, but can grow to be over six feet tall. One-celled organisms, such as bacteria, usually grow to certain sizes and then reproduce, resulting in an increased number of organisms.

Organisms obtain food and use the energy it produces. That armadillo on the side of the road was probably smashed while looking for food. You may have been walking beside the road on the way to a convenience store to purchase a snack or drink. Some organisms have the ability to produce their own food. The sagebrush has cells that enable it to produce its own food. Substances that make food are broken down through chemical changes in the cells. All the physical and chemical changes that take place in a living thing to produce energy and maintain life are called ***metabolism***.

Organisms release energy. One very important chemical process that takes place in cells is *respiration*. Respiration is a process in which oxygen is obtained and distributed to tissues and cells. Oxygen then combines with food and releases energy. You inhale oxygen when you breathe. That lizard that slipped away continues to breathe even without its tail. The armadillo was breathing until its lungs were crushed. The life process ceased to exist for that particular armadillo; therefore, death occurred.

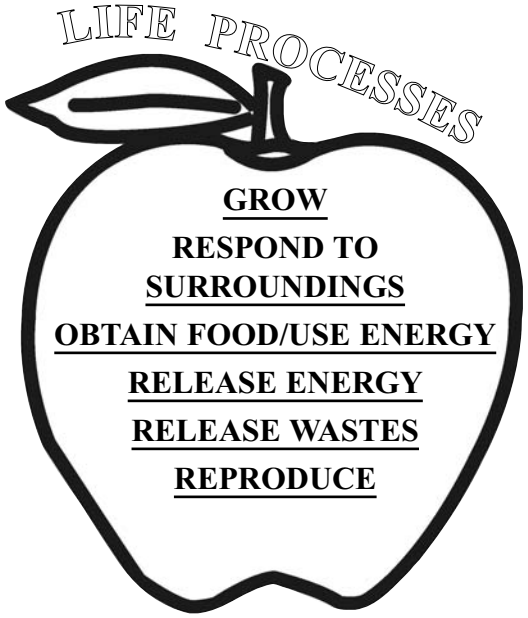
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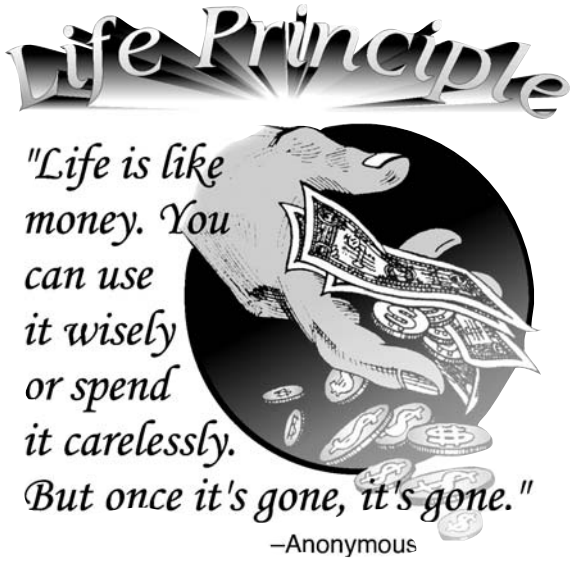
All living things must release wastes. The chemical changes that occur in an organism produce wastes. The wastes must be removed from the organism, or these toxic substances will be absorbed back into the organism, causing it to become ill and die.

All organisms can produce more living things of their own kind. The process by which organisms produce more of their own kind is called *reproduction*. This life process ensures that a certain kind of organism will continue to exist.

Living organisms exist in many sizes, shapes and colors. Organisms live in different places and respond differently to various threats. Yet, organisms all have in common life processes that enable the organisms to survive.

You hurried along the side of the road to meet your friends. Little did you know that something soon would happen to change your life significantly. You might not have walked so rapidly if you had known what was ahead! But, you will read more about that in the next lesson.





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Lesson 2
Human Anatomy

Chapter 1

The Nervous System

Section 1

Lessons 1-5

RESPONDING TO SURROUNDINGS



You continued your walk to the convenience store to buy a soft drink and meet your friends, Rondarius and LaKendrick. While you were telling them about the lizard's tail and the flattened armadillo you encountered along the way, you noticed that LaKendrick kept squinting his eyes and moving his head as he listened. A direct ray of sunlight reflected off a car's chrome bumper and shined directly into LaKendrick's eyes, impairing his vision. However, he continued listening intently to your story and grunted in disgust when you told him about the flies on the dead armadillo.

As you and your friends walked outside the store, you noticed a red car driving by slowly. The passenger was a man with a scar on his face. The driver was a man who nervously looked over his shoulder at the road behind him. Suddenly, the passenger fired several gunshots at a man talking on a pay phone just outside the entrance to the store. You quickly ducked behind a metal trash barrel and tried to steady yourself by grabbing it for support, but it was too hot to touch. You jerked away your hand and fell to the ground. Rondarius and LaKendrick had jumped behind a parked truck. The red car sped away. The man on the phone was unhurt, but extremely angry. He yelled and shook his fist, then got into his truck and drove away in the opposite direction. Your heart was pounding as you saw him throw something out of the truck and into the bushes on the side of the



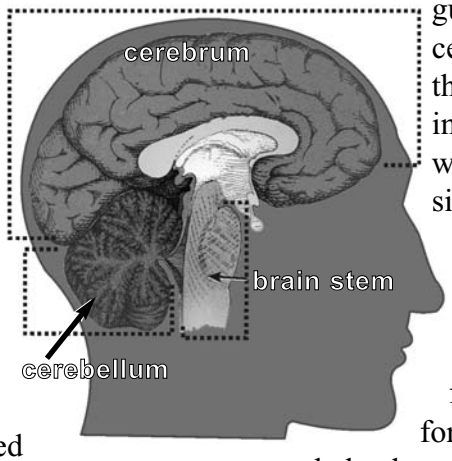
VOCABULARY

Central nervous system: the brain and the spinal cord
Cerebrum: the part of the brain that controls thinking
Cerebellum: the part of the brain that controls skeletal muscle movement
Brain stem: the base of the brain that connects with the spinal cord
Neurons: nerve cells
Reflex: spontaneous response of the body to a stimulus

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road. Rondarius and LaKendrick looked worried. The three of you decided you had better leave the area.

What you witnessed was the result of one of the life processes—responding to surroundings. All living things (organisms) respond to their surroundings. You, your friends, and even the man at the telephone, responded to surroundings in various ways. So did the armadillo on the highway; but fortunately, you responded quickly enough to avoid the same fate.



Some responses are instinctive or automatic. You remember how LaKendrick blinked and turned his head to avoid the direct rays of the Sun. He did that without thinking. Other responses require thought followed by a decision. When you heard gunshots, you and your friends took cover quickly. Although your response may have seemed automatic, you actually had to process the information and decide to take cover. Your nerve cells took this message from your environment to your brain. Your marvelous brain, composed of 100-billion nerve cells, processed that message, formulated a response, and sent that to all parts of your body. In a fraction of an instant, you were able to respond.

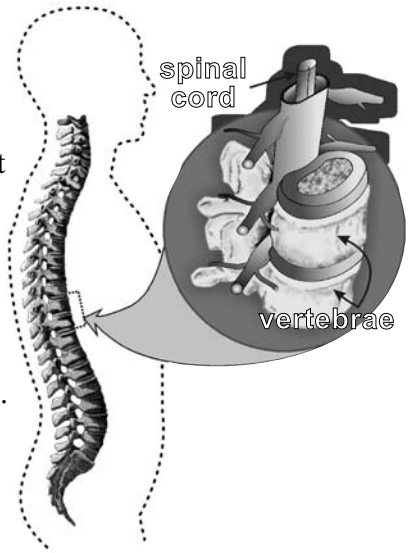
Your brain and spinal cord are a part of the ***central nervous system*** which is your body's communication network and control center. Every decision, every response, and every action you make involves the central nervous system. The brain has three parts, each with a specific function.

The largest and most complex part of your brain is the ***cerebrum***. The cerebrum makes you aware of what is happening in and around you. It controls your thinking and decision-making processes. Your cerebrum controls many special areas. Some are speech, hearing, sight, touch, smell, memory, thought and judgement. When you heard gunshots, your cerebrum processed the information to inform you that you were in a dangerous situation.

The second largest portion of the brain is the ***cerebellum***. It functions as a center for the coordination of skeletal muscle movement and determines what movements the body will make. The cerebellum processed the information to determine the physical coordination you would need to crouch behind the trash barrel.

The ***brain stem*** is the third part of the brain. The brain stem connects the spinal cord to the brain. Various parts of the brain stem control automatic activities such as heart rate, blood pressure, breathing rate, body temperature, growth and digestion. While you were ducking for safety, you did not have to remember to breathe or tell your heart to beat. Your brain stem was taking care of that automatically for you.

Your spinal cord is a long rope-like structure which is protected by the *vertebrae*, the bones that make up your spine. The spinal cord begins at the base of the brain stem and extends down your back. The spinal cord is a collection of nerve cells called ***neurons***. Neurons are very sensitive and can react to the slightest



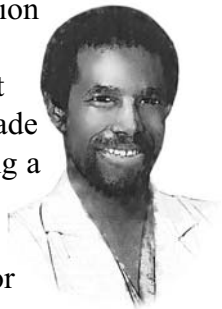
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stimulus. Neurons send electrical charges called nerve impulses from the point of stimulation to the brain or the spinal cord.

When LaKendrick's eyes blinked in response to the bright sunlight being reflected directly into them, he reacted quickly by moving his head. Such a reaction is called a ***reflex***. A reflex is a spontaneous response of the body to a stimulus. The response occurs automatically, without conscious effort or thought. Reflexes are protective actions that help the body react quickly to changes in the environment.

Your central nervous system works with your endocrine system, the system which produces hormones to help regulate your body, for responses to emergencies. In fact, all your body systems influence one another in determining your state of health. Exercise, proper nutrition and adequate sleep will help keep the central nervous system functioning properly. Many head and spinal cord injuries resulting in mental dysfunction, paralysis or death can be prevented by taking a few simple precautions. Always wear a helmet when riding a bike or skateboard or when rollerblading. Wearing a seat belt in a vehicle gives you added protection in case of an accident. Never dive into a shallow pool or lake, head first. Illegal drug use, including alcohol and tobacco, can destroy brain cells.

A doctor who specializes in problems with the brain is called a *neurosurgeon*. Dr. Benjamin S. Carson, an American of African descent, is a neurosurgeon who has received recognition for his surgical innovations. His operation to separate a pair of Siamese twins joined at the back of the head made medical history. Leading a 70-member surgical team, Dr. Carson successfully operated for 22 hours to separate the twins. Operations of this kind usually fail, but Dr. Carson's surgery was a success. Both twins survived.



Dr. Carson

Dr. Carson was raised by a single mother. His mother had a third grade education, but she did her best to raise two good sons. In the fifth grade, Dr. Carson was at the bottom of his class. Classmates called Benjamin "dummy." Because of failing grades, his television time was limited and homework had to be completed. Mrs. Carson also required Benjamin to read two library books a week and give a written report on each one. Benjamin soon realized that he was not dumb after all and began to read as often as possible. He was determined to become a doctor, and he met that goal.

In addition to his duties as a neurosurgeon, Dr. Carson wrote two books, *Gifted Hands* and *Think Big*. Dr. Carson says the letters of Think Big stand for the following:

Talent: Our Creator has endowed all of us not just with the ability to sing, dance or throw a ball, but with intellectual talent . . . .

Honesty: If you lead a clean and honest life, you don't put skeletons in the closet . . . .

Insight: It comes from people who have already gone where you're trying to go. Learn from their triumphs and their mistakes.

Nice: If you're nice to people . . . they will be nice to you.

Knowledge: It makes you into a more valuable person. When people need you, they pay you.

Books: They are the mechanism for obtaining knowledge . . . .

In-Depth Learning: Learn for the sake of knowledge and understanding, rather than for the sake of impressing people or taking a test.

God: Never get too big for Him.

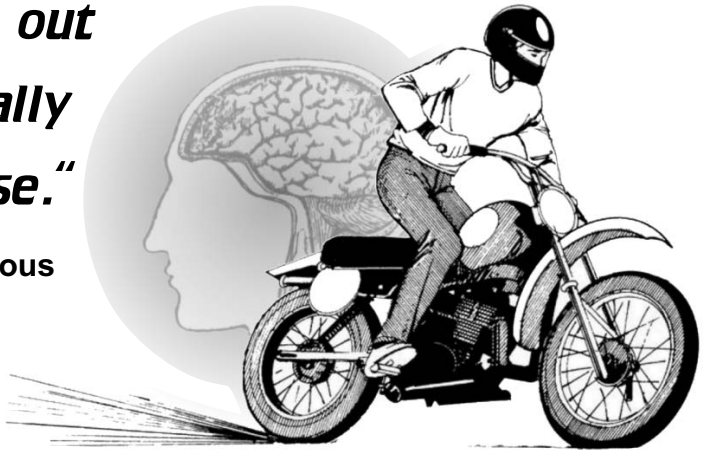
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When you, LaKendrick and Rondarius responded to the dangerous situation at the convenience store, you each relied on your healthy central nervous system to protect you through alert responses. After talking over the situation, you three decided to leave the area because it was not a safe place. Little did you know that was one of the best decisions you ever made. But more about that in the next lesson.

Life Principle

"A well thought - out response is usually the best response."

— Anonymous



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Lesson 3
Human Anatomy

Chapter 1

The Endocrine System

Section 1

Lessons 1-5

GROWING



Rondarius led the way from the parking lot to the road. He decided that the best way to go was in the opposite direction from the car with the gunman. You and LaKendrick agreed and followed Rondarius in the direction of the man who had been talking on the phone. You wondered if Rondarius and LaKendrick saw that man toss the package from his car as he sped away. Apparently, they did not see the package because as they approached its location, nothing was said. LaKendrick was still worried that the gunman might turn around and come back.

As you approached the bushy area where the package was located, something inside of you told you to walk on by. But before you knew it, you blurted out what you saw and suggested that you try to find the package. The bushes were thick and tall in the area, but without too much effort, you spotted a plastic bag caught in one of the branches of the tallest bushes. You could not reach it, but Rondarius grabbed it easily.

You and Rondarius had been friends since first grade. You were the same age, in the same class, and had always played together on the same teams. That is, until last year. Rondarius suddenly grew taller than you—a lot taller. He made the basketball team, but you did not. That fact did not hurt your friendship, but you wondered if you would ever catch up to him.

VOCABULARY

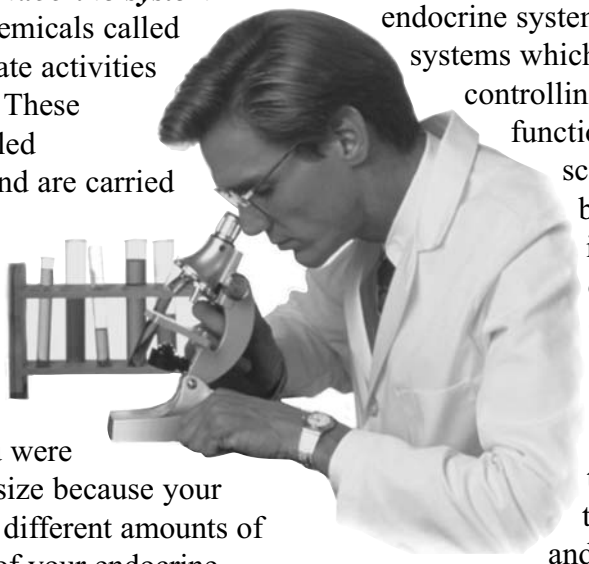
Endocrine system: a system of glands that produces hormones that regulate activities of different body cells
Hormones: chemical messengers
Gland: tissue or organ that releases chemical substances

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Rondarius gave the bag to you to open. Carefully, you removed the contents: an oddly shaped bottle of liquid with a label bearing a chemical formula. You knew that chemicals could be extremely dangerous when used in the wrong way. LaKendrick wanted you to put the bottle back in the bag and leave it. But you decided to keep it until you could figure out what it was. Then you would put it back.

The three of you decided to take a shortcut through the bushes. Just as you walked into the bushy area, you realized that a car was slowing down near where you found the bag. LaKendrick, the smallest of the three of you, agreed to crawl under the bush to see who was driving that car. He noticed the car's logo about the same time a man in fatigues opened the door and stepped out. The logo stated, "Lone Star Chemical Company." You wished you had left the bag alone.

