Name______________________ Period__________ Date______________

Topic 2: Life processes

Use evidence from Michael Jackson's Thriller video to determine which of the 8 characteristics of life the zombies do and do not have. You must justify your response using what you have learned about what it means to be a "living" organism.

1. Which characteristics of life led you to believe if the zombies are living or non-living organisms?

____

____

2. If a zombie were living and had cell(s), do you think it would be multicellular or unicellular? Explain.

____

____

3. The scientific term for a living thing is a(n) ________________________________.

As you learned, all living things show 8 characteristics to be considered living but all plants and animals also share many of the same life functions. If a living thing has all 8 off life functions, it is called an **ORGANISM**!

When we refer to all of the life functions of an organism, we are referring to its **METABOLISM**--the total of all the life functions required to sustain life (to stay alive)

R + R + R + E + G + N + T + S =
METABOLISM

An organism's external (outside) environment is always changing. By keeping the control and regulation of its metabolic activities, an organism can maintain a stable internal (inside) environment. This is called **HOMEOSTASIS**.

- **HOMEOSