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The GED Science Test

Life Science

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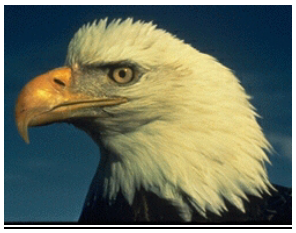
#23 Passing the GED Science Test

It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.
Charles Darwin

Video 23 Focus: how your body works, what keeps you healthy, what makes you sick, and what your children will look like.

You Will Learn From Video 23:

- The structure of cells and how DNA carries each cell's entire genetic blueprint.
- About photosynthesis and its importance to all living organisms.
- An ecosystem can be home to thousands of organisms.



Words You Need to Know:

While viewing the video, put the letter of the meaning by the correct vocabulary word. Answers are on page 24.

_____1. cell	a. contains all the instructions needed to direct a cell's activities
_____2. DNA	b. the basic functional unit of an organism
_____3. mitosis	c. the study of how traits are passed to offspring
_____4. photosynthesis	d. replication of a cell and its DNA
_____5. genetics	e. process where plants convert the sun's energy into chemical energy

Points to Remember:

- All living things have several things in common.
- The cell is the basic functional unit of a living organism. Ecosystems are home to thousands of organisms, each playing a necessary role.
- About half of the GED science questions will be about the life sciences.

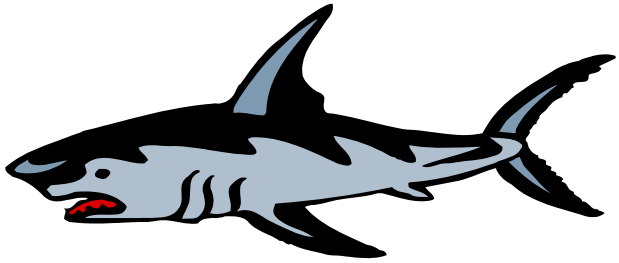
Life Science

Depending on where we live, many of us are not aware of or get to see the wide variety of life there is around us. Yet, if you go to any outdoor area, for example, a meadow, a forest, even a city park, stop, look, and listen. Do you hear birds chirping, insects buzzing? Can you see any squirrels, dogs, cats, or other mammals? Do you notice any frogs, lizards or other reptiles, and amphibians? If you are by water, can you see any fish? After a while, you should be able to notice that the world is teeming with life, and life is more than just we humans!

Life science (or biology) is the study of all living things, from plants to animals and humans. In fact, in Greek, *bio* means "life" and *ology* means "to study." So a biologist would be someone who studies organisms, or living things, of which there are over 1.5 million different types. Biologists study their structures, life cycles, and their relationship to their environment. Of course, you can tell if something is living just by looking at it, right? Well, sometimes it is not that simple, so scientists have came up with the following ways to separate the living from the non-living:

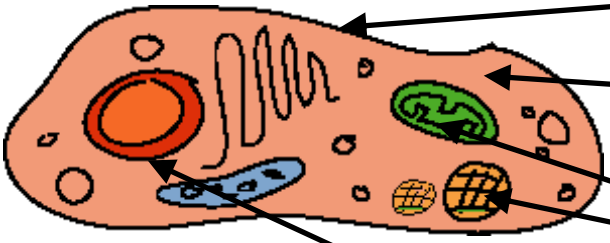
- has a life cycle (from birth to death)
- has the ability to move or grow
- has the need to find sources of energy as in feeding
- has the ability to respond to stimuli, or something in the environment, that causes a change in behavior
- has the ability to reproduce
- made up of cells.

Life science is a huge subject since it covers every organism from the smallest, single-celled bacterium to the largest animal on earth, the blue whale. All of these organisms have similarities, such as needing energy to grow, interacting with their surroundings, and producing offspring. Likewise, no matter how large or small, all of these organisms are alike in that they are composed of cells.



The Cell

The **cell** is the basic functional unit of an organism, meaning that each cell has the potential to fulfill all the functions of that organism. Cells also must arise from other pre-existing cells. Animal cells and plant cells do have some differences, so let us start with animal cells first.



The first part of a cell is the cell membrane.

The second part of a cell is the cytoplasm.

The third main part of a cell is the nucleus.

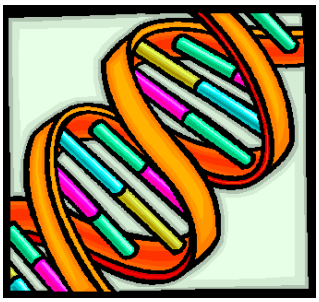
The fourth part consists of the many organelles.

So, even though not all cells are exactly alike, they do have the common structures as shown above, and, to restate, all cells have 4 distinct parts:

First, cells are surrounded by a thin covering, which separates the cell from its environment. This membrane is called the "**cell membrane**," or "plasma membrane," and it acts as a barrier or wall. However, cell membranes are semi-permeable, meaning that they will allow some substances to move both into and out of cells through the cell membrane. This allows the cell to take in required nutrients and expel any waste products.

Secondly, the inside of the cell is called the **cytoplasm**. The cytoplasm is the semi-liquid substance in which all of the internal "organs" of the cell are dissolved. This is where much of the biochemical activity of the cell occurs. The main component of cytoplasm is water.

Thirdly, all cells have a nucleus. Cells must create **DNA**, the genetic material which allows a cell to replicate, and this DNA is located in a specific region in the cell called the **nucleus**. The nucleus and its DNA hold all of the information needed to function and to create another cell.



Finally, cells have **organelles**, which are structures **(**of which the nucleus is one) within the cytoplasm that perform certain specialized duties.

Test Your Knowledge:

Directions: Fill in the blanks with the correct word. Answers can be found on page 24.

1) The inside semi-liquid substance of a cell is called _____.

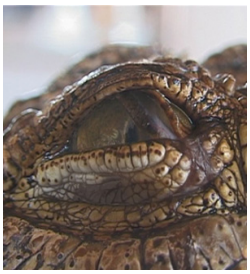
2) The cell's internal structures that carry out specialized functions are called _____.

3) The _____ is a covering that separates the inside of a cell from the cell's outside environment.

4) The _____ is the region of the cell that contains DNA.

Plant and Animal Differences

There are two main differences between plant and animal cells. Both are very important differences that culminate in very different living organisms. First, all plant cells have cell walls. The **cell wall** gives a plant cell a more inflexible structure, preventing the cell from moving, and giving it more support and protection. They can be found outside of the cell membrane.



The second difference is **chloroplasts**, which are the green, pigmented organelles within the cytoplasm that allow the plant to undergo photosynthesis. Chloroplasts allow plants to create their own food by using the Sun's energy.

The World of Plants

Photosynthesis is the amazing process by which plants, algae, and some bacteria can convert the sun's energy into a chemical energy then used by the organisms to function. In fact, the above are the only organisms that can do such a thing. Now, how important is photosynthesis to us? It might be the most important process ever, because all our food and our fossil fuels are the products of photosynthesis!
So, what actually happens during photosynthesis?

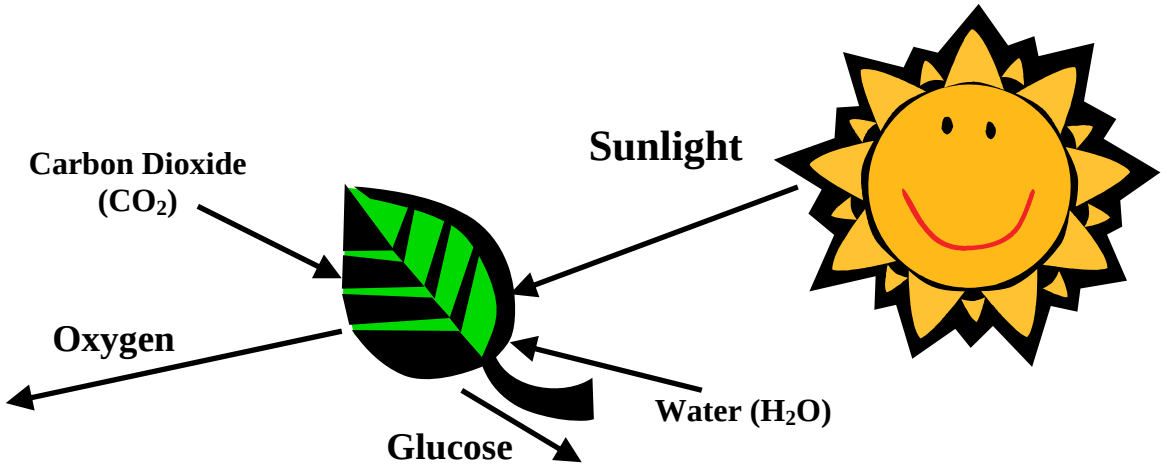
Photosynthesis

1. Plants take in carbon dioxide (CO_2) from the air and water (H_2O) from its roots.

2. Then the energy from sunlight is collected by chloroplasts within the plant's leaves and is used to transform carbon dioxide and water into glucose and oxygen.

3. The oxygen is released into the air, which will eventually be used by most living organisms, especially animals.

4. The glucose is used by the plant for its life functions**,** or it is stored for future use. This storage of glucose, a form of chemical energy, is what feeds humans and animals. For example, if we eat vegetables, we gain the energy that was stored by those vegetables. On the other hand, let's say we have chicken for dinner. We would still owe plants for the energy, because that is where the chicken received its energy. This proves the importance of the photosynthesis.



PHOTOSYNTHESIS

What Makes Plants Green?

Chloroplasts are the green, pigmented organelles within a plant cell. They are also the reason why plants, especially their leaves, are green. But why are chloroplasts green? They are green because they are filled with pigments, and pigments are chemical compounds that reflect certain wavelengths of light. Those pigments are called **chlorophyll** and are contained within the chloroplasts. Chlorophyll absorbs all the colors of the rainbow except green. Thus, only the green portion of sunlight is reflected back to our eyes, and that is what we see!

The key to remember is that all living organisms must obtain energy to stay alive. Different organisms find different sources of energy, but each organism is dependent on other things for its survival.

Test Your Knowledge:

Directions: Circle the best answer to each question. Answers can be found on Page 24.

5) What two things does a plant need to take up from its environment before sunlight can be used for photosynthesis?
   a) oxygen and carbon dioxide
   b) sunlight and glucose
   c) water and carbon dioxide
   d) glucose and oxygen

6) What does a plant "breathe out," or expel, after photosynthesis has taken place?
   a) water
   b) oxygen
   c) sunlight
   d) carbon dioxide

7) Where does a plant get its initial energy to create the glucose it needs?
   a) wind
   b) dirt
   c) oxygen
   d) sunlight

8) Green plants are green because
   a) sunlight turns them green.
   b) photosynthesis alters the cell structure of the plant.
   c) glucose is green.
   d) leaves contain green pigment that absorbs all colors except green.

The Animal Kingdom

Today, nature shows abound on television as desire for more shows dealing with the natural world grows. From the Crocodile Hunter to Mutual of Omaha's Wild Kingdom, the amazing world of animals is brought right to your living rooms. Do you have a favorite animal? Most of us would probably pick some type of mammal or bird. Mammals and birds belong to a group of animals called **vertebrates**, which means animals with backbones, and humans are also included in this group. However, did you know that more than 95% of animals are **invertebrates**, or animals without a backbone?

Invertebrates

Invertebrates, animals without backbones, rule the animal world. They were the first and they will probably be the last on earth. Most invertebrates, for example, jellyfish, either do not have a skeleton like we do, or they are equipped with a hard outer structure called an **exoskeleton** that provides protection to invertebrates such as lobsters.

Sponges

Invertebrates come in all shapes and sizes. Some have tentacles stretching 165 feet long**,** and some can only be seen through a microscope. Many have soft, fluid-filled bodies, while others have hard armored shells. Some invertebrates are so unlike what we would call "animals," they were once thought of as a type of plant. For example, sponges have no head, no legs or arms, and no nerves! Why do we consider them animals? The answer is that they do not make their own food through photosynthesis, but rather eat other animals.

Most invertebrates are small compared to us; some are so small they are microscopic. Amoebas are one example of a microscopic invertebrate. They have only one cell and can move around by changing their shape to form a "fake foot," called a **pseudopod**.

One reason for their small size has to do with not having a skeleton for support. Jellyfish consist of 98% water. Known for their tentacles and stinging cells, jellyfish are considered a major nuisance at many beaches, and can prove to be deadly. One of the most dangerous jellyfish is the Box Jellyfish, which can cause a human's death in minutes. They capture their prey by injecting their toxins into any unlucky prey that touches its tentacles.

Similar to jellyfish is the Portuguese Man of War—though this is technically a colony of animals and not a jellyfish. The Man of War can have tentacles up to 165 feet long! Often these tentacles will attach themselves to you as you swim away. If this happens, do not rub the affected area, this will only make things worse. Use a stick or a driver's license to peel or scrape off the tentacles. Then rinse with salt water, not fresh water, and seek immediate treatment. Remember, they will keep stinging you and that can be fatal.

Nudibranch

Most of the soft-bodied invertebrates are ocean-dwellers. Living in a watery environment allows them to move and support themselves without a backbone. They also can be some of the most beautiful creatures in the world. For example, nudibranches are sea slugs that absorb oxygen from appendages that grow from their backs. Although alien looking, their striking colors and unusual appendages provide underwater photographers a wealth of amazing photographs.

Nudibranch

Test Your Knowledge:

Directions: Fill in the blanks with the correct word. Answers can be found on Page 24.

9) Animals that have backbones are called _____.

10) Amoebas move by changing their _____.

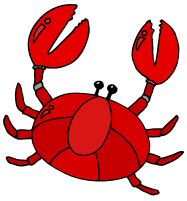
11) Another word for a "fake foot" is a _____.

12) Jellyfish consist of 98% _____.

13) 95% of animals are _____.

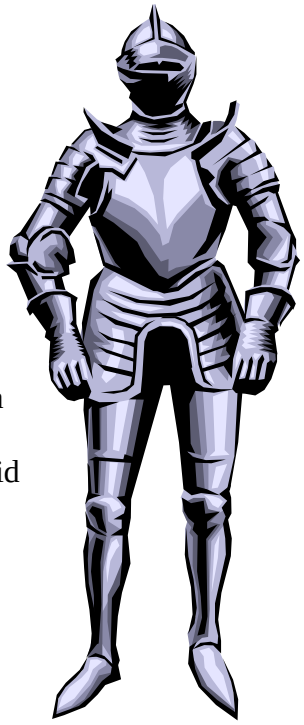
Other Invertebrates

Whether on land or in the sea, some invertebrates have adapted by creating "armor plating," which gives them protection from predators, as well as support, as our skeleton does for us. These hard-shelled invertebrates can be found in the ocean, as with lobsters or clams, or on dry land, as with ants and spiders. In fact, the group of invertebrates called **arthropods** makes up about 75% of all animal species. The most common of these are insects, crabs and lobsters, spiders, and centipedes. From those examples can you guess what some common characteristics of arthropods are?



All arthropods have the following 4 characteristics:

1. an exoskeleton
2. a brain and a system of nerves
3. a body broken up into segments
4. jointed legs



These four characteristics have allowed arthropods to become very successful. The exoskeleton obviously serves as protection. The complex nervous system allows them to adapt to their environment better, and their segmented body and legs allow for the ease of movement. If you have ever seen a knight in a suit of armor, you would see the importance of having these segments and joints. How stiff would his movement be if a suit of armor did not have these joints?

Vertebrates

Vertebrates are animals with backbones. While invertebrates are all cold-blooded, vertebrates can either be cold-blooded or warm-blooded. No, cold-blooded does not mean a "mean" animal, or one that has freezing blood. What it does mean is that a **cold-blooded** animal cannot regulate its internal temperature. Can you think of any animals that have to "sun" themselves just to keep warm? You probably have seen lizards or snakes lying on a warm patch of asphalt soaking up heat. This heat is crucial for the animal to survive. Most reptiles, amphibians, and fish are cold-blooded vertebrates.

Warm-blooded vertebrates can regulate their own internal body temperature. Warm-blooded animals do not need to seek external heat sources every morning just to start our day. Can you see how this would be an advantage for survival?

This adaptation has allowed warm-blooded animals to flourish throughout the world. They are the most widespread of all animals, inhabiting every continent and adapting to all different environments from the frozen Artic to the hot deserts of Africa. Their ability to regulate their bodily temperatures has allowed them to create large active brains, complex nervous systems, and bodies of all sizes, from the tiniest mouse to the largest blue whale. Those abilities have made them the most adaptable, versatile, and evolved of all animals.

Adaptation

Survival of the fittest is due to adaptation. As environments change over time, living organisms must be able to change with them. If they are incapable of doing so, they often will go extinct. For example, China's Giant Panda can only survive on a diet of bamboo. They developed this specialized diet because pandas are the only animals able to digest this tough fibrous plant, and, in the past, bamboo trees flourished. Thus, they had no competition for an almost unlimited source of food. However, bamboo began to disappear throughout China as humans started to encroach on panda territory. Land development has caused the destruction of many bamboo forests, and, without bamboo, pandas will go extinct. They do not have enough time to adapt to another food source.

An animal's environment consists of many different things, from climate to what kinds of food exist in it. Also, the presence of predators will cause prey animals to behave differently in order to survive. An **adaptation** is something about an animal that makes it possible for it to live in a particular place and in a particular way. Adaptations can be physical or behavioral, but each adaptation has been produced by evolution and allows certain animals to survive in their natural environment. These adaptations make it possible for a great variety of creatures to live and flourish on earth. Sadly, though, animals in the wild can only live in places to which they are adapted. They must have the right kind of environment where they can find the food and space they need.

So adaptation is the key to survival. One such sign of adaptation is found in the grasslands of Africa. There lives the tallest of all mammals, the giraffe. Giraffes can grow up to 16 feet tall, and, it is believed, they need this height to reach the succulent leaves of the acacia tree, their main food source. Although other animals eat acacia leaves, giraffes are the only ones that can reach the top branches.

Height is not the only adaptative feature of giraffes though. Acacia trees are also known for the formidable spikes. These spikes can grow a few inches long and do provide a good defense. How does a giraffe grab acacia leaves without hurting itself? It uses its eighteen inch long, prehensile tongue with which it is able to grab objects. Some animals are so good at adapting that even with the spread of humankind throughout the world, they have

been able to thrive. Raccoons are considered opportunists. They will take advantage of any opportunity to achieve a goal. Raccoons are amazing creatures. Their diet consists of just about anything, and their ability to find their food is what makes them so successful. As with most mammals, raccoons do rely on their sense of vision, hearing, and smell to hunt and gather food, but being primarily **nocturnal**, or active at night, they are one of the only mammals to rely heavily on the sense of touch. Their hands are so sensitive that scientists believe that they can create a mental picture just by feel alone, and just as detailed as we can with our eyes. This adaptation has allowed raccoons to prosper.

How does this adaptation allow them to prosper? Well, in some urban areas at night, raccoons have been known to search for food, especially in our garbage. Typically they would reach their hands into the garbage cans, while keeping their heads and eyes up looking for any dangers such as dogs. In the wild, this ability also allows them to blindly feel for potential food, but if they touch something that might do them harm, their sensitive touch will alert them and cause them to instantly recoil before any harm is done.

Adaptation does not just occur on a physical level, where, over time, a species will change its physical appearance, or use a physical characteristic to its advantage. Some animals adapt to survive using their mental prowess. Even though many consider the human mind unique in its ability to think, learn, and solve problems, many scientists are now supporting the theory that animals can do likewise. They believe that animals do not always act by instinct alone, but rather have the ability to think, solve complex problems, and learn by example.

For example, crows have developed an excellent solution to the age old problem of how to crack a nut. Since 1990, crows have been seen waiting at traffic light crosswalks along with pedestrians. Once the traffic halts, both humans and crows enter the roadway. The crows, however, do not cross all the way like their human counterparts do; rather, they stop on the road to place walnuts there. After the light changes, they fly away to wait, and the cars drive over the walnuts crushing them open. Of course, once traffic halts again, there they go to collect their reward. This shows that some species use intelligence to adapt to a changing environment, especially to take advantage of an opportunity.

In conclusion, living organisms want to survive long enough to produce offspring. If their environment changes, and they still successfully reproduce, their offspring will have the same characteristics that allowed their parents to survive, thus, increasing their chances to live long enough to reproduce.

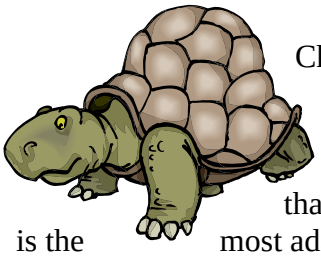
Charles Darwin and the Theory of Evolution

Darwin Island, Galápagos Islands, Ecuador

In 1832, a young scientist named Charles Darwin explored South America and the Galápagos Islands, located just off Ecuador's coast. Darwin discovered that the islands held similar types of animals, but that they also held distinct differences. For example, one of the most famous animals discovered there is the Galapagos giant tortoise. These looked just like regular land tortoises found on the continent, however, they were huge. Some can weigh over 550 pounds and measure 6 feet from head to tail. It is known that the tortoises have a hierarchy, or a pecking order, where the larger you are the more authority you have. They can display this authority by climbing over each other to get to somewhere else. Can you imagine having a 550 pound tortoise climbing over you?! Obviously, you would want to be larger than the others.

Along with other observations, Darwin concluded that all of the animals must have had a common ancestor. The animals on the island had originally come from the continent, but once on the islands, each species became isolated, and, because of the different environment, eventually changed in appearance and behavior. This is evolution. In fact, Darwin also noted that on every main island of the chain, each population of tortoises was different from the other islands' tortoises. Each one had adapted to best survive on their particular island.

Darwin's theory of evolution states that evolution is a process that every living organism goes through, yet the changes take place very slowly over several generations. He believed that individual organisms with favorable traits were more likely to survive because of those traits. This would allow them to have more offspring, and these offspring would also have those favorable traits. This is called **natural selection**. On the other hand, individuals with unfavorable traits tended not to live as long or reproduce as much, and those traits eventually died out.



Charles Darwin once said, "It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change."

The giant tortoises are also known for their amazing life span. The oldest one on record lived 150 years, until he was killed in a fall. The San Diego Zoo has a large collection of giant tortoises, with one having lived over 100 years!

Sadly, though, when Darwin first visited the islands there were approximately 250,000 tortoises, now there are only 15,000 left. Humans have drastically reduced their population by killing over 200,000 of them throughout the 17th, 18th, and 19th centuries. They are currently on the Endangered Species List, and the Charles Darwin Research Station is currently breeding them to repopulate the islands.

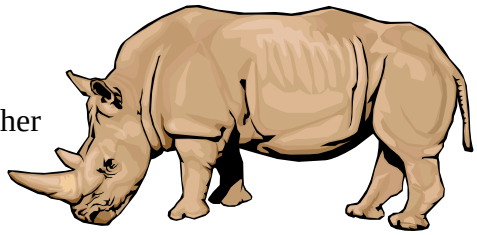
Test Your Knowledge:

Directions: Circle the best answer to each question. Answers can be found on Page 24.

15) What special physical feature does a giraffe have that enables it to pick acacia leaves?
   a) long legs
   b) prehensile tongue
   c) good eyesight
   d) long neck

16) Which word best describes how nature improves the chances of survival of organisms with favorable traits?
   a) evolution
   b) adaptation
   c) natural selection
   d) luck

The Web of Life



Plants and animals, including humans, all depend on each other for survival. Not only do these groups of living things, called **species**, need to interact with each other, but they must also interact with non-living things, such as the ground, the weather, etc. This interaction is what affects an individual's chance of survival.

All the individuals of a species are called a **population**, but a population exists only in a specific area. If a group of individuals are found in another region, they are considered a separate population.

On an even larger scale is the community. A **community** refers to all the populations in an area. This area is considered a habitat. A **habitat** is where the interaction of communities with the non-living world around it can be seen. A habitat is a population's environment, and it is the habitat that must supply the needs of that population. Needs such as food, water, temperature, oxygen, and minerals are crucial to living organisms, and when a habitat no longer gives these things, species must adapt, move out**,** or face death.

An **ecosystem** is where several habitats interact with several communities of organisms. Ecosystems come in a variety of sizes. They can be as small as a tide pool or as large as an entire ocean. Ecosystems must remain stable enough for all species to survive. When they are stable, the number of individuals that die are roughly equal to the number of individuals born.

Test Your Knowledge:

Directions: Fill in the blanks with the correct word. Answers can be found on Page 24.

16) All the individuals of a species in a specific area are called a _____.

17) All of the populations in an area are called a _____.

18) The non-living objects that living organisms must interact with are called a

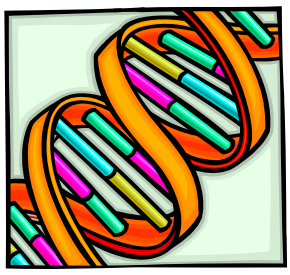
_____.

19) Where several habitats interact with several communities is called an

_____.

Genetics

Why do we often resemble our relatives? Who do you resemble the most? your father? your mother? one of your grandparents? In actuality, you probably have a blend of both of your parents' characteristics. All animals, including humans, pass on characteristics to their offspring. The study of how those characteristics, often called **traits**, are passed from generation to generation is called **genetics**. To understand genetics, you must first become familiar with some terms.



DNA and the Human Genome

Cells are the basic working units of every living organism, and the **DNA** within a cell's nucleus contains all the instructions needed to direct a cell's activities. The **genome** is all the DNA found within a cell. It is an organism's complete set of DNA, and can vary widely in size depending on the size and complexity of the organism. For example, some bacteria only contain around a few million base pairs of DNA, while a human can contain around 3 billion base pairs. A **base pair** is the unit of measurement for DNA, and describes the joining of two bases together, either adenine-thymine or guanine-cytosine. DNA is created by only those 4 bases—think of it as an alphabet containing only the letters A, T, C, and G—but it is the order of the pairing that is important.

Here is a quick example:

Think of the 4 bases, adenine, thymine, guanine and cytosine, as fruit. You might have apples, oranges, bananas, and pears. Let us say that apples and oranges always go together, and bananas and pears always go together. So an apple and an orange is considered one base pair. What will follow those two? Maybe, a pear and a banana, or maybe an orange and an apple. It is this order of the chain that gives us certain characteristics, and each specific order or sequence is called a **gene**.

For example, let us say the gene for blue eyes is this:

Apple-orange
Banana-pear
Pear-banana
Pear-banana
Orange-apple
Banana-pear
Orange-apple
Apple-orange

= Blue Eyes

If a human had a gene with this sequence**,** s/he would have blue eyes. However, if one base pair, let's say the first apple-orange**,** were changed to an orange-apple, that person's eyes might be a different color! That is how important DNA is. It provides the instructions on how a living organism will be built**.**

DNA is also arranged into what scientists call **chromosomes**. Humans have 24 distinct chromosomes, each containing about 50 million to 250 million base pairs. Each chromosome is a separate linear strand of DNA containing the genetic information for cell life.

In summary, the genome is the entire picture, the chromosome is a portion of the picture, and the gene is the actual instruction on how to make the proteins that will give us our traits.

Test Your Knowledge:

Directions: Put the letter of the meaning by the correct vocabulary word. Answers can be found on Page 24.