Scientists have used chemicals to cure diseases, to improve health, to develop new products, and to create many of the conveniences we all enjoy. Without chemicals we would not have glue, gasoline, plastics and or even videos. In fact, we would not even grow and develop without the chemicals our bodies produce and use. The ***endocrine system*** in your body produces chemicals called ***hormones*** which regulate activities of different body cells. These hormones are often called chemical messengers and are carried in the blood to various organs of the body to activate those parts in specific ways.



Even though you and Rondarius were the same age, you were different in height and size because your bodies were producing different amounts of chemicals within each of your endocrine systems. The endocrine system consists of glands which control body activities by secreting hormones directly into the blood-stream. These hormones affect specific tissues throughout the body. A ***gland*** is a tissue or organ that releases chemical substances. The pituitary gland is often called the *master gland* because its hormones influence the functioning of all the other endocrine glands. The pituitary gland produces several distinct hormones, one being the *growth hormone*.

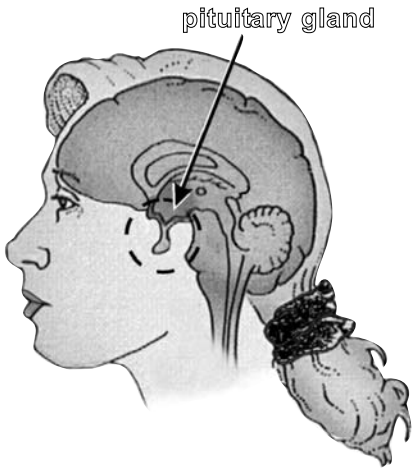
Teens develop and grow at wide ranges of physical rates. You, LaKendrick and Rondarius would all probably be about the same size in a few years. But that would depend on several factors including your pituitary gland, your heredity, and the nutritional choices you made. Each person is a unique and special individual, created with different gifts and abilities. Size is only one of many factors which make up an individual. Most people realize that success depends on choices you make in life, not size or shape, nationality or shade of your skin. You do not have control over those factors, but you do have control over choices you make. Choices affect the path you take in life.

The central nervous system and the endocrine system are the two body systems which work closely in controlling and regulating bodily functions. Endocrine glands are scattered throughout the body. They work independently of each other, but together they control body activities. Some of the major glands of the endocrine system are the pituitary, the thyroid, the parathyroid, the adrenal, the pancreas, and the ovaries and testes.

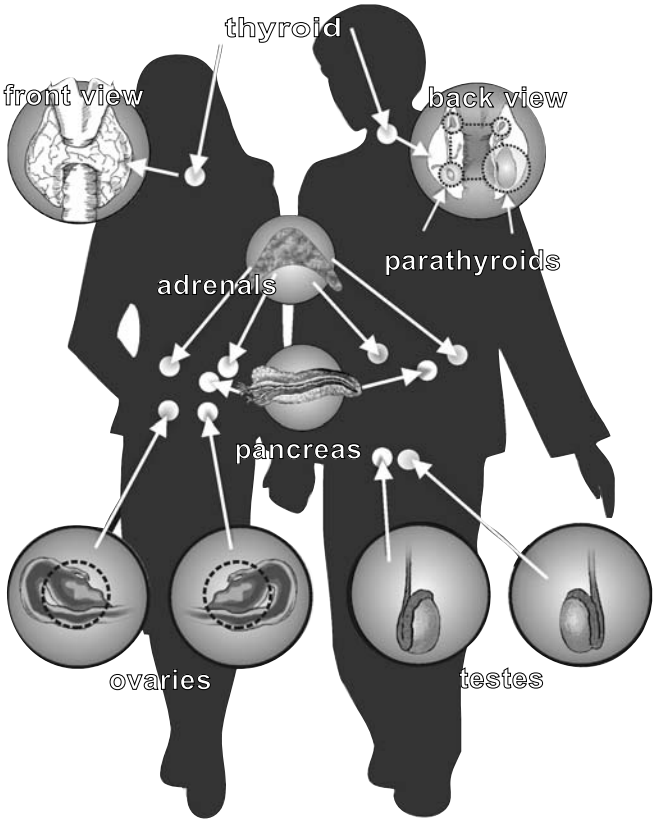
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The following chart identifies the basic functions of each gland.

ENDOCRINE SYSTEM	
GLANDS	**FUNCTIONS**
Pituitary	**Controls development and body growth** **Serves as "master gland"**
Thyroid	**Controls how cells release energy** **Controls amounts of calcium in blood**
Parathyroid	**Helps control calcium in the blood**
Pancreas	**Regulates glucose, secretes enzymes to digest food**
Adrenal	**Controls body's reaction to stress** **Controls salt and water balance in blood**
Ovaries	**Controls female characteristics, reproduction**
Testes	**Controls male characteristics, reproduction**



Endocrine System



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You, Rondarius and LaKendrick were in a very stressful situation. Each of your adrenal glands were secreting the hormone, *adrenaline*, into your bloodstreams to help your bodies meet the demands put upon them.

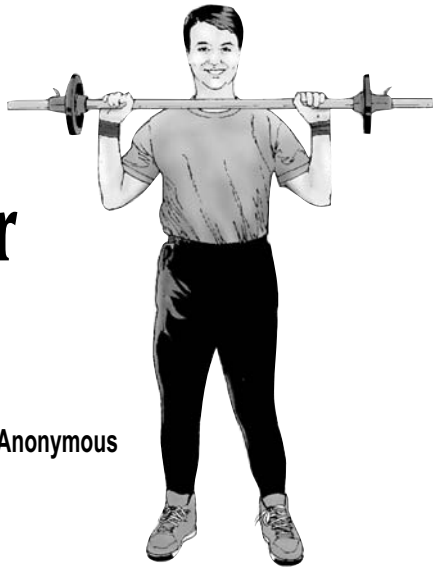
The three of you would have to make a choice about what to do with the chemical you found. When used in appropriate ways, chemicals can be very beneficial. However, when used inappropriately, the results can be deadly.

The man from Lone Star Chemical Company wanted to find the missing chemical, or the results could turn deadly.

LIFE PRINCIPLE

"You are as strong as your character."

—Anonymous



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Lesson 4
Human Anatomy

Chapter 1

The Muscular/Skeletal System

Section 1

Lessons 1-5

MOVEMENT



Clutching the bag, you started to run. Rondarius and LaKendrick followed your lead as you raced down the twisted path between bushes, trees and overgrown weeds. You and Rondarius had walked this path since first grade. It was a shortcut from the road leading from the convenience store to your neighborhood. You could navigate it with your eyes closed. But not today. You were running as fast as you could, heart pounding, and eyes wide open as you glanced over your shoulder to see whether the man in fatigues was following you. Rondarius easily passed you, taking full strides as he ran. You and LaKendrick sprinted, trying to keep up. You remembered how you used to win every race between the two of you. However, that day, you knew who was the fastest.

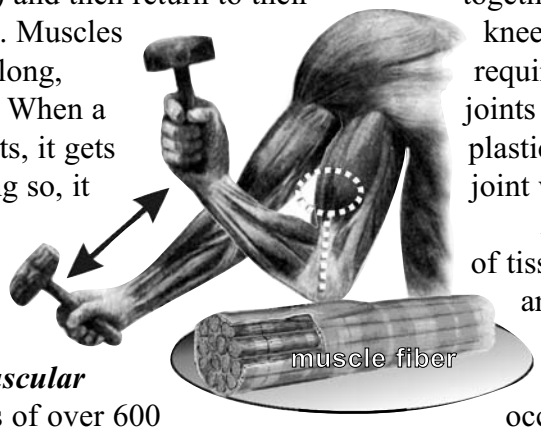
Bursting from the wooded area, Rondarius knew exactly where to go without even asking. He headed toward the tree house in the lot near your grandparents' house where you and Rondarius spent most of your free time. Rondarius quickly climbed the tree, stepping on the boards his grandfather had carefully nailed in place. You gave LaKendrick a boost as Rondarius reached down with his hand to hoist up LaKendrick. After a quick glance toward the field, you climbed the ladder. You were breathing too hard even to speak, but your mind was racing. You wondered whether anyone would believe that you were only curious about the bag. You reached down and rubbed your legs. They were hurting from running so fast. All you wanted to do was rest a few minutes, and then decide what to do about the bag.

VOCABULARY

Muscular system: body tissues that can be tightened or loosened to produce body movement
Skeletal system: bones and various tough tissues composing the body's framework
Cartilage: flexible, gristle-like connective tissue
Joints: place where two or more bones meet
Ligaments: strong bands of tissue that connect bone to bone at a joint
Tendons: tough bands of fiber that connect muscles to bones

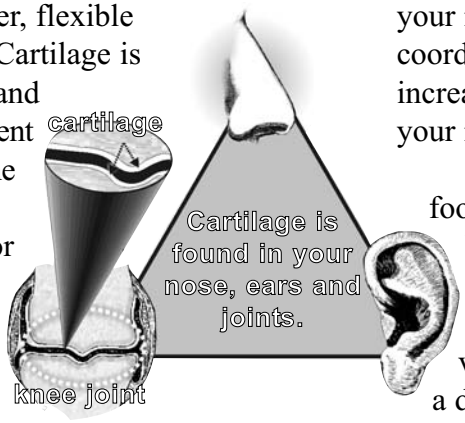
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All body movement depends on the ability of the muscles to *contract* (shorten) or *extend* (stretch) and then return to their original shapes. Muscles are bundles of long, fibrous tissues. When a muscle contracts, it gets shorter. In doing so, it pulls on the attached bone moving a body part.



The ***muscular system*** consists of over 600 major muscles and functions to support and move the skeletal system. Your muscles and your bones work together to produce the kind of movement needed to run across a field or boost a friend up a tree. The ***skeletal system*** is your body's framework. Your skeleton contains over 200 bones in all shapes and sizes that together support the body and help it move in a coordinated manner. Without your skeleton, your skin and organs would be in a big pile on the floor. Your skeleton gives you shape and structure.

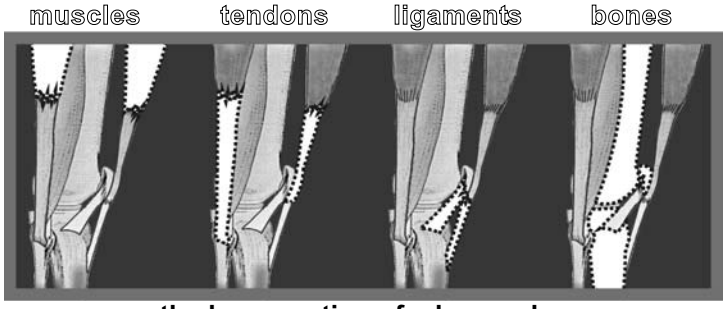
Your skeleton also protects your *vital organs*, such as the brain, heart and lungs (without which you could not live). Healthy bones are hard and flexible. The arrangement of minerals and fibers in bones gives bones great strength. Part of your skeleton is made of ***cartilage***, a softer, flexible connective tissue. Cartilage is in your nose, ears and ***joints***. The movement of bone against bone would be almost impossible if not for the smooth surface and elasticity of cartilage helping to reduce friction.



All body movements are allowed by joints. Joints are places in your skeleton where two or more bones meet or are joined together such as in your elbow, hip and knee. Some athletes injure their knees and require knee joint replacement with artificial joints made of a combination of metal and plastic. Once in place, an artificial knee joint works just like the natural joint.

Ligaments are strong bands or cords of tissue that connect the bones to one another at a moveable joint. Ligaments hold the bones in place. Sprains are the most common injury to joints and occur when tissue around a joint is twisted or receives too much pressure. The ligaments around the joints are stretched or torn, resulting in swelling and pain.

Tendons are bands of fiber that connect muscles to bones. When tendons are stretched or torn, the injured area becomes inflamed. This condition is known as *tendonitis*.



the knee section of a human leg

The more you use your muscles, the more efficient and strong they become. Using your muscles will help you become better coordinated and stronger. Regular exercise increases the size as well as the strength of your muscles.

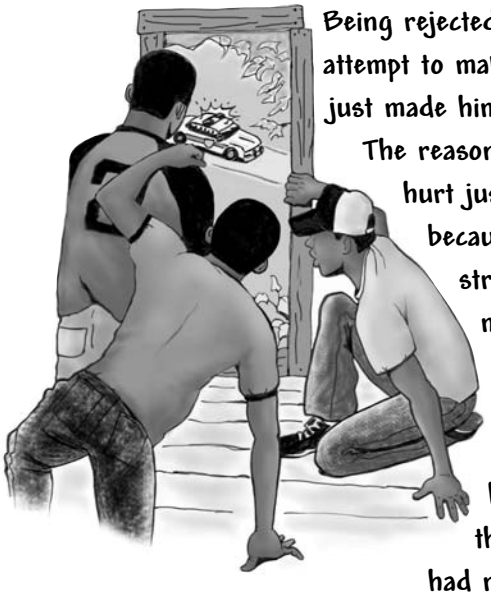
Your eating patterns should include foods high in calcium to produce strong bones and teeth. Good sources of calcium include dairy products and vegetables. Teenagers who eat vegetables and drink four glasses of milk a day usually receive adequate quantities of calcium.

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Dairy products and (green) leafy vegetables such as (leaf) lettuce are good sources of calcium.

Crouching in the tree house, you watched a police car cruise the neighborhood. Perhaps the presence of policeman had scared away the man in fatigues. Your thoughts rambled. You reasoned you could improve your running ability by exercising on a regular basis. Rondarius was probably in better shape than you because he participated in regular workouts with the basketball team. Even though you did not make the team, you had continued to practice, workout, and keep up your skills. Michael Jordan was probably the greatest basketball player in history; but he did not make his school team the first time he tried out, either. But neither did he give up. Being rejected on his first attempt to make the team just made him work harder.



The reason your legs hurt just then was because you strained your muscles from over-exertion. Regular exercise could have prevented that. But you had much more to think about than your sore legs. Those police sirens in the distance seemed to be getting closer.

LIFE PRINCIPLE



"NO PAIN, NO GAIN."

—Anonymous

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Lesson 5
Health

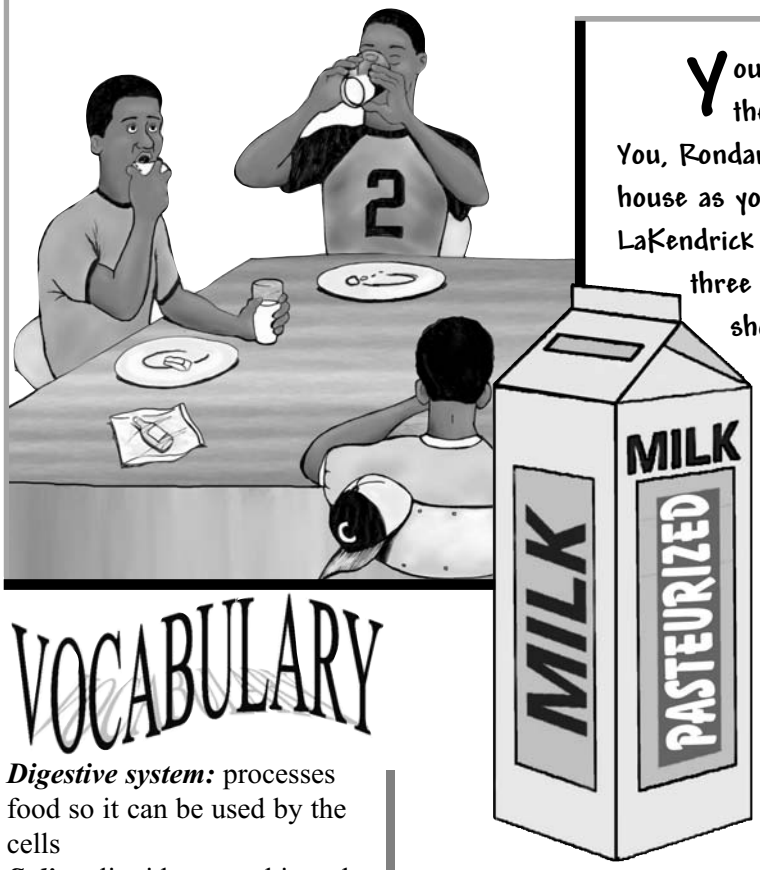
Chapter 1

The Digestive System

Section 1

Lessons 1-5

HUNGER



Your leg still hurt, and the excitement of the afternoon was starting to affect you. You, Rondarius and LaKendrick laid low in the tree house as you watched two police cars pass. LaKendrick thought the police were looking for the three of you. Rondarius suggested that you should tell an adult what happened. You knew that your grandmother would believe you, and her house was right next door. She was watching TV news as you walked in the door. Your grandmother poured each of you a big glass of milk. A hot skillet of corn bread was on the stove. You cut pieces for Rondarius, LaKendrick and yourself and spread the corn bread with butter. Suddenly, the events of the afternoon seemed far away as your hunger overtook you, and you bit into a delicious piece of corn bread. Things seemed normal for a few minutes until your grandmother noticed the bag. You knew you had to tell her the truth. But you could not seem to find the words to begin, so you just asked for another glass of milk.

All living organisms must obtain energy to perform their life processes. Most organisms receive energy from food. You can be in the midst of an emergency and still become hungry. Hunger is your body's way of signaling to you that you need energy to continue life. Think of your body as a car. A car cannot run without fuel. When that gas tank is empty, the car stops. It must have fuel for energy to operate. Your body needs food as its energy source. Living things obtain energy by breaking down food which contains stored energy. The final

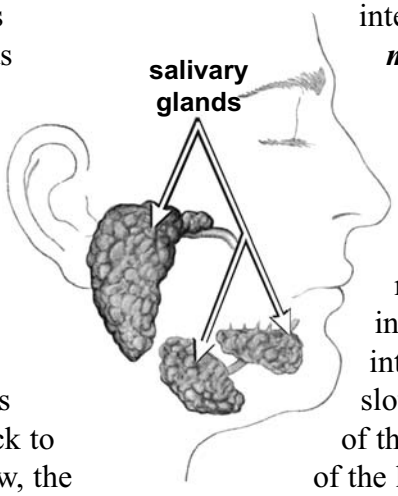
VOCABULARY

Digestive system: processes food so it can be used by the cells
Saliva: liquid secreted into the mouth by the salivary glands
Digestion: the breakdown of foodstuff into a small enough size so that it can be absorbed into the bloodstream
Carbohydrates: sugars and starches in food
Esophagus: tube for the passage of food from the mouth to the stomach
Bile: liquid secreted by the liver to aid in digestion
Molecules: small particles

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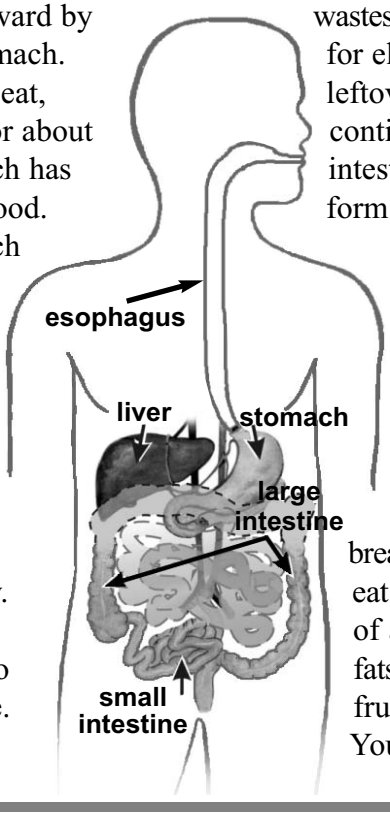
steps in this process take place by way of chemical reaction in the cells. The body has a special system designed for processing the food you eat into a size small enough to enter tiny cells. That special system is the ***digestive system***.

When food is placed into the mouth, the first step of the digestive process begins with chewing. The primary function of the teeth is to break the food into smaller pieces. As food is chewed, the salivary glands moisten food with ***saliva***. A special chemical substance, or enzyme, in the saliva starts the ***digestion*** of ***carbohydrates***, which are sugars and starches in food.



The tongue pushes the moist ball of food back to the throat. As you swallow, the food enters the ***esophagus***, or food tube, where the food is carried downward by muscular movements to the stomach.

Depending on what you eat, food may stay in the stomach for about three to four hours. Your stomach has about a one quart capacity for food. Liquids pass through the stomach somewhat rapidly. The stomach retains solid food longer because solids require more time to mix with the *gastric juices*. These gastric juices are often called *digestive juices* and are simply acids and enzymes which help break down the food chemically. A muscular valve at the end of the stomach opens at intervals to let food enter the small intestine.



The major part of digestion occurs in the small intestine which is about 20 feet in length and one inch in diameter. Intestinal juices produced by glands in the small intestine along with ***bile*** from the liver and secretions from the pancreas complete the chemical breakdown of food.

This usable part of food becomes a thin, watery liquid and is absorbed into the bloodstream through the walls of the small intestine. Digested food, in the form of ***molecules*** absorbed in the blood, supplies the necessary nutrients your body needs for fuel. Your bloodstream (arteries, veins and capillaries) carries this liquid fuel to all parts of your body.

The unusable part of your food is referred to as undigested food and moves in a watery mass from the small intestine into the large intestine. This mass moves slowly through the large intestine. Most of the water is reabsorbed through the walls of the large intestine into the bloodstream and carried mainly to the kidneys, which filter more wastes and discharge urine to the bladder for elimination from the body. The leftover solid waste, called *feces*, continues to move through the large intestine and out of the body in the form of a bowel movement.

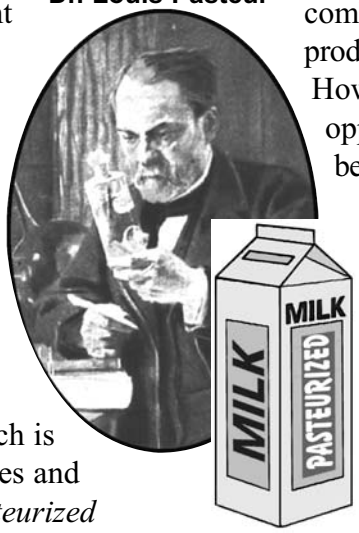
As long as you are alive, you will need to fuel your body with food. To help promote a healthy digestive system, you should chew your food thoroughly. Chewing thoroughly helps reduce the amount of work your stomach must perform to break down solid food. You should eat a well balanced diet consisting of a variety of healthy foods low in fats, sugars and meat and high in fruits, vegetables and whole-grains. You need quality fuel to energize

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your body.

Pure water is a key ingredient in good health. Your body is about two-thirds water. Water "lubricates" your body, just like oil lubricates machinery. Drinking 6-8 glasses of water each day will help aid in the digestion process as well as weight control. You can give yourself an advantage to a longer and healthier life by carefully choosing what you eat and drink.

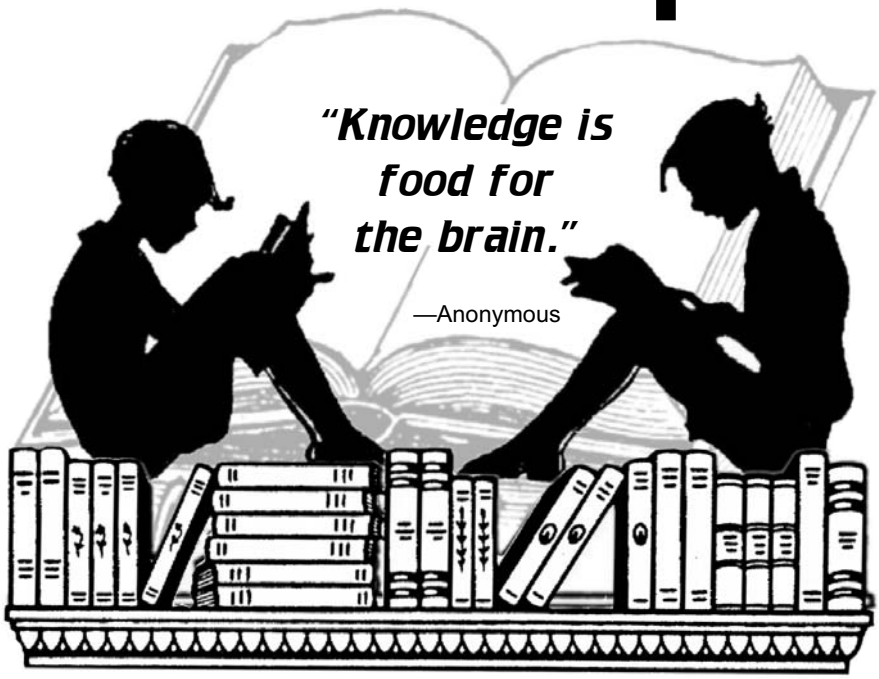
Dr. Louis Pasteur



Milk is high in calcium which is necessary for developing strong bones and teeth. The milk we buy today is *pasteurized* milk, meaning that in the manufacturing process, the raw milk is heated to a temperature sufficient to kill harmful bacteria. This process was developed by Dr. Louis Pasteur (1822-1895), a French physicist and chemist, and is named after him. However, Dr. Pasteur has been called the greatest biologist of all time because of his discovery of germs and his work to combat the spread of disease-producing organisms (germs). However, Pasteur was intensely opposed by many other biologists because of his opposition to the new Theory of Evolution, and because his own work supported evidence for the intelligent design of life. Pasteur's work with processes of pasteurization and sterilization saved countless lives as many disease-producing organisms were eliminated from homes and hospitals.

Your grandmother made a healthy choice in providing milk for you to drink with your corn bread. You were comforted that your parents and grandparents always looked after your best interests.

Life Principle



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Lesson 6
Human Anatomy

Chapter 1

The Circulatory System

Section 2

Lessons 6-10

BLOOD

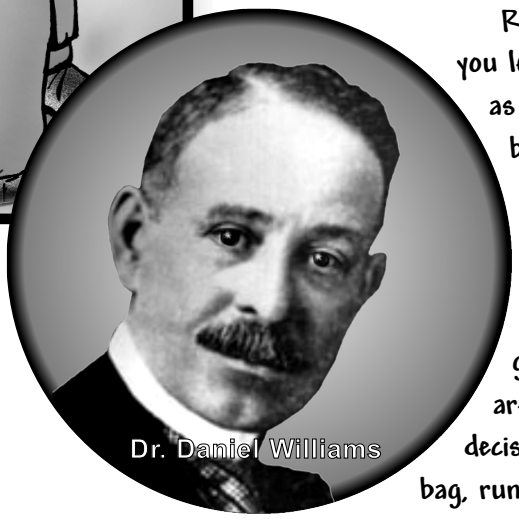


VOCABULARY

Circulatory system: transports food and oxygen to cells by way of the blood
Plasma: liquid part of the blood
Marrow: soft tissue in the center of most bones, produces all red blood cells and some white
Artery: largest of the blood vessels; carries blood away from the heart to the body
Capillaries: tiniest of the blood vessels, about the diameter of a hair, where materials are exchanged between the blood and body tissues
Veins: the vessels that carry blood back to the heart

Before you could answer your grandmother about the bag, her television news program was interrupted by a local news bulletin. An unidentified man had been stabbed at a local convenience store and taken to the hospital. Anyone with any knowledge about the incident was requested to call the police. 1

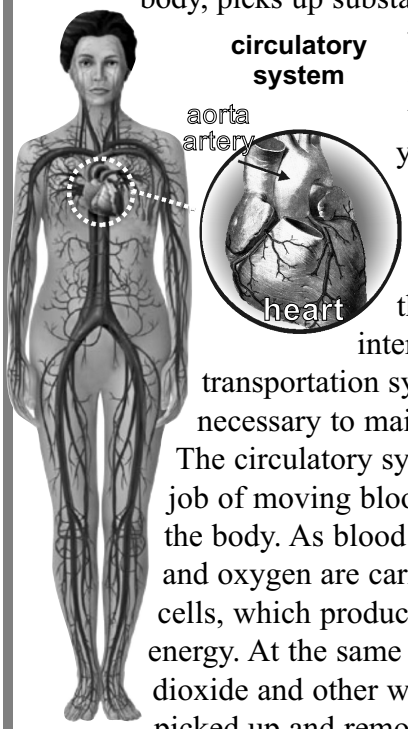
Rondarius said he was glad you left the convenience store as quickly as you did, because apparently someone returned to finish what was started. That was one good decision you made—to get out of a dangerous area. As far as your other decisions (like picking up the bag, running from the man in fatigues and hiding from the police)—well, those might not have been the right decisions to make after all. But you had more questions than answers. 2


Dr. Daniel Williams

Dr. Daniel Hale Williams, an American surgeon of African descent, performed the first type of open-heart surgery in 1893 by removing a knife from the heart of a stabbing victim. The patient recovered and lived several more years. Since that time, much has been learned about open-heart surgery and a great deal can be done to save victims of violent attacks. However, much depends on the type of wound, the amount of blood loss, and the damage to internal organs during the attack. 3

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4 Your heart and blood vessels are the main parts of your ***circulatory system.*** It transports necessary items to all parts of your body, picks up substances which are unnecessary, and delivers them to parts of your body for release. Blood is the major component of the body's internal transportation system and is necessary to maintain life. The circulatory system has the job of moving blood throughout the body. As blood circulates, food and oxygen are carried to body cells, which produce heat and energy. At the same time, carbon dioxide and other wastes are picked up and removed from cells.



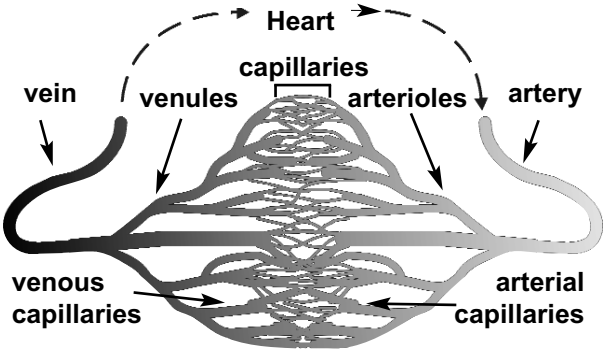
5 Blood is made up of a watery liquid called ***plasma*** in which solid parts of the blood (red blood cells, white blood cells, platelets) are suspended. Plasma makes up about 55 percent of your blood, while solids compose about 45 percent. Blood is the fluid that transports all the substances that the body needs to sustain life. Without blood, you could not survive.

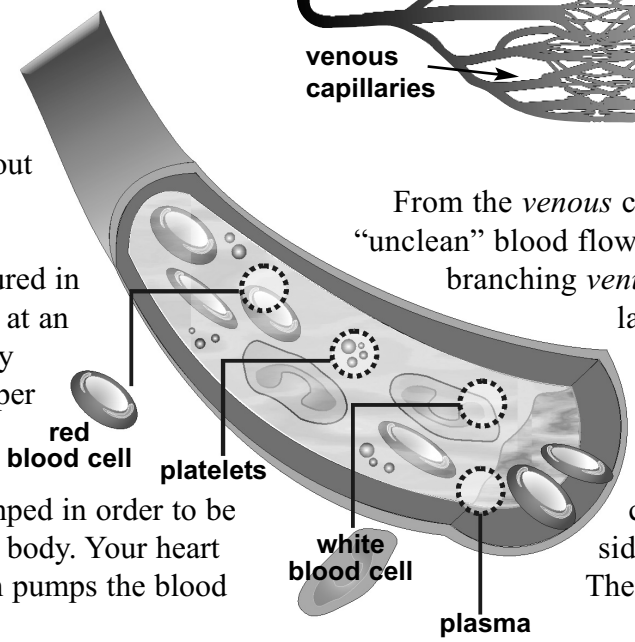
6 Blood is manufactured in the ***marrow*** of most bones at an extremely rapid rate: nearly 4 million new blood cells per second plunge into your bloodstream!

7 Blood must be pumped in order to be transported throughout the body. Your heart is a muscular organ, which pumps the blood hard enough and fast enough to send blood to every part of your body. This amazing little pump is about the size of your fist and will beat/pump an incredible 100,000 times a day for over 70 years, if you take care of it!

8 As the heart contracts, blood is pumped out of the lower left part of the heart and up through the main ***artery*** known as the aorta. The *aorta* is an elastic-like tube which curves up and back from the heart, down through the chest and into the abdomen, then branches into arteries leading to the main organs of the body. The arteries carry bright colored, "cleansed" blood away from the heart. Arteries branch into smaller vessels called *arterioles* which end in a fine mesh of tiny hair-like *arterial* ***capillaries***. The capillaries are where the blood releases nutrient materials and oxygen into the tissues and picks up carbon dioxide and other waste products.

Blood Vessel Branches





9 From the *venous* capillaries, darker, "unclean" blood flows into the larger, branching *venules* and on to larger blood vessels called ***veins***. These veins carry away the waste-filled blood from body cells to the right side of the heart. The blood is taken next

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from the right side of the heart to the lungs. In the lungs, carbon dioxide, a waste gas, is released, and fresh oxygen is absorbed into the blood. Then, the cleansed blood returns to the left side of the heart and out the aorta, and the blood starts its route once more. Your blood can circulate throughout your entire body in less than a minute!