20) _____chromosome	a. the unit of measurement of DNA
21) _____gene	b. all the DNA found within a cell's nucleus
22) _____genome	c. a linear strand of DNA that contains the genetic information necessary for cell life
23) _____base pair	d. characteristics such as eye color
24) _____traits	e. a specific sequence of DNA that determines a particular characteristic for an organism

Cell Division

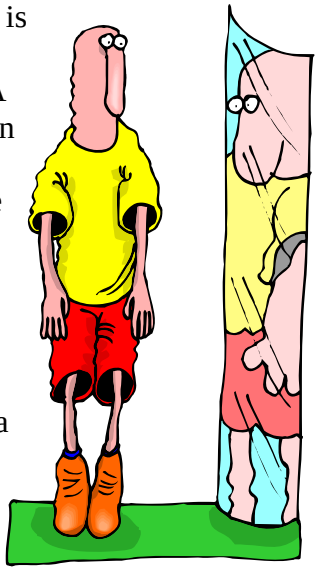
Scientists have discovered that an organism will grow as its cells divide. A cell will first duplicate its DNA and then split into two separate**,** fully functional cells. This process is called **mitosis**. Mitosis is the replication of a cell, called the parent cell, to form two daughter cells with identical sets of chromosomes. Each daughter cell contains a set of the parent cell's chromosomes.

Earlier we spoke of a change in a base pair that might change a person's eye color. This is called a **mutation**. A mutation is a change in the genes or chromosomes of an organism during the chromosomal duplication process. In other words, as the parent cell is creating a duplicate copy of its DNA, there is an error and one or more base pairs are changed. This can either have little or no effect, or it can cause a drastic condition. Mutations can occur through a variety of ways. One common way is radiation, which at high enough doses can cause cancer or even death. Sometimes mutations are inherited and cause severe conditions such as hemophilia or muscular dystrophy.

Do two parents each pass on a complete set of chromosomes to their offspring through mitosis? If so, that would mean the offspring would contain twice the number of chromosomes. Sex cells undergo a different process called meiosis. **Meiosis** is a type of cell division where egg and sperm cells are produced. In meiosis, a parent cell will duplicate its DNA once, just like in mitosis, however, it will split 2 separate times, creating 4 daughter cells with half the original genetic information. So when an egg cell and sperm cell meet, they will combine to form a cell with a complete set of chromosomes; this process is called **fertilization**.

Health and Nutrition

America is known as the land of plenty. We have so much that obesity is virtually tied with tobacco use as the #1 preventable cause of death in America, and sits alone at the top in the United Kingdom as of 2004. A study completed by the U.S. Centers for Disease Control and Prevention says that over 400,000 overweight people died in 2000 from physical inactivity and poor nutrition, while tobacco use killed 435,000. Are we eating ourselves to death?



Nutrition is the study of the health value of food, and nutritionists are often responsible for getting people to eat healthier. What is eating healthier, though? Obviously, a hot dog everyday for lunch is not a healthy diet, but should you become a strict vegetarian? Nutritionists have been able to set the proper amounts of each type of food humans should eat, and even though this might be altered a little from year to year, the key thing most nutritionists would advise is to eat a balanced diet consisting of carbohydrates, proteins, fats, vitamins and minerals. Your body needs enough energy and nutrients to survive.

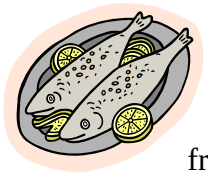
Food provides us with the energy we need to live, and the measurement of how much energy can be found in each food type is called a **calorie**. Many Americans in the early 21st century have found that getting enough calories everyday is quite easy, in fact your body stores excess calories in the form of fat.

Fat is a the most concentrated source of energy and is very important, as living organisms need this storage substance to provide itself with energy during times of stress and/or lack of food. For example, when grizzly bears hibernate they still can burn up to 4,000 calories a day. Since they do not eat during hibernation, they must pack on the extra weight in the form of fat, because after waking they usually have lost between 25 to 50% of their original body weight. Today, though, many humans are realizing that due to the easy availability of food in America, our bodies do not need the large fat reserves as in previous centuries. No more than 30% of our calories should come from fat.

Carbohydrates are the main source of energy for humans and can be found in a wide variety of food products. Complex carbohydrates are often called starches and can be found in breads, cereals, beans, rice, starchy vegetables, and pastas. They are a good source of vitamins, minerals, and fiber. Simple carbohydrates are also healthy for you when found in vegetables, fruits, and milk, yet unhealthy when found in processed or refined sugars such as candy, syrup, carbonated beverages, etc. These provide little of no vitamins, minerals, or fiber, but a very high number of calories, which can often turn into fat if not used by your body.

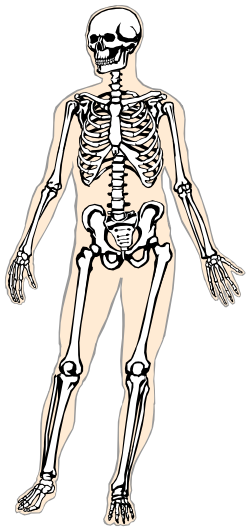
Nutritionists typically recommended that between 40 to 60% of your total calories come from carbohydrates, preferably from complex carbohydrates (starches) and naturally-occurring sugars rather than processed or refined sugars.

Protein is the final of the three sources of energy. It is vital for tissue growth and repair as it is the main component of muscles and organs. Protein can be found in all meats and animal products. Vegetables do provide protein, but only in an incomplete form, meaning you must combine various vegetables, such as rice and beans, to get the complete set of amino acids to build the proteins your body needs. **Amino acids** are the building blocks of protein, or, in other words, if you break down protein you are left with amino acids. The human body requires around 20 amino acids, and 9 of those can only be found in food, as your body cannot produce them.



Nutritionists typically recommend that 10 to 30% of your total calories come from protein, preferably from lean meats and vegetables. Any extra protein not used by your body will be stored as fat.

The Human Body and Its Systems

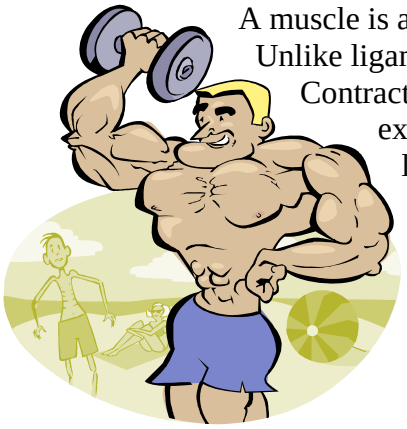


Doctors and scientists have separated the human body into distinct systems to allow us to better understand and explain how our bodies work. All of these systems are necessary for survival.

Skeletal System

The skeletal system provides humans with a form, while supporting and protecting us. A typical human will have about 200 bones that are connected to each other by **ligaments**. Ligaments are tough**,** fibrous tissues that allow our bones to move without separating from each other. The point where bones connect together are called **joints**.

Muscular System



A muscle is a type of tissue that allows us to move in a controlled manner. Unlike ligaments, muscles can contract (shorten) and relax when needed. Contraction will cause a muscle to move a bone around a joint. For example, try this experiment. While sitting down, extend one of your legs. Which muscles do you feel working? The muscles on the front of your thighs flex, or contract, as you extend your leg. Now, bring your leg back down. Those same muscles relax as the ones on the back of your legs contract.

Nervous System

To raise your leg, you used your muscles, but how did you tell your muscles to do the action? This required using your nervous system. The nervous system controls all the muscles in your body, and it senses the world around you. It does this by sending electrical signals called **nerve impulses**. Think of how a power plant sends electricity through cables and wires to all homes and buildings in your town to be able to run electrical devices. Your body consists of many nerves that act like those wires, with the power plant being your brain.

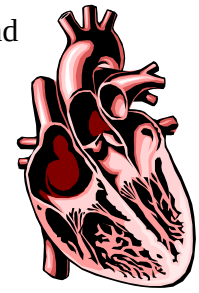
If you touch something for the first time, nerve cells in your fingertip send impulses up your arm to your spinal cord, then up to your brain. Your brain then processes the information your fingertip gathered and sent. Your brain then will decide what to do next. If the object is harmful, your brain will shoot an urgent message back to your fingertip using the system of nerves, probably causing muscles in your fingers, hand, and/or arm to contract, lifting your finger away. Your nervous system is complex, yet the entire process might have taken only a fraction of a second to complete.

Digestive System

Earlier we spoke about food and nutrition. You place an apple in your mouth, chew, and then swallow, but what happens to the apple? The apple continues a process called **digestion**, where it is broken down into nutrients for your body to use.

Digestion starts in the mouth where it is broken into small enough chunks to swallow. Saliva moistens and softens the food to ease in swallowing, and once swallowed, food travels down the esophagus which connects the mouth to the stomach. In the stomach the food is churned in acid to further break it down. After a few hours, the food travels farther down into the small intestines where all of the water and nutrients are absorbed into the bloodstream. Any leftover material continues into the large intestines where it is prepared to be eliminated from the body.

Circulatory System

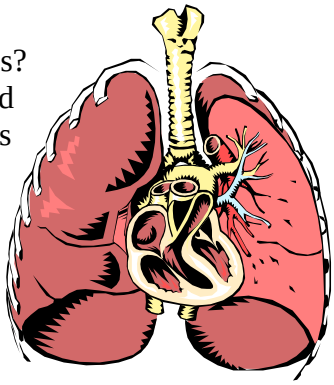


Your body needs nutrients to survive, and from the small intestine the nutrients and water that your cells need are absorbed into the bloodstream. They have now entered another system called the **circulatory system**.

Blood is the fluid that courses through your body carrying the nutrients, water, and oxygen your cells need. Blood moves because of the pumping of the heart. The heart is a muscular organ that, due to pressure, sucks blood into its right side, and then pumps it out to the lungs where it picks up valuable oxygen and release carbon dioxide. Then as more pumps of the heart bring more blood into the lungs, the pressure pushes the oxygen-rich blood back to the left side of the heart. After dropping off some oxygen to the heart, the pumping motion again pushes the blood out into a system of arteries that traverses your body, giving off oxygen and other nutrients to all of your cells. Once depleted, blood then enters veins that carry it back to the right side of the heart.

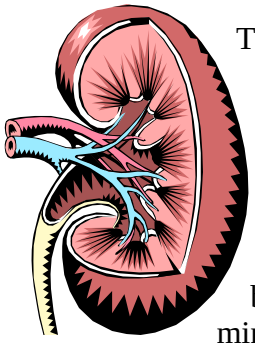
Red Blood Cell

Respiratory System



How do the lungs give to the blood the oxygen that is needed by your cells? The respiratory systems does it. Respiration is the taking in of oxygen and the releasing of carbon dioxide. As you expand your chest and lungs air is sucked in through your mouth or your nose. The air then travels through your **trachea**, or windpipe, which lies right next to your esophagus. The air finally reaches your lungs by branching off into what are called the bronchial tubes and, eventually, into even smaller branches that end in tiny air sacs called **alveoli**. Alveoli is where blood picks up oxygen.

Excretory System



Throughout the description of these systems**,** you might have noticed how many of them require a "dumping off" of waste products, things that your body does not need. **Excretion** is the process where these waste products are removed from the body, but before that happens your body must first collect the waste. Kidneys are the organs tasked with collecting all of the garbage found in your blood. Your blood passes through your kidneys 300 times a day where they act like a filter, separating all the waste from the items your body's cells need. A healthy kidney can clean all of your blood in about 45 minutes and produce around 6 cups of waste, called urine, each day. This urine then travels to the bladder, where it is conveniently stored for future elimination.