Red blood cells look like tiny circles with pale centers. They carry *hemoglobin* which gives the blood its ability to absorb oxygen in the lungs. Red blood cells deliver oxygen to all body tissues.

White blood cells are larger than red blood cells and have a much different function. The purpose of white blood cells is to fight disease and infection. Production of white blood cells increases when an infection occurs in the body.

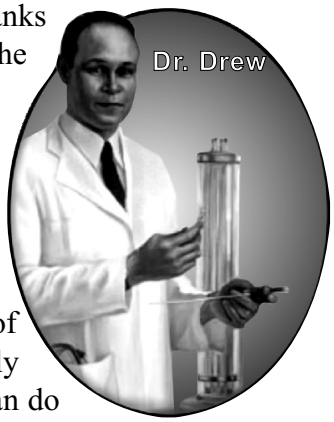
Platelets are the smallest parts of blood. Platelets function to form a clot at the site of a cut or broken surface to help prevent further blood loss.

This chart will help you understand the important functions of blood solids.

BLOOD	
Red Blood Cells	**Deliver oxygen to the body tissues**
White Blood Cells	**Fight disease and infection**
Platelets	**Clot to prevent blood loss**

If you were to separate solids from blood, the remaining substance would be plasma, which is a liquid composed mainly of water and some nutrients. Plasma carries antibodies, which help protect against infectious diseases. Plasma is used in treating bleeding problems and in some emergency situations such as transfusions. The American Red Cross operates a system of providing blood and plasma for victims of national disasters and other emergencies.

Dr. Charles Richard Drew, an African American surgeon, organized and operated one of the first plasma banks in New York City. The plasma bank served as a model for the widespread system in operation by the American Red Cross today.



Taking care of your heart is probably the best thing you can do to maintain a healthy circulatory system. Smoking and over-eating adds stress to the heart. Limiting your intake of foods high in "bad" fats (animal fats, hydrogenated and partially hydrogenated vegetable oils) and salt will protect both your heart and blood vessels. A regular exercise program will strengthen your heart. The heart is a muscle, and like any muscle, needs to be exercised. This can be done by aerobic workouts or activities such as jogging, swimming, brisk walking, skateboarding or rollerblading.

You wondered who did the stabbing: the man in fatigues or the men who fired the shots. Perhaps, the man on the phone was guilty. Maybe the victim could provide answers, if he survived.

LIFE PRINCIPLE

"Out of the heart come the issues of life."



—King Solomon

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Lesson 7
Human Anatomy

Chapter 1

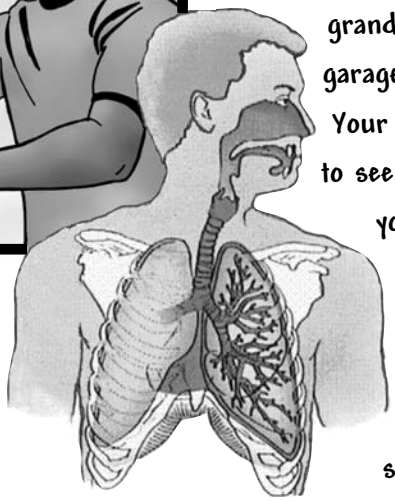
The Respiratory System

Section 2

Lessons 6-10

TAKE A BREATH





VOCABULARY

Emphysema: lung disease caused by inhaling toxic fumes
Respiratory system: the means by which organisms obtain and distribute oxygen and give off carbon dioxide
Trachea: windpipe, tube leading from nose and throat to lungs
Cilia: tiny hair-like structures
Bronchial tubes: trachea branches carrying oxygen to the lungs
Alveoli: (singular: *alveolus*) tiny thin-walled sacs in the lungs
Diffuses: moves from an area of higher concentration to an area of lower concentration
Hyperventilate: breathing abnormally fast and deep for a prolonged period of time

You always liked your grandparents' house. Grandmother would cook something that you liked, and your grandfather usually worked in his garage fixing somebody's car or bike. Your grandparents always seemed glad to see you. Standard procedure was for your grandmother to fix you a snack, and then you would head out to the garage to help your grandfather. You and your mom lived in a small apartment about six blocks from your grandparents. Your mom had to work most of the time to support the family. Other than helping your mom, you divided your time between the convenience store with your friends and your grandparents. Your grandfather had not seemed healthy lately. He coughed a lot and had trouble breathing. His ***emphysema*** was becoming worse, and he was having to use his oxygen machine more frequently. That day he was taking a nap, so he did not hear the news bulletin.

Your grandmother gasped when she heard that a stabbing had occurred so close to her home. Rondarius and LaKendrick looked at you, waiting to see what you were going to do. Your heart was pounding, and you started breathing quickly as you blurted out the details to your grandmother. You felt dizzy and could not seem to catch your breath. She told you to slow down and start from the beginning.

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Without oxygen, life cannot exist. The process of breathing oxygen from the air is accomplished through the ***respiratory system***. Actually, an exchange of gases occurs when you breathe. You breathe (inhale) air through your nose or mouth. Because only 21 percent of the air you inhale is oxygen, your body needs to move a steady supply of air into your respiratory system.

Air is inhaled mainly through the nostrils where the air is warmed and cleaned by mucous membranes and tiny hairs that line the nose. The warmed, moistened air moves to the *pharynx*, a passageway at the back of your nose and mouth, and then to the *larynx*, or voice box.

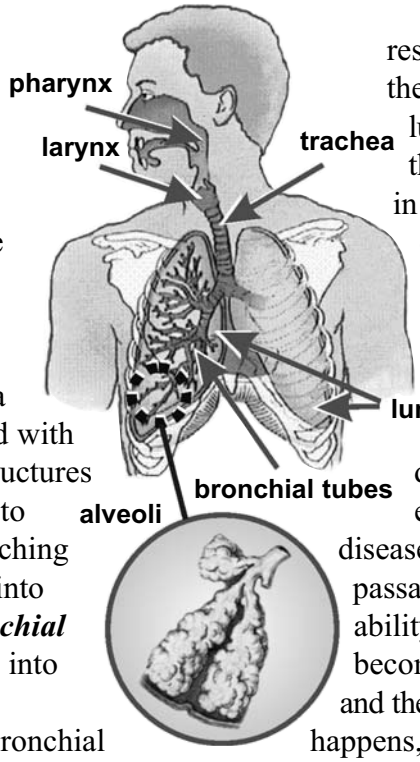
From the larynx, air moves down the ***trachea***, or windpipe, which is lined with a mucous membrane and covered with ***cilia***. Cilia are tiny hair-like structures which constantly move, trying to keep foreign particles from reaching the lungs. The trachea divides into two short branches called ***bronchial tubes*** through which air moves into the lungs.

Inside your lungs, the bronchial tubes branch into increasingly smaller and smaller passageways. At the ends of the narrowest tubes in each lung are clusters of about 300 million tiny, thin-walled sacs called ***alveoli***. The alveoli have the appearance of miniature clusters of grapes.

The lungs are the main organs of your respiratory system, where the exchange of oxygen and carbon dioxide takes place. As oxygen is released to your body cells, carbon dioxide is absorbed by the blood. Once the blood is back in the lungs, the carbon dioxide ***diffuses*** into the alveoli from the plasma and red blood cells. Your lungs release this waste gas from your body whenever you breathe out (exhale). Due to the intricate design of your lungs, the surface area for air-exchange—if it were spread flat—would equal about half the area of a tennis court!

The air you breathe is actually a mixture of gases, particles of dirt, pollen, dust and smoke. These pollutants can damage your respiratory system and interrupt the flow of oxygen to your body's cells.

RESPIRATORY SYSTEM



The natural defenses in your respiratory system help prevent these particles from reaching your lungs or from becoming stuck in the moist lining of the trachea or in the cilia. But even the best defense system cannot prevent damage from some pollutants, such as smoke from tobacco or other weeds or exhaust fumes. Smoking tobacco or other drugs causes severe damage to the lungs, resulting in emphysema. *Emphysema* is a disease that occurs when air passageways or alveoli lose their ability to expand and contract. Air becomes trapped, the alveoli rupture, and the lung is scarred. When this happens, less oxygen can be carried by the blood while the amount of carbon dioxide increases, resulting in shortness of breath and coughing.

You can keep your respiratory system healthy by not smoking and by avoiding air that is polluted. Additionally, regular exercise helps increase your body's ability to use oxygen. These health measures, or actions, make your breathing more efficient.

Under normal conditions, your brain in your central nervous system instructs your body just how fast to breathe, whether you are running or sleeping. Sometimes

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emotional stress or fear can cause you to ***hyperventilate***, producing dizziness or chest pain due to inhaling too much oxygen at once.

Hyperventilation is what happened to you when you were under the stress of trying to tell your grandmother about the gun shots and plastic bag. That stress caused you to breathe faster than your brain was telling you to and made you hyperventilate. Your grandmother was right when she told you to slow down. To stop the symptoms of hyperventilation, simply slow your breathing rate.

Telling your grandmother did relieve some of the anxiety you felt. And at least your breathing returned to normal . . . that is, until you heard a loud knock at the door!

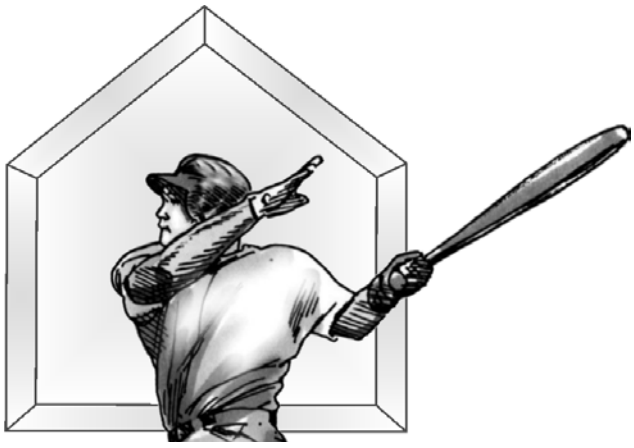
LIFE PRINCIPLE



"Few things in life are as easy as breathing."

—Anonymous

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Lesson 8
Physics

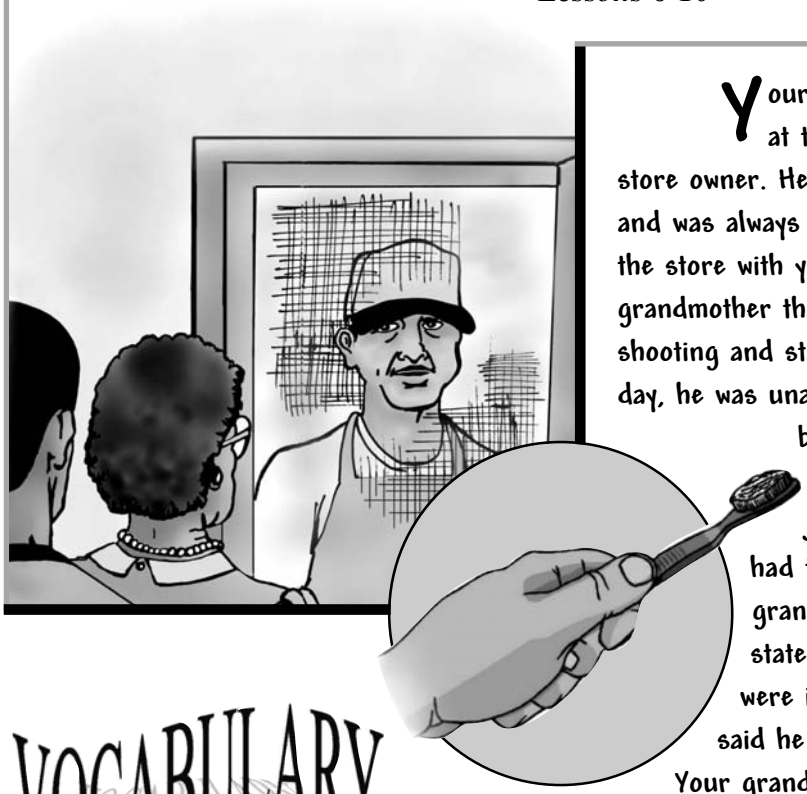
Chapter 1

The Scientific Method

Section 2

Lessons 6-10

PROBLEM SOLVING



Your grandmother answered the knock at the door. There was the convenience store owner. He was a friend of your grandparents and was always nice to you when you "hung out" at the store with your friends. The owner told your grandmother that in all the confusion of the shooting and stabbing at his store earlier in the day, he was unable to find you to see if you had been injured. Your grandmother assured him that you were fine, just somewhat frightened by all that had taken place. The owner told your grandmother that the police were taking statements from all the customers who were in the store at the time. He also said he had given the police your name. Your grandmother thanked the owner for his concern, and he left. You realized that the time had come for you to make a decision about the bag and the chemical it contained.

VOCABULARY

Hypothesis: a presumption based upon facts (plural is hypotheses)
Variables: ingredients in situations that are apt to change, thereby changing the outcomes of situations
Data: information
Fledgling: the beginning stages of an undertaking, not fully developed

Everyone has decisions to make every day. Some decisions are insignificant such as which teeth to brush first . . . the upper or the lower. The important thing is that you brush your teeth. Where you start does not really matter as long as they are all brushed. Other decisions are more significant, such as what clothes you wear or what foods you choose to eat. Occasionally, you will make major decisions in life such as which job to take or who you will marry or which church you will attend. Life is a series of making decisions: some big, some little. All decisions have consequences—good or bad—that affect your life.

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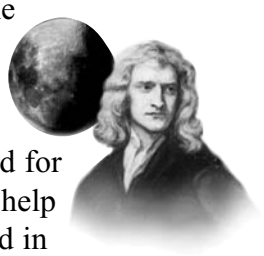
When you arrive at a decision, you have actually solved a problem. Consider the act of brushing your teeth. You have a problem: your teeth need to be cleaned. You solve that problem by deciding to brush your teeth. You work on several strategies to solve that problem in the most efficient way by deciding which toothpaste to use, what type of toothbrush to use, and how you will go about the actual brushing. You will start at the top or the bottom, the front or the back. Before long, you work out a routine, and brushing your teeth becomes a habit you develop for a healthy lifestyle.

The *scientific method* is the organized way scientists solve problems. This method uses several steps, or processes, to help scientists arrive at the best solutions to problems. The order of steps can be rearranged, depending on the problems to be solved. The scientific method works for solving science problems and is a good way to solve personal problems, too.

THE SCIENTIFIC METHOD FOR PROBLEM SOLVING

Step 1. Identify the problem.

The problem is the question you want to answer. Sir Isaac Newton lived in England in 1666 and had looked at the Moon for years with the question, "Why doesn't the Moon fall down to the Earth?" Newton had searched for an answer to his question to help explain why the Moon stayed in place while rain fell from the sky to the Earth.



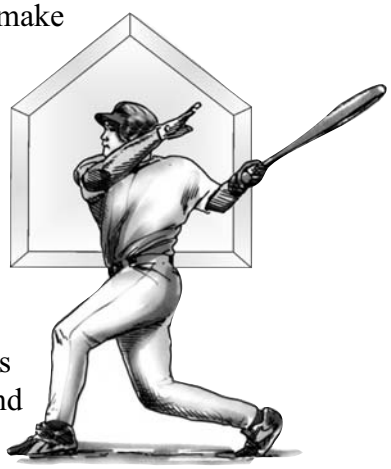
Step 2. Make observations.

Observations are anything you notice about the problem. Sir Isaac Newton noticed that when objects were dropped, they fell toward the ground. He observed, moreover, that the Sun, stars and Moon did not fall. One day Newton observed an apple falling from a tree to the ground. The scientist began to think in terms of a force which holds things together. These observations helped Newton identify the force of gravity.

You, like Newton, should write down your observations. These become part of your research information and can provide useful clues in problem solving.

Step 3. State a ***hypothesis***.

A hypothesis is an educated guess, or presumption, about a solution to your question or problem. Your hypothesis may not be *the* answer, but it is a *possible* answer. Suppose the coach calls you to bat. Your team needs you to make a hit. You have a choice between a wooden bat or a metal bat. You have practiced with a metal bat, feel confident with a metal bat, have gotten plenty of hits with a metal bat, and have used a metal bat for years. You have a choice as to which bat you will pick up as you walk to the plate. Your best guess would be a metal bat because that is the one with which you have had success. You should choose the metal bat.



However, in a softball or baseball game, numerous ***variables*** exist. Many conditions could change to affect whether you make the hit or not. You need to use the correct stance, keep your eye on the ball, and swing at just the right time. Just using the right bat will not guarantee the hit. But, choosing the metal bat was a good presumption at something which would help you make that hit.

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Step 4. Test the hypothesis.