Review Questions

Directions: Circle the best answer to each question. Answers can be found on Page 24.

1. Which of the following is an invertebrate?
    a. bear
    b. jellyfish
    c. giraffe
    d. tortoise

2. Which body part takes in and stores oxygen until blood carries it away?
    a. heart
    b. kidneys
    c. lungs
    d. stomach

3. Which part of an animal cell acts like a wall?
    a. nucleus
    b. membrane
    c. cytoplasm
    d. organelles

4. Which body part acts as a blood filter?
    a. heart
    b. kidneys
    c. lungs
    d. stomach

5. Arthropods make up what percentage of all animals?
    a. 25%
    b. 50%
    c. 75%
    d. 100%

6. Chloroplasts are the green, pigmented organelles within plants that are able to produce
    a. light
    b. water
    c. carbon dioxide
    d. glucose

7. The “building blocks” of protein are
    a. amino acids
    b. carbohydrates
    c. fats
    d. vitamins

GED Practice Exercises

Directions: Circle the best answer to each question. Answers can be found on Page 24.

Questions 1-2 refer to the following passage.

Have you ever been barraged by many different sights, smells, and sounds all at once? This commonly happens, especially in a busy city where cars are honking, scents of food drift by, all as you watch people walk by. These are all stimuli that bombard your senses, however, to cope your brain undergoes selective attention. Selective attention occurs when your brain focuses on one stimuli and disregards the rest. This allows you to concentrate on the most important stimuli at the moment.

1. In which situation would you most likely use selective attention?
    1) while listening to a teacher lecture in a quiet classroom
    2) when feeling cold air conditioning hit your skin
    3) while listening to your friend talk at a noisy restaurant
    4) when tasting delicious food at dinner
    5) while watching a dramatic TV show at home

2. Selective attention can be important to one's survival because it allows you to…
    1) listen to music.
    2) take in multiple stimuli at once.
    3) do two things at once, like walk and talk.
    4) focus on the most important, or life threatening, stimuli.
    5) see farther.

Question 3 refers to the following passage.

In many areas of the United States, wolf populations and coyote populations have been influenced by the success of the other, mainly because wolves are the predators of the smaller coyotes. Thus, if the wolf population increases, invariably the coyote population will decrease. In the United States, what has been seen is that the population of coyotes has increased, and, in fact, they have flourished, spreading throughout the North American continent. One reason is a decrease in wolf populations. Throughout history, humans have hunted wolves because we feared them, they hunted our livestock, and their beautiful pelts were valuable. Coyotes are not as heavily hunted because being much smaller, they are often mistaken for dogs. Coyotes also tend to eat small mammals like cats and mice rather than our livestock. However, because of human interaction, we have caused the endangerment of one species and the flourishing of another. In fact, coyotes are even starting to prosper in suburban and urban areas, and they have even been spotted in downtown parks.

3. Which of the following is not a reason for the success of coyotes in North America?
    1) Coyotes are now being domesticated.
    2) Wolf populations have declined due to human hunting and trapping.
    3) Coyotes are sometimes mistaken for dogs.
    4) Coyotes tend to eat smaller animals and not our livestock.
    5) Coyotes are not often hunted for their pelts.

Questions 4-6 refer to the following passage.

Raptors are birds of prey that include eagles, hawks, falcons, and owls, to name a few. All raptors use special adaptations that allow them to stand out as aerial predators, ready to capture and kill their prey. These adaptations include incredibly strong feet with razor sharp talons, a keen sense of hearing, excellent eyesight, and wings that are adapted specifically to each species' hunting style. Most raptors have eyesight around 8 times better than humans. This is due to the large size of their eyes especially in comparison to their head. In fact, they are so large that raptors must use a flexible neck to turn their head, because they cannot move their actual eye. As for hearing, raptors can locate prey in dense bush, and, once located, they will dive out of the air to snare its prey using its deadly talons. The power of their feet combined with the piercing design of the talons can inflict severe injury; some prey are crushed to death just by the power of the raptors' feet. Once caught, raptors can use their powerful wings to lift and carry its prey to a safe area to feed. Now, even though not all raptors use the above technique to capture their prey, all raptors do eat meat. For example, vultures' feet are relatively weak and so they tend to eat carrion rather than capture and kill prey. However, they do similarly have strong beaks, which allow them to tear into their scavenged meal.

4. Which of the following is an example of a raptor?
    1) Sparrow
    2) Vulture
    3) Parrot
    4) Ostrich
    5) Emu

5. How many times better than humans do most raptors see?
    1) 2
    2) 5
    3) 8
    4) 10
    5) 100

6. Which of the following is an adaptation that not all raptors share?
    1) strong feet
    2) sharp talons
    3) excellent eyesight
    4) keen sense of hearing
    5) diet of meat

Answers and Explanations

Page 1: Words You Need To Know

1) b
2) a
3) d
4) e
5) c

Pages 4-16: Test Your Knowledge

1) cytoplasm
2) organelles
3) cell membrane
4) nucleus
5) c
6) b
7) d
8) d
9) invertebrates
10) shape
11) pseudopod
12) water
13) invertebrates
14) b
15) c
16) population
17) community
18) habitat
19) ecosystem
20) c
21) e
22) b
23) a
24) d

Page 21: Review Questions

1) b
2) c
3) b
4) b
5) c
6) d
7) a

Page 22-24: GED Practice Exercises

1) 3
2) 4
3) 1
4) 2
5) 3
6) 1