Experiments are used to test hypotheses. To determine if the choice of bat will have an effect on your batting average, you need to practice equally with both types of bats: wooden and metal.

Step 5. Collect ***data***.

Data are pieces of information from the experiment. The purpose of the experiment is to collect more data about the problem. Keep a record of how many hits you score with each type of bat.

Step 6. Study data.

Decide what the information means. Study your record of hits with each type of bat. Data helps you assess your batting average with each bat. The data helps you form a good conclusion.

Step 7. Make a conclusion.

Decide if your data supports your hypothesis. You continue to use a metal bat because that is what you have used for years to get the most hits.

Sometimes your values will influence your conclusion as you work to solve a problem. That was the case with Dr. George Washington Carver, the great American scientist of African descent.



Born in 1864 to a slave mother and raised by kindly, "white" foster parents, George grew up to become the world's top authority on products made from the peanut and sweet potato. Dr. Carver developed 325 products from peanuts and 118 from sweet potatoes. Dr. Carver said that the Bible influenced his decisions in many ways. He chose to work in Alabama at Tuskegee Institute, a ***fledgling*** college for students of African descent, under the direction of a former slave, the great "black" educator, Booker T. Washington. Rather than accept offers which would have paid him more money, Dr. Carver felt God could use him to help his countrymen more if he stayed in Alabama. In fact, he named his science lab "God's Little Workshop."

Your grandmother knew that you were facing a big problem and that you would need big help. She awoke your grandfather, and together they prayed for guidance about what you should do. Then, they called your mother, LaKendrick's parents and Rondarius' mother to discuss what to do with the chemical you found in the bag.

From your observations, you knew that the stranger had not wanted to be caught with the bag, so he had thrown it from the car. Your hypothesis was that the chemical held the answer to the events that had occurred at the convenience store. The data was that gunshots were fired and one man had been stabbed. After discussing the events, you concluded that you should tell the police the truth. Your grandfather dialed the number.

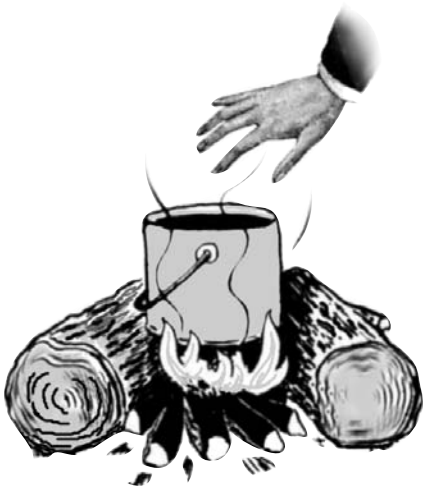
Life Principle



"Problems are opportunities in disguise."

—Anonymous

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Lesson 9
Human Anatomy

Chapter 1

The Five Senses

Section 2

Lessons 6-10

USING YOUR SENSES



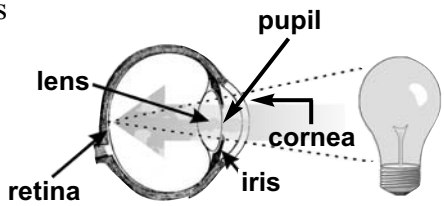
Your mom took you to the police station where you delivered the bag with the chemical and agreed to answer some questions. You learned that the stab-victim was the man who had been talking on the pay phone. He was the same man you had seen get into his truck after someone had shot at him and driven away. You explained that you had seen the victim toss the bag out the car window. The police asked you to explain carefully any details, beginning with your walk to the convenience store. You told about the dead armadillo with the flies and the lizard's tail. Then, you told about your arrival at the store. You tried to remember what you saw, what you drank, what you heard, what you felt, and what you touched. The police told you that every detail could provide clues needed to solve the case.

VOCABULARY

Pupil: dark opening in the center of the eyeball
Iris: colored area around pupil
Cornea: a tough, transparent membrane protecting the iris and lens
Lens: a fat, transparent disk; focuses and spreads light entering the eye to form images on the retina
Retina: tissue lining the back of the eyeball, receives images from the lens
Receptors: nerve endings that are sensitive to certain stimuli
Vibrations: rapid back and forth motions
Salivate: to produce saliva

Your five senses enabled you to gather different kinds of information around you to interpret events and remember them. The senses of sight, hearing, touch, taste and smell work together to give you an understanding of your environment. Knowing how your senses operate and how to use them effectively helps you interpret your observations accurately.

The sense of sight begins with light entering your eye through an opening called the ***pupil***. The pupil is the dark spot in the center of the eye. The colored area around the pupil is



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the ***iris*** which is actually a ring of tiny muscles. These muscles control the size of the pupil. Both the iris and pupil are covered by the ***cornea***. An increase of light causes the size of the pupil to become smaller. In dim light, the iris muscles relax to allow the pupil to enlarge, which lets more light enter. As it enters the eye through the pupil, light passes through a ***lens*** which focuses the light on the ***retina*** at the back of the eye. The retina is a tissue that contains about one billion light-sensitive ***receptors***. Another three million retina receptors allow you to detect colors and shapes.

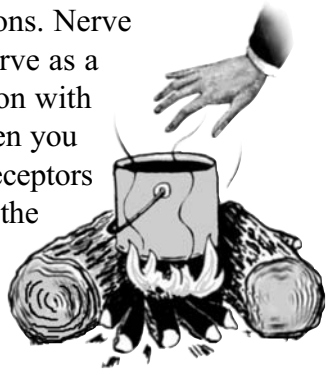
Early camera makers used the design and wonders of the eye as a model for their inventions. However, no man-made instrument can duplicate the precision of the original design. Eyes not only receive image-producing light, they continuously send messages. Eyes are called the "windows of the soul." Eyes can communicate what we think and feel, whether sparkling with happiness or reflecting sadness, despair, anger or fear. Eyes can communicate a spirit of sensuality or one of integrity, high character and a hundred other things.

The sense of sound begins with rapid back and forth motions called ***vibrations***. You are able to hear because of the vibrations in the air that strike your eardrums. These vibrations are called *sound waves*. All sounds are produced by vibrating objects. Any solid, liquid or gas that carries the pattern of sound is called a *medium* for that sound. The molecules in matter bounce back and forth as sound travels through a medium to your ears, causing your eardrum to vibrate. The sound you hear is really air pushing on your eardrums. The vibrations are passed to the fluid in your inner ear. The fluid bends the tiny hairs in your inner ear, and passes on the vibrations in the form of messages to your brain.



Some sounds cause images to appear in our minds. Most people become worried when they hear sirens. Many people become fearful when they hear dogs growling. Some people think of children when nursery rhymes are heard. Others think of traffic when horns honk. An interesting experiment with dogs was done by a Russian scientist named Ivan Pavlov to associate sounds with mental images. In his experiment, Dr. Pavlov rang a bell, then set food in front of the dogs and allowed them to eat. If you have ever watched dogs eat, you know they produce a lot of saliva. Dr. Pavlov continued a routine of ringing the bell, setting food in front of the dogs, and letting them eat. Then, the doctor changed his routine. He rang the bell but gave the dogs no food. The dogs began to ***salivate*** in anticipation of the food. Pavlov continued with the experiment and found that every time he rang the bell the dogs salivated, even if they did not receive any food. The dogs were conditioned to salivate because they associated the bell with food and began to anticipate a meal.

Your sense of touch begins with your skin which is the barrier between your internal organs and your environment. Your skin responds to pressure and pain as well as hot and cold sensations. Nerve endings in your skin serve as a means of communication with your environment. When you touch a hot stove, the receptors in your skin respond to the heat and communicate in micro-seconds to your brain that you



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need to jerk away your hand. If your skin were not so sensitive, you could leave your hand on the stove until the flame burned your hand. Your skin's main function is to serve as a watertight covering. Additionally, your skin is your body's first line of defense against germs. One of the best precautions you can take to rid yourself of germs is to wash your hands often, certainly after using the toilet and before eating or handling food.

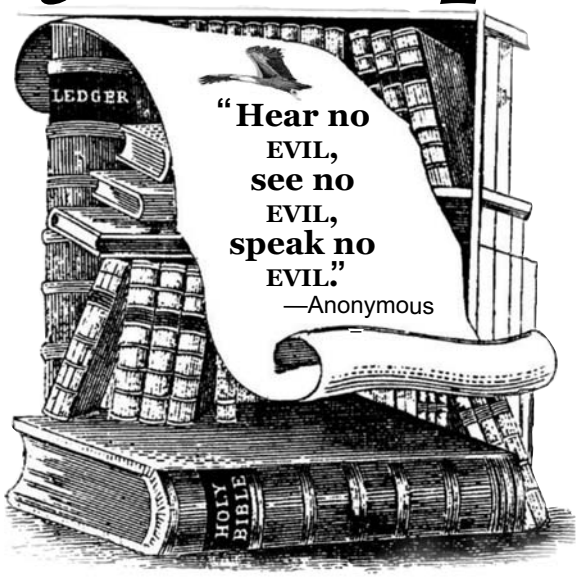
Your sense of taste is a function of your taste buds located on your tongue. Your tongue has four types of taste buds or taste receptors—sweet, sour, salty and bitter. Each type of taste bud is located in a different area of your tongue. Taste buds are also located on the roof of your mouth.

Your sense of taste is closely related to your sense of smell. Smell receptors are located in your nose. When you eat something, the odor of that food travels up a passage from the back of your mouth to your nose. The smell receptors identify that food from past experiences and send a message to your brain. Your brain interprets the flavor of that food based on your combined sense of taste and smell. When you have a head cold, your smell receptors do not work as well. That is why, when you have a cold, food does not taste as good as it normally would taste.

People use their senses to remember special times in their lives. Certain sounds, smells or tastes remind us of holiday activities. The smell of pine or cedar trees can bring Christmas memories. The sound of fireworks is related to 4th of July celebrations of our independence from England in 1776. Certain food odors remind us of holiday meals such as Thanksgiving dinner.

You, Rondarius and LaKendrick were given a big assignment. You needed to use your senses to remember exactly what had happened during the incident at the convenience store. You hoped that something you said would help solve the crime.

Life Principle



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Lesson 10
Human Anatomy

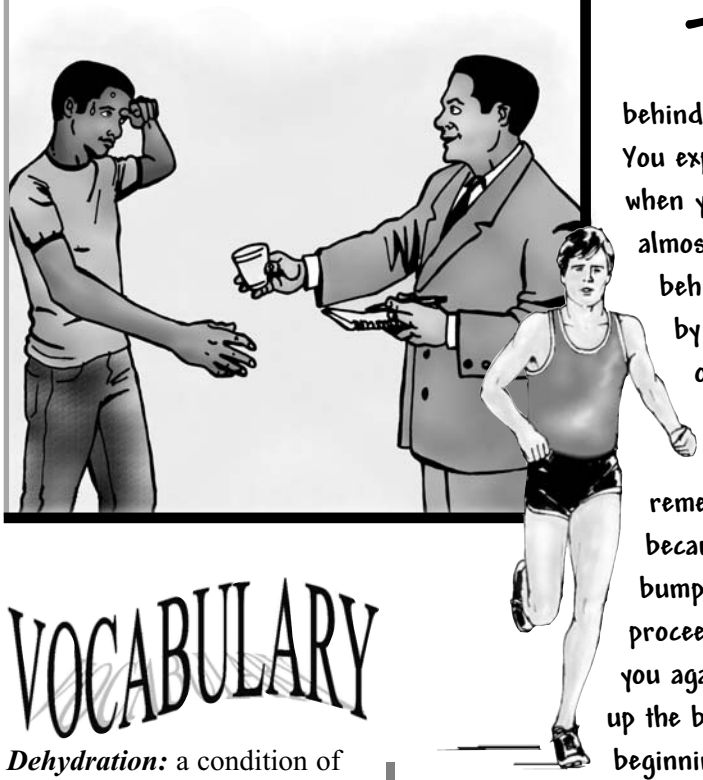
Chapter 1

The Urinary System

Section 2

Lessons 6-10

WHAT A WASTE



The police detective who questioned you stopped you when you told about ducking behind the metal trash barrel in the parking lot. You explained that you had needed to find protection when you had heard gunshots. You added that you almost lost your balance when you crouched behind the barrel and tried to steady yourself by grabbing it, but it was too hot to hold onto. The detective asked you if the barrel was in the direct sunlight, but you remembered that it had not been. You remembered exactly where the sun had been because of the way it reflected off the chrome bumper into LaKendrick's eyes. As you proceeded with the details, the detective stopped you again when you came to the part about picking up the bag. You felt yourself becoming nervous and beginning to sweat; and wiped your face with your sleeve. The investigator offered you a drink of water, which you gladly accepted. But, he came right back to the point about your taking the bag and running through the field with it. You began to sweat again.

VOCABULARY

Dehydration: a condition of significant loss of body fluids
Strenuous: vigorous or hard
Kidneys: main part of urinary system
Urinary system: composed of kidneys, urinary bladder and connecting tubes; filters liquid wastes from the bloodstream
Ureters: tubes leading from the kidneys to the urinary bladder
Urethra: tube through which urine passes to outside of the body
Nephrons: microscopic blood-cleaning units of the kidneys

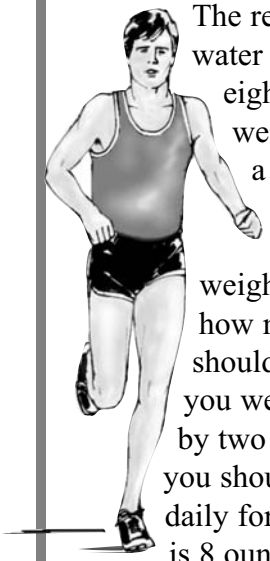
As the body uses energy to function, the body produces a number of waste products. The human body is about 66 percent water. Slightly more than four pints of water are exchanged daily. The body loses that amount and must replace it. Some water is lost in perspiration, some in the air exhaled and some through the kidneys.

Second only to oxygen in importance, water is essential for life. You cannot survive without it. Water is necessary to help regulate every body function. Water in the form of plasma in the blood carries nutrients to your cells and transports

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wastes from your cells. All organisms have waste products which must be eliminated for survival. Body cells eliminate wastes in several forms including excess water, carbon dioxide, and nitrogenous waste products. When you perspire, you eliminate waste products and prevent the buildup of internal heat. Sometimes you perspire as a result of becoming too hot. Sometimes you perspire when you are in a stressful situation.

Athletes and other individuals who exercise in hot weather must replace fluids lost through sweating during competition.

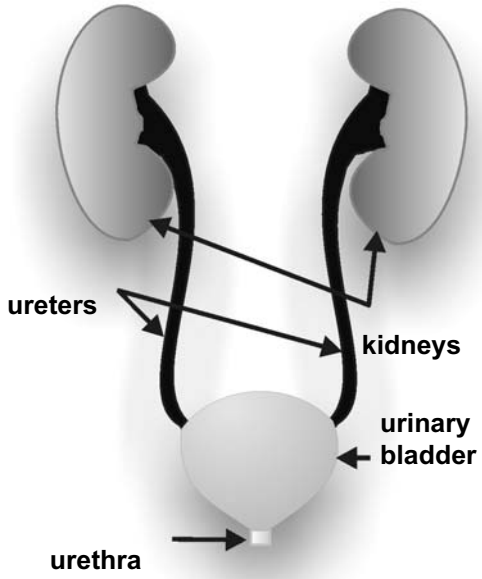


The recommended amount of water intake each day is six to eight glasses, depending on your weight and activity. To arrive at a specific amount of water for your weight, divide the number of pounds you weigh by two. That will indicate how many ounces of water you should drink each day. Suppose you weigh 100 pounds. Dividing by two gives an answer of 50. So you should drink 50 ounces of water daily for good health. Because a cup is 8 ounces, 50 ounces would be six and one fourth cups. (Beverages containing caffeine do not count much, because caffeine pulls water from the body.)

If you are working or exercising in hot weather, you must increase the amount of water significantly to avoid ***dehydration*** or heat stroke. Recommendations include drinking water before, during and after a ***strenuous*** workout.

The majority of the water in your body is eliminated through your two, fist-sized, bean-shaped ***kidneys***. The kidneys are the most important part of the ***urinary system***. The kidneys filter some liquid waste products and excess water from the blood. The liquid wastes, called *urine*, pass through ***ureters*** and

Urinary System



are stored temporarily in the *urinary bladder*. The urine passes through a tube called the ***urethra*** to the outside of the body.

The kidneys filter every drop of blood in your body about 350 times a day, or about once every four minutes, by means of over one million tiny blood-cleaning units called ***nephrons***. Your body contains about 6 quarts of blood. By circulating it 350 times a day, your kidneys have to filter about 2,100 quarts of blood per day.

In addition to filtering waste products, kidneys also regulate the volume of blood and keep necessary substances in the blood at proper maintenance levels. For example, if too much sugar exists in the blood, the kidneys have to work harder to filter the excess sugar.

The kidneys are necessary for survival. You have two kidneys. Most people could survive with only one kidney. However, if both kidneys fail, the person will die. When someone suffers from kidney failure, only a couple of medical options are available. A person can be connected to a kidney *dialysis* machine, which mechanically filters wastes

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from the blood and is a painful process. A kidney *transplant* may be performed (at great cost) if a donor can be found. A donated kidney would then be surgically implanted into the person's body. Less than five percent of kidney transplant patients survived for more than two years until Dr. Samuel Kountz, an American surgeon of African descent, developed a technique for detecting the body's rejection of a transplanted organ. Dr. Kountz's work resulted in prolonging the lives of transplant patients. He developed the largest kidney transplant research and training program in America.

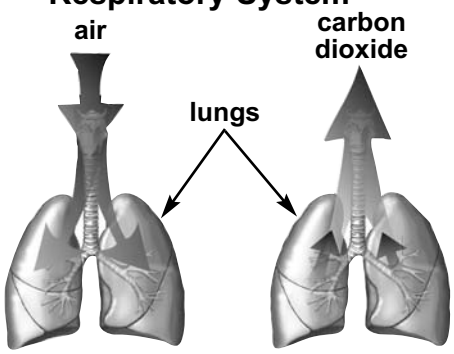


Dr. Samuel Kountz

The best way to maintain the bodily processes which eliminate waste is to eat nourishing food and drink plenty of water each day. Avoiding alcohol and chemical substances harmful to the body helps lessen the strain on the kidneys.

Waste products like carbon dioxide are removed through the respiratory system.

Respiratory System



The exchange of oxygen and carbon dioxide occur in the lungs. Carbon dioxide is released when you exhale. Some waste products, like old red blood cells, are filtered from the blood by the liver, ushered into the large intestine and passed from the body with undigested foodstuffs.

You stopped sweating after you described the events of your day, including how you picked up the bag with the chemical. You felt better after telling the truth . . . that is, until you saw the man in fatigues saunter through the door.

Life Principle



"Most of the time we make the consequences we face."

—Anonymous

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Lesson 11
Biology

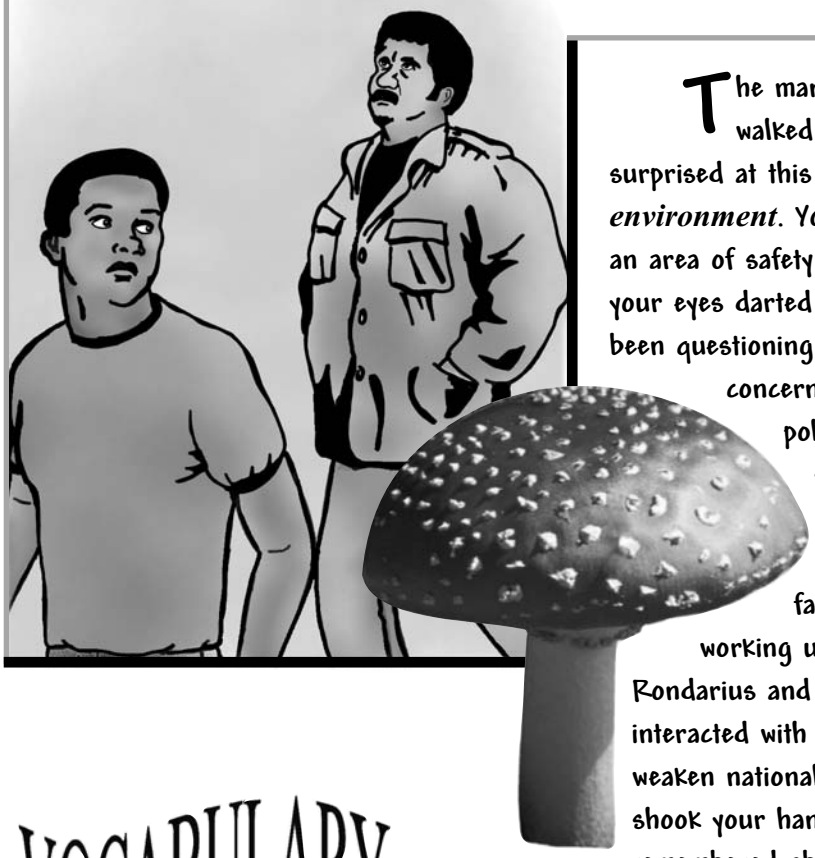
Chapter 1

Ecosystems

Section 3

Lessons 11-15

INTERACTIONS



The man in fatigues looked intense as he walked briskly toward you. You were surprised at this sudden intrusion into your ***environment***. You thought the police station was an area of safety. You felt your muscles tense as your eyes darted to the police detective who had been questioning you. He did not seem to be concerned that this man was invading police territory. In fact, the detective stood and shook hands with him like they were old friends. You finally discovered that the man in fatigues was actually an FBI agent working undercover in a chemical lab. You, Rondarius and LaKendrick unknowingly had interacted with a crime organization's efforts to weaken national security. The man in fatigues shook your hand and told you that one detail you remembered about the day's activities had helped provide the evidence needed to arrest the men involved. Your observation about something in your environment had provided the needed clue.

VOCABULARY

Environment: your surroundings
Ecosystem: interactions within your environment
Producers: organisms which make their own food
Consumers: organisms which consume other organisms for food
Decomposers: organisms which break down once-living things for food

All living things, including people, depend on their environments for life. An environment consists of everything around an organism. Your environment can change as you move throughout the day. During school hours, most of your environment consists of a classroom and the people in it. After school, you may have a job. That would be your work environment. Where you live is your home environment. A particular place where an organism lives is its *habitat*.

As you move through your environments, you interact with both living and nonliving things. You interact with your

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friends, classmates, teachers, supervisors, parents, ministers, elected officials, clerks, convenience store owners, and many others. Additionally, you also interact with other living things such as plants and animals. Your interaction does not stop there. Your over-all environment is filled with many nonliving things as well. You can feel the warmth of the Sun or the chill of a cold wind. You interact with cars, perhaps riding in one or watching for one as you cross the street.

You are affected by, and interact with, all the living and nonliving things within your environments. These relationships form an ***ecosystem***. An ecosystem is a community



of organisms interacting with one another and with the environment. Your school is actually an ecosystem. At school, students and teachers interact with one another and with nonliving things such as books, papers and pencils. Your neighborhood is another ecosystem. You and your neighbors interact with one another as well as with the structures that make up your neighborhood. Even the plants and animals that live within your neighborhood affect one another.

Survival depends on how organisms live and interact within their environments. Food in some form provides the energy all organisms need to perform life processes. Depending on how they get their food, organisms can be either ***producers***, ***consumers*** or ***decomposers***.

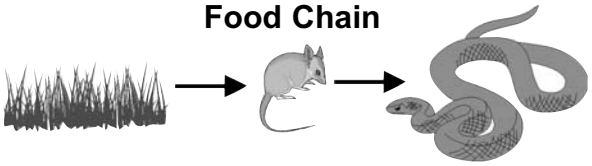
Producers can make their own food. Green plants are producers. They use soil, sunlight, carbon dioxide and water to produce food. *Consumers* are organisms that are unable to make their own food. They must consume other organisms to obtain energy. People are consumers. Animals are consumers. A *decomposer* is an organism that breaks down once-living things for food. Fungi (plural of *fungus*) and bacteria are decomposers. Producing, consuming and decomposing to obtain food are ways in which organisms interact.



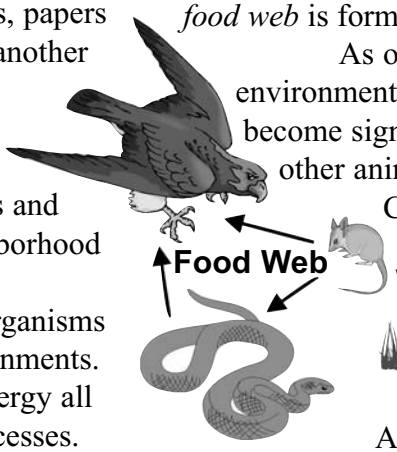
Fungus

Food provides the energy organisms need for survival. Energy flows in an ecosystem according to what the organism eats. When consumers eat plants, the energy from the plants is passed to the consumer. These animals are eaten by other animals, and the energy passes from one consumer to the next. A *food chain* is a model of how the energy in

Food Chain



food is passed from organism to organism in an ecosystem. When food chains overlap, a *food web* is formed.



Food Web

As organisms live in their environments, ecosystem interactions become significant. Animals that eat other animals are called *predators*. Cats eat mice. Cats are the predators, mice are the prey. Many people have cats as pets to help eliminate mice.

An organism's survival is related to how well the organism can interact within its ecosystem. For humans, survival against wild animals or forces of nature is not a major concern in modern times. However, violent crimes are a rising cause for concern,

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in America, as statistics reveal. Acts of random violence occur, which claim the lives of innocent bystanders. Drive-by shootings, carjackings, school shootings or gang conflict often lead to death or serious injuries for anyone in the vicinity (environment) at the time. International violent crimes, better known as *terrorism* are gaining momentum and producing worldwide fear.

Domestic violence, or violence against family members, is also increasing. Instead of resolving conflicts, some family members resort to physical or verbal abuse to get their way or protect their bad habits.

Everyone faces conflicts in life. No environment (or person) is without problems or obstacles which need to be overcome. Learning to communicate feelings and to express emotions in healthy ways can be helpful in preventing misunderstandings or conflict. Listening carefully to what the other person is saying is helpful in understanding a different perspective and agreeing on a compromise.

Resolving differences is a healthy way to maintain positive relationships. Avoiding the use of drugs and alcohol helps keep your mind clear and functioning. Many churches and faith-based organizations provide programs for family counseling, conflict resolution and communication skills which help teach behaviors for successful interactions and better environments.

The man in fatigues walked with you to your mom's car. You were thankful that you were going home to a safe environment. You asked the agent about the clue that had helped. He told you it had to do with the metal barrel that was too hot for you to grasp. He said that he would explain more the next day when he planned to take you to the chemical lab where he worked as an undercover agent. Right then, all you wanted to do was go home!

LIFE PRINCIPLE

"A clean thought comes from a clean heart."

—Anonymous



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Lesson 12
Biology

Chapter 1

The Reproductive System

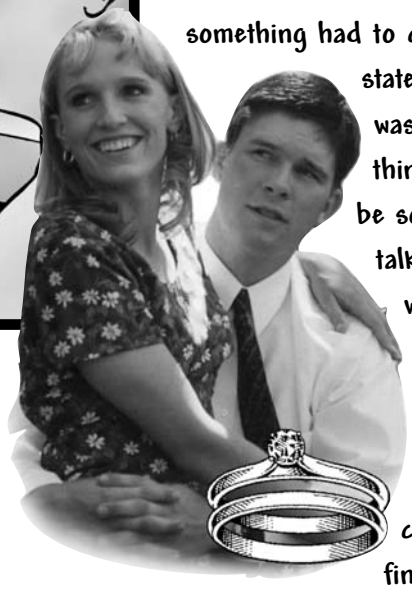
Section 3

Lessons 11-15

THE SAME KIND



Agent Gomez arrived in a suit at your door. He looked different than when he was in his fatigues. As he drove to the chemical company, he explained that what you had said about the metal trash barrel made him realize that something had to cause the barrel to be hot. You stated in your account that the barrel was not in the sun. The only other thing that could cause the barrel to be so hot would be fire. The man talking on the pay phone knew he was being followed, so he threw the recipe for making the chemical formula into the trash barrel and tossed in a lighted match. The papers did not burn completely, and the man's fingerprints linked him to the crime. He had stolen the directions and a bottle of the chemical from the Lone Star Chemical Company where Agent Gomez was working undercover.



You still had questions about the attempted drive-by shooting of the man using the pay phone. You also wanted to know how he got stabbed. But the question you asked first was about the chemical formula. You wanted to know what was so important about the formula that would cause the man to risk his life to steal the paper. You were shocked to hear that it was a formula for reproducing a type of super-human being. You knew that sheep could be cloned. You wondered if humans could be reproduced with the use of chemicals.

VOCABULARY

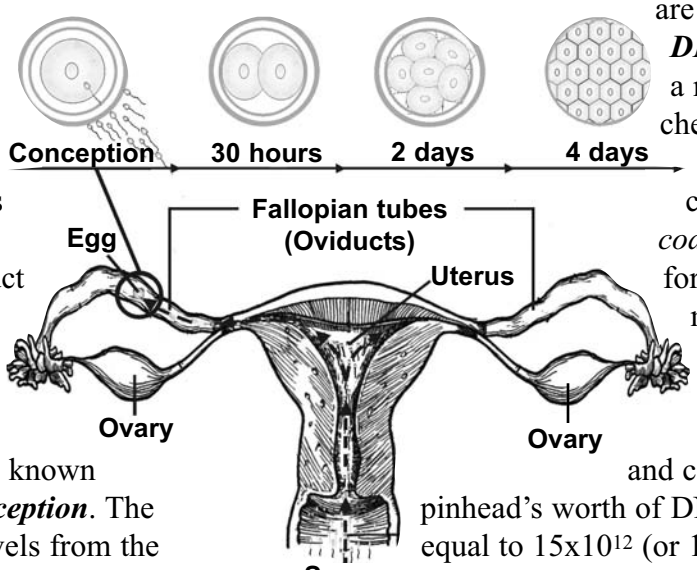
Sperm: male sex cell
Egg: female sex cell
Fertilization: process of sperm and egg uniting
Ovulation: process of releasing an egg
Conception: beginning of a new person; fertilization, pregnancy
Reproduction: process by which living things produce other living things of the same kind
DNA: abbreviation for deoxyribonucleic acid; chemical name for microscopic genetic code housed in tiny nucleus of each cell
Lactation: a period of milk production in female humans and mammals

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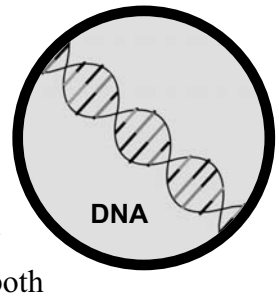
You already knew that new life is created when the male sex cell, the ***sperm***, and the female sex cell, the ***egg***, are joined during the process of ***fertilization***. The male reproductive system produces sperm in the *testes* which are two small glands in a sac called the *scrotum*.

A sperm is shaped somewhat like a tadpole. The long, whip-like tail provides a means of movement as millions of microscopic sperm navigate through a thick, whitish fluid called *semen*, or seminal fluid.

The human female reproductive system releases an egg cell from an ovary, usually once every 28 days. This process is called ***ovulation***. The egg cell travels through a *fallopian tube*, or oviduct, on its way to the *uterus*. If sperm are in the oviduct and conditions are right, one sperm will penetrate one egg which will produce one individual. This is known as the moment of ***conception***. The fertilized egg then travels from the oviduct into the uterus where it attaches to the uterine wall. There the baby will grow and develop for approximately nine months. Then the male and female become parents, responsible for nurturing a child.



When an egg is not fertilized, it will pass from the female's body. The lining of the uterus would have thickened with blood and tissue in preparation for pregnancy. However, fertilization did not occur, so the lining is not needed. The body releases that extra lining in a process called *menstruation*. The menstrual flow usually lasts about 3 to 5 days. Then the whole cycle begins again with the release of another egg. The entire monthly cycle requires approximately 28 days and continues year after year during a female's reproductive years, except during pregnancy, ***lactation*** or certain other hormonal changes.



Reproduction is the process for producing offspring. This is the way a species continues. The offspring is the product of equal contributions from both parents. The egg is contributed by the female parent, and the sperm is contributed by the male parent. Within the egg and the sperm are molecules of ***DNA*** which contain a mind-boggling chemical code. This information is called the *genetic code* and is necessary for building and maintaining life. Information in the genetic code is so incredibly detailed and compacted that a pinhead's worth of DNA would be equal to $15x10^{12}$ (or 15 million million) 160-page books! That would be enough for each of the 6 billion people on Earth to have 2,500 copies! The incredible complexity of the genetic codes of all living things has caused many scientists to question old theories of evolution. They reason that such complexity could not have come about either by chance or over long time periods.

Humans, animals and plants all have genetic codes. The offspring is a product of the contributions of each parent. That is why pigs give birth to pigs, dogs give birth to dogs, a rose bush produces seeds that become rose bushes, a daisy produces seeds that become daisies, and humans give birth to

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humans. The DNA genetic code is consistent with scientific evidence which confirms that humans always produce humans and any specific animal always produces only that animal. Humans come from humans. They cannot come from monkeys nor any other animal. This is known as a *scientific principle:* species of parents will give birth to the same species. In fact, the definition of reproduction states that principle. *Reproduction* is the process by which living things produce other living things of the same kind.

A major difference, however, exists between animal reproduction and human reproduction. Animals mate through instinct. That means that they have inherited behaviors which signal times to mate and produce offspring. Humans are very different. We can choose if or when we want to have a sexual relationship. That choice becomes one of the most significant decisions we make.



The sexual relationship is designed to be a special part of the loving relationship between a husband and wife who are committed to each other for a lifetime. Such a relationship can bring a sense of joy and unity in marriage between a man and a woman and develop a lasting bond of closeness and intimacy. However, if misuse or abuse of the sexual relationship happens, through rape, promiscuity or perversion, the resulting bitterness and pain can also last a lifetime. Humans have been created with the ability to make wise decisions. We do not have to act on emotions, which can change radically from one day to the next. Some people react emotionally and lustfully toward persons of the opposite gender. The absence of moral restraint often leads to sexually transmitted diseases and premature pregnancies. Some humans consider only the moment. They do not think about the future. They gamble that negative consequences will not happen to them—only to other people. Decisions about sex affect you for a lifetime and therefore, need to be considered very carefully.

Each year in America, about a million pregnancies occur among unmarried teenagers. Of those one million out-of-wedlock pregnancies, approximately one-third of the babies are aborted. That means that 333,000 babies are killed each year before they can be born. At least three million teenagers (both boys and girls) contract sexually transmitted diseases (STDs) each year. Those STDs lead to deadly and disabling health problems. HIV/AIDS will lead to death. Sexual activity outside of marriage can have serious and life-threatening consequences.

The healthiest decision a teenager can make is to develop the moral courage to abstain from sexual activity until marriage. Then, once married, to be faithful to the marriage partner for life. Abstaining from any sexual relationship outside of marriage is a wise choice for a healthy future.

Agent Gomez picked up LaKendrick and Rondarius on the way to the chemical company. Gomez told all three of you that you had made a healthy choice in choosing to leave the convenience store when you did. Mr. Gomez continued, "After the man talking on the phone avoided the gunshots, he jumped into his truck, drove a short distance and threw out the bag. Later, he returned to see if the evidence he had tried to burn in the trash barrel was destroyed.

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The man who fired the gun had also returned. He and his accomplice attempted to stab the other man to death!"

Agent Gomez believed that you, Rondarius and LaKendrick might be able to identify the criminals, who were believed to work at the Lone Star Chemical Company.

Life Principle



"Imitation is the greatest form of flattery."

—Anonymous

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Lesson 13
Biology

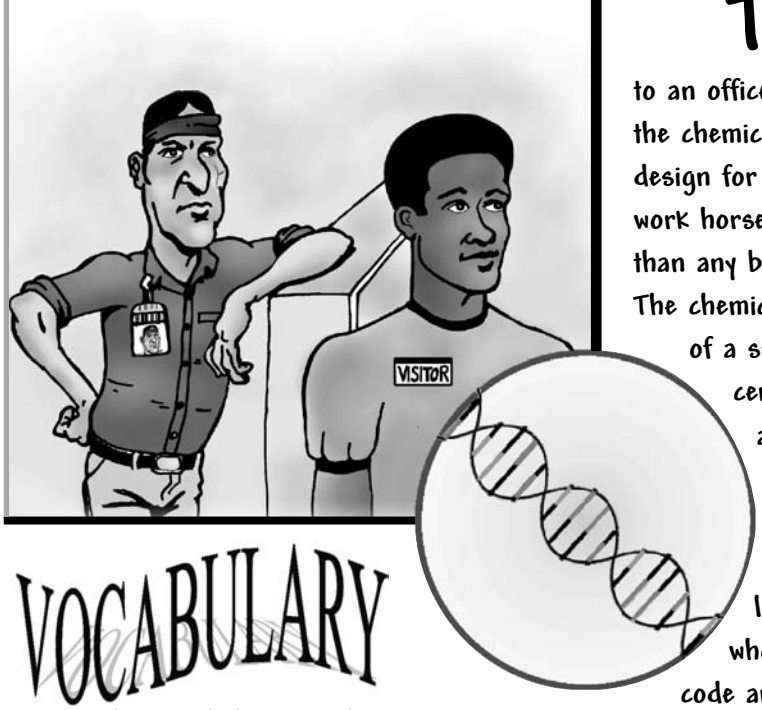
Chapter 1

Genetics

Section 3

Lessons 11-15

TRAITS



The four of you entered the Lone Star Chemical Company and went directly to an office. There, Agent Gomez explained that the chemical you found was an experimental design for producing a genetic code for a type of work horse which could run faster and stronger than any breed of horse which currently exists. The chemical was to be injected into the ovaries of a specific group of mares with the certainty of producing a breed of bigger and stronger horses. Those colts would be cloned and a new generation of super-horses would be developed. All of this was top secret until it was leaked to agents from another country who had the capabilities of analyzing the code and applying it to the human race. Their insane plan was to produce a superior race of humans to infiltrate and take control of the United States. The super-humans would have ***traits*** of strength and speed which could equip them to become the most powerful army on planet Earth.

VOCABULARY

Traits: characteristics passed from parent to offspring
Hemophilia: a disease in which the blood has difficulty in clotting
Sickle cell anemia: a disease in which the red blood cells are a sickle shape and do not carry enough oxygen
Monk: a male member of a religious order
Chromosomes: part of the cell that carries the information which determines traits
Gene: part of a chromosome

Any characteristic passed from parent to child is a trait. Traits include such characteristics as height, hair color, skin shade, eye color and ear shape. Even certain diseases like ***hemophilia*** or ***sickle cell anemia*** are inherited traits. Long legs, curly hair and dimples are also examples of inherited traits. *Genetics* is a branch of science that studies the way traits are passed from parent to offspring.



Normal red blood cell



Sickle cell

For many years, farmers have used genetics advantageously to produce better livestock and crops. If

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farmers want a certain trait in cattle, the farmer looks for animal pairs that exhibit the desired trait and uses those pairs in the breeding process. For example, a farmer who wants cows that produce large quantities of milk will find a cow that is a good milk producer and breed her to a bull which sires good cows. This process is known as *selective breeding*.



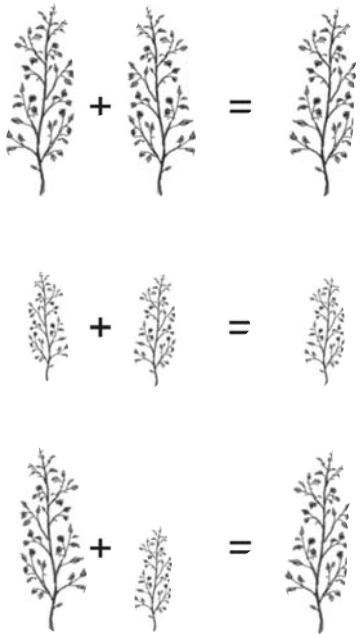
Farmers also use this same process to grow high quality crops. If farmers want corn with sweet, tender kernels, farmers look for a crop of corn with sweet, tender kernels. Rather than selling all of that corn at the market, the farmer saves some of the good seeds for planting the next crop.

Farmers have learned that traits do not occur accidentally, but rather, in patterns. In other words, farmers do not leave to chance what type of corn they will produce or what type of cattle they will raise. Through the study of genetics, farmers can predict which traits will be in evidence in the plant or animal offspring. Certain genetic principles apply to all breeding situations.

Gregor Mendel, an Austrian ***monk*** and amateur scientist, conducted numerous experiments with over 21,000 pea plants in the mid-1800s. He showed that traits do not occur purely at random. Mendel was able to show that certain traits occur in a mathematical ratio and are predictable. He worked with some of these traits: shape of seeds, color of seeds, color of seed coats, color of pods, shape of pods, plant height and position of flowers. For several years, he kept records as he observed variations in plants. Some seeds were smooth; others were wrinkled. Some seeds were yellow; some were green. Some seed coats were green, while some were white. Some pods had full shapes, some had flat shapes. Some plants were tall; some were short. Some plants had flowers on the sides of branches; some had flowers at the tips of branches. Mendel noticed that two variations occurred for each trait. For example, for plant height, traits were either tall or short. For plant color, they were either yellow or green.

Mendel crossed pea plants with different traits to discover what would be produced. For example, he crossed a tall pea plant with a short pea plant. Then from those plants, he would cross seeds to see what the next generation would produce. He found that certain traits appeared frequently, while other traits appeared only occasionally. As he studied his data, he began to see a pattern develop. He found that when he crossed tall pea plants with tall pea plants, the result was tall pea plants. He also found that when he crossed short pea plants with short pea plants, the result was short pea plants.

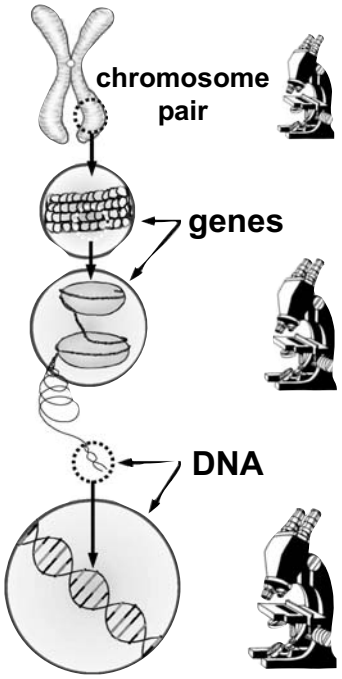
Mendel's Observations on Traits



Because he always obtained the same results, he called these traits "pure." He then crossed a pure tall pea plant with a pure short pea plant. The result was tall plants. Never was the result short plants. In distinguishing between the trait of height, he decided that tallness was *dominant*, meaning always expressed because it always dominated or over ruled the short trait. He concluded that a trait must be controlled by factors inherited from both parents.

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Scientists now realize that the factors from the parents, which influence traits in their offspring, are actually located on the 46 ***chromosomes*** in the cell provided by each parent. The chromosomes are the part of the cell that carries the information which determines the traits of the offspring. A ***gene*** is a section of a chromosome. You can think of a chromosome as resembling a string of beads. Each bead would be a gene. In humans, each parent contributes 23 pairs of chromosomes to the offspring. In plants and animals, the number of chromosomes will be different, but the principle is the same. Each parent of the offspring contributes half of the chromosomes. The genes on those chromosomes can be either dominant or recessive or blended.



Mendel's work greatly enhanced the study of dominant and recessive genes and predictions about offspring. Based on Mendel's work, other scientists learned that many traits have predictable patterns of inheritance. Genes express themselves in offspring three basic ways.

A *dominant* gene will express itself to the exclusion of all other genes of the same trait. For example, in humans, one parent contributes a dominant gene "B" for brown eyes to its offspring. The other parent contributes a recessive gene "b" for blue eyes. Because brown is dominant, the offspring's eyes will usually be brown.

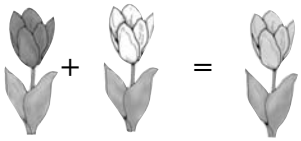
A *recessive* gene will express itself only when not in the presence of a dominant gene. If both parents contribute a recessive gene "b," the offspring would then have blue eyes, because no dominant gene existed to mask or hide the recessive gene.

For some traits, genes are neither dominant nor recessive but are what is known as *incomplete dominance*. Some flower colors would be controlled this way. A plant that received an "R" from both parents would be red in color. (Note that a capital letter is used to represent a dominant gene, while a lower case letter represents a recessive gene.) A flower that received an "r" from both parents would be white. If an offspring received an "R" from one parent and an "r" from the other, this new flower would be pink. Neither gene would dominate, but instead the two would blend.

An Example of INCOMPLETE DOMINANCE



R+R=R



R+r=Pink



r+r=White

The human race, animal world and plant kingdom all demonstrate marvelous design. Each living organism is intricate and precise in structure and reproductive qualities. Therefore, scientists can use genetics to improve the quality of life. Mendel's experiments were a major breakthrough in helping to understand inheritance from one generation to the next. Gregor Mendel, who came to be known as the *Father of Genetics*, was discovering the Laws of Genetics (later called *Mendel's Laws*) during the same time Charles Darwin was putting forth his Theory of Evolution. Darwin had no knowledge of genetics on which to base his theory, and Mendel's work was ignored by the scientific community for

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the next 30 years. Mendel (who believed Earth was divinely created) rejected Darwin's theory, although he was quite familiar with it. Later, Darwin supporters tried to incorporate Mendel's Laws into the Theory of Evolution to strengthen the theory, although Mendel's Laws actually contradicted the concept of one kind of creature slowly evolving into another kind.

Recently, the subject of cloning has received considerable attention. A *clone* is the product of genetic duplication of a single cell from a single donor without the normal sexual process. However, much information still has to be learned about cloning before scientists justify experimenting with humans. Most clones of animals have developed symptoms of pre-aging and organ failure leading to death.

You and your friends were escorted through the chemical lab by Agent Gomez. He pretended to give you a tour so you might identify the men at the convenience store. You saw two men mixing chemicals at a table near the back of the lab. One of them looked your direction, and you saw a scar on his face. You froze with terror!

Life Principle



"Influence is passed from generation to generation."

—Anonymous

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Lesson 14
Biology

Chapter 1

The Immune System and Disease

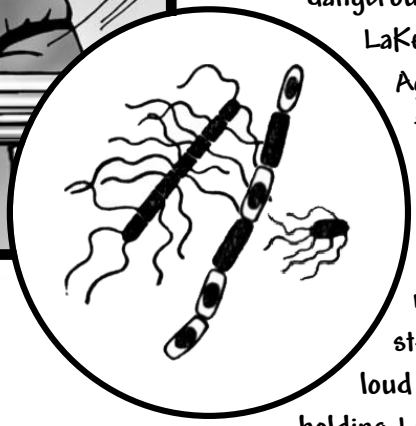
Section 3

Lessons 11-15

STAYING ALIVE



Apparently, the man with the scar recognized you at the same time you recognized him. He grabbed LaKendrick and put a knife to his throat. Holding LaKendrick, he demanded that Agent Gomez let him leave the building. You realized that the man was dangerous and would probably kill LaKendrick outside. You looked at Agent Gomez. His finger motioned toward a buzzer on the floor under a table near you. As Agent Gomez was negotiating with the man, you quietly and quickly moved two steps to your left and stepped on the buzzer. Suddenly, a loud alarm sounded, and the man holding LaKendrick reacted by throwing the knife at the only movement in the room. That movement was you! Agent Gomez tackled the man and handcuffed him. LaKendrick and Rondarius ran to you. You looked at your arm and saw blood!



VOCABULARY

Pathogens: tiny disease-producing microorganisms that attack body cells and tissues
Communicable diseases: diseases you can "catch" from or "give" to other people, such as colds, flu or pneumonia
Vaccine: a liquid containing dead or weakened bacteria or viruses injected into the body to stimulate the immune system to produce antibodies against a certain disease

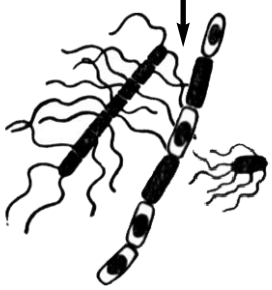
Your body systems work together to keep you alive. That is the job of your body . . . to survive. Sometimes you are not even aware that your body is engaged in a battle. An enemy force can invade your body without you even realizing it, and your body will organize an army to fight against harmful invaders. The enemy invaders are called *pathogens,* and the army your body sends into battle is your *immune system*.

Pathogens are microorganisms that invade your body with the purpose of attacking your cells and tissues. Pathogens exist in several forms, but the most common are bacteria and viruses. Pathogens are commonly referred to as *germs* and are the cause of many types of diseases in the human body.

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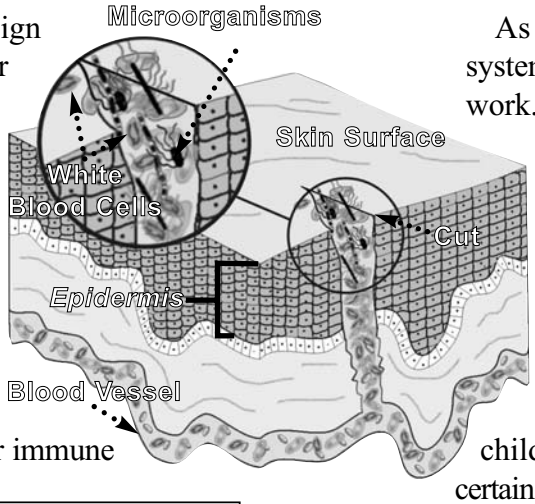
Bacteria are types of microorganisms which enter the body and multiply at rapid rates. Bacteria may release poisons that kill or injure body cells. *Viruses* are other types of microorganisms that invade cells of the body, but viruses have different strategies. A virus will take over the cell and reproduce itself. In either case, these pathogens can be very harmful to your health. They are responsible for many common, ***communicable diseases***.

Common Microorganisms



Before you are aware that an enemy has invaded your body, your defense system is already at work. Your immune system is in charge of protecting your body against pathogens and will immediately send white blood cells to destroy foreign invaders. Many times your immune system is successful, and you do not even realize that a battle took place. Every day you are exposed to germs which enter your body through your nose or mouth or even through tiny cuts or scrapes on your skin. Your immune system works hard on a daily basis to keep you free from as many germs as possible.

White Blood Cells Defend the Body



Pathogens are spread in many ways—through the air, through tiny drops of water, through contact with infected persons, through open wounds, or even through some animals. The common cold, strep throat and pneumonia are diseases that can be spread when tiny drops of water are coughed or sneezed into the air by infected persons. Sneezes can travel 36 inches in a second at the rate of 100 miles per hour. Always cover your nose and mouth when you sneeze or cough. Mosquitoes can spread malaria, and an infected animal, such as a dog or squirrel, can spread rabies.

As strong as your immune system is, it cannot do all the work. You must help prevent the spread of communicable diseases by living a healthy lifestyle, which includes avoiding people with communicable diseases, plus getting good nutrition and adequate sleep.

Most states require that children be vaccinated against certain communicable diseases. Through the process of vaccination, a ***vaccine*** is injected into the body which provides an immunity to certain diseases by means of ***antibodies***. Many diseases such as smallpox, polio, measles, mumps and rubella are less threatening because of worldwide efforts to immunize children.

Food can be a source of germs if not handled properly. Food must be properly stored and preserved. Temperature is an extremely important factor in food preservation. Perishable food, such as meat, must be refrigerated to

VOCABULARY

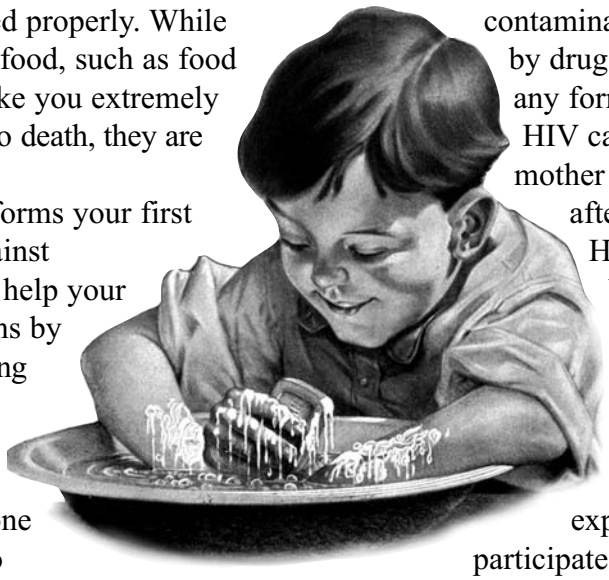
Antibodies: protein substances produced by white blood cells to combat specific bacteria or toxins
Antiseptic: medicine applied to the outside of the body that stops or slows down the growth of germs
Antibiotics: medicines that kill or reduce harmful bacteria in the body

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prevent spoilage. When such food is left on a table or counter too long, pathogens grow. Eating food that has not been refrigerated properly can cause you to become very ill.

Some foods must be cooked at high temperatures for long periods of time to kill bacteria that is present in the food. That is what Louis Pasteur realized when he established the process known as *pasteurization* for milk. Each state has laws that regulate food handling during manufacturing processes and in restaurants to keep food safe. Those laws are based upon discoveries by scientist Lloyd A. Hall. Dr. Hall's research on chemical sterilization helped provide information on how to preserve and handle food safely. He specialized in food preservation techniques and developed processes for curing (chemically preserving) meats and extending shelf-life of seasonings and bakery goods. Dr. Hall received more than 100 patents on products and methods that he invented.

Be sure that the food you eat has been cooked and handled properly. While diseases from bad food, such as food poisoning, can make you extremely sick or even lead to death, they are not contagious.



Your skin forms your first line of defense against infection. You can help your skin fight pathogens by bathing or showering regularly. Simply washing your hands frequently during the day is one of the best ways to prevent the spread of germs to the rest of your body. This is especially important after using the toilet and before putting food into your mouth. If you are cut, first use soap and water to clean the area. Then, you should use an ***antiseptic*** to stop or slow the growth of pathogens.

If the pathogens which have attacked your body are bacteria, certain medicines called ***antibiotics*** can help eliminate the bacteria and stop infections. Antibiotics are effective in working against bacteria and helping your body return to a better state of health.

Viral infections are harder to treat. Although no man-made cure exists for a virus such as the common cold, certain anti-viral herbs have been found to be beneficial. Scientists are still searching for a cure for HIV/AIDS. The letters in *HIV* stand for Human Immunodeficiency Virus. Notice that last word . . . virus. HIV is a malicious, highly infectious virus which causes AIDS (Acquired Immunodeficiency Syndrome). AIDS is fatal. A person infected with HIV eventually progresses into AIDS, which eventually leads to death. HIV/AIDS is a communicable disease transferred through contaminated body fluids. The two most common methods of spreading HIV are through sexual contact and through shared, contaminated hypodermic needles used by drug addicts. (Substance abuse in any form is harmful to your body.) HIV can also be spread from mother to baby before, during or after birth. In some instances, HIV can be spread through blood transfusions, although that is rare because donated blood is tested for HIV. The best way to avoid HIV is to avoid behaviors which would put you at risk of exposure. People who participate in sex outside of marriage or sexual contact with multiple partners increase the risk of HIV and many other sexually transmitted diseases (STDs), with horrible consequences.

You can do much to help your immune system operate effectively: wash your hands frequently; become immunized;

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eat food which has been cooked and handled properly. Avoiding behaviors which would put you at risk for diseases such as HIV/AIDS will help you stay alive and well.

You and LaKendrick were happy to be alive. Thankfully, the knife missed its mark and only slightly wounded your arm. Agent Gomez took you to the medical emergency room to make sure the wound was cleaned and treated properly. LaKendrick believed you saved his life. Maybe you did.

Life Principle



"Life is a gift worth living."

—Anonymous

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Lesson 15
Health

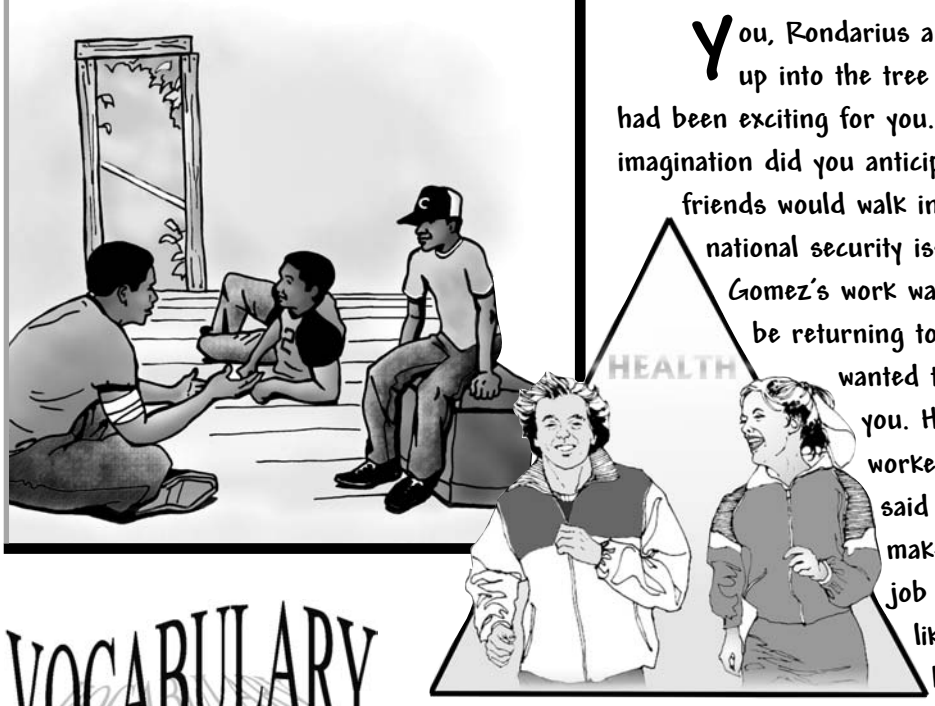
Chapter 1

Lifestyle Factors

Section 3

Lessons 11-15

A HEALTHY FUTURE



You, Rondarius and LaKendrick climbed up into the tree house. The last few days had been exciting for you. Never in your wildest imagination did you anticipate that you and your friends would walk into the middle of a national security issue! Although Agent Gomez's work was finished, and he would be returning to Washington, D.C., he wanted to keep in contact with you. He liked the way you worked under pressure and said that some day you would make a good candidate for a job with the FBI. You would like that. If FBI work would be anything like the last few days, you would be in for quite an adventure! Agent Gomez said you would have to finish school and keep yourself out of trouble.

You thought back to what he said about the plastic bag. He said that you should have called the police immediately. Instead, you had hidden the bag in the tree house when the police drove by. But, Agent Gomez said that after you talked with your grandparents, you did right by telling the truth. Mr. Gomez called that a good decision. He said that a good future is made by making good decisions, one at a time.

Your future will be affected by your decisions. Choices you make lead to a great future or to a future filled with hurts and disappointments.

Your health will be a significant part of your future. In fact, where you live, the kind of work you do, the types of

VOCABULARY

Life expectancy: the average number of years a person is expected to live

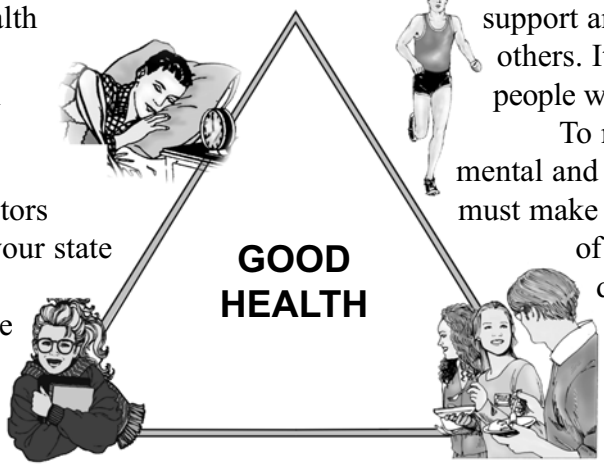
Lifestyle factors: repeated behaviors which affect your life

Well-balanced meals: meals which contain all the nutrients needed for a healthy life (vitamins, minerals, enzymes, proteins, carbohydrates, "good" fats)

Learned behaviors: non-inherited behaviors we learn or aquire

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activities you practice and what kinds of friends you have will be influenced by your health. Some people think that good health means you are free from any kind of disease. Actually, health involves more than simply freedom from disease.



Your body is made up of many factors which contribute to your state of wellness. *Wellness* means an overall state of well-being. Your *physical health* is probably what most people think of first when they think of health. Physical health does play an important role in wellness. Physical health means that your body and its systems are in good working order. You have enough strength and energy to get through the day. You can perform routine tasks and responsibilities.

Your *mental health* includes how you feel about yourself and others. It also includes how you relate to others and your world around you. It involves expressing your emotions in healthy ways and practicing self-control when faced with temptations such as violence, pornography or other forms of mind pollution. A mentally healthy person develops critical thinking skills and can solve problems effectively.

Spiritual health involves your belief system and includes practice of the U.S. National motto, "In God We Trust." In fact, doctors report that people who pray and attend religious services regularly are more likely to be emotionally stable and experience better physical health than people who neglect religious practices.

Your *social health* involves relationships with people around you. It involves working cooperatively and sharing ideas to reach a common goal. It includes maintaining friendships and lasting relationships as well as offering support and encouragement to others. It also means avoiding people who practice harmful habits.

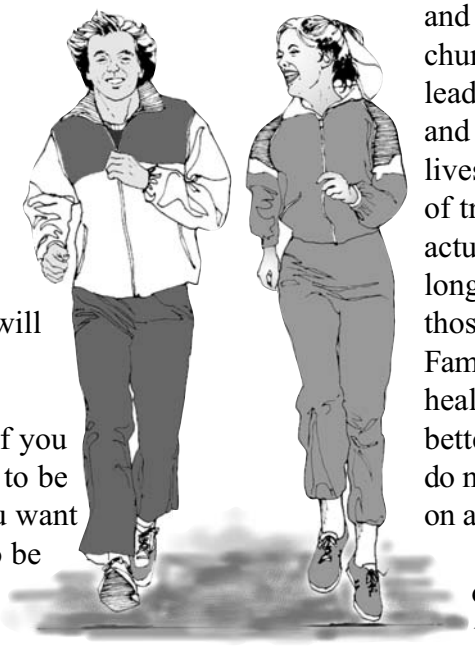
To maintain your physical, mental and spiritual/social health, you must make an effort to work on each of those areas. You must make decisions which promote good health, if you want a future marked by enjoyment of life. The current average ***life expectancy*** is about 80 years. Those 80 years can be filled with a lifetime of activity and personal fulfillment, or they can be spent in a state of disability, injury and regret. Much of your adult life will depend on decisions you make during your teen years, when you may feel the least like seeking wise counsel from those who have "been there" before you.

Research shows that you can take action which will promote a healthy future. Over the past 100 years, history records that health issues have changed dramatically.

In the early 1900s, the average life expectancy was 49 years. The leading causes of death were pneumonia, flu and tuberculosis. Notice this important distinction. The leading causes of death were *communicable* diseases. Today, the four leading causes of death in the United States are heart disease, cancer, strokes and accidents. Notice the differences! Studies indicate the leading causes of death today may be the result of certain negative ***lifestyle factors***. Modern medicine has given this generation great freedom from airborne communicable diseases. However, sexually transmitted diseases (STDs), including HIV/AIDS are increasing. Sexually transmitted diseases are a result of negative lifestyle choices.

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Lifestyle factors have significant roles in health. Lifestyle factors are simply choices you make about how and with whom you are going to live. Among the four leading causes of death today, each was the result of a choice that people made regarding how they would live. Heart disease is number one. Heart disease often results from unhealthy eating habits or substance abuse. A person can choose to limit food intake and to exercise regularly to help reduce weight. A person also can choose to not smoke, drink alcohol or use drugs.



Healthy lifestyle factors will lead to a longer, happier, more productive life. If you are going to live to be 80 years old, you want those 80 years to be healthy and productive. The alternative is to be sick and unproductive. Here are some lifestyle factors recommended by doctors and scientists that can lead to a healthy future:

*give up (or never start) using tobacco
*exercise daily
*eat nutritious, ***well-balanced meals***
*avoid alcohol and illegal drugs
*save sex for marriage
*get 8 hours of sleep each night
*wash your hands frequently
*learn to respond positively to stress
*channel anger into something productive
*emulate positive role models who live by core values
*participate in spiritual and social activities

Simple things like wearing seat belts, wearing protective headgear and equipment when you play sports and driving the speed limit will help prevent accidents which could lead to injury or even death.

Relationships in your life can help influence your future as well. Statistics show that married people live longer than single people. Research indicates that families who pray together and attend church together lead happier and healthier lives, stay out of trouble and actually live longer than those families or individuals who do not. Families who eat meals together produce healthier, happier children who perform better in school, compared with families who do not eat together or share mealtime activities on a regular basis.



Most aspects of most people's health depend on choices they make regarding the physical, mental/emotional, spiritual/social dimensions of their well-being. The kinds of choices we make are ***learned behaviors***:

What we are taught, we learn;
What we learn, we practice;

What we practice, we become;
What we become has consequences . . .
healthy or unhealthy. However—

Anything I have learned, practiced or become; **I can change**.

The **choice** *is* **mine**.

(Author unknown)

You have only one body. You need to take care of it. Your future depends on it.

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Rondarius and LaKendrick climbed down from the tree house, and you followed. They went to their homes while you walked toward your grandparents' house. You smelled your grandmother's homemade bread and heard your grandfather working in the garage. You smiled. You realized that you have a great future ahead of you and people who care about you.

Life Principle



"No matter what a man's past may have been, his future is spotless."

—John R. Rice

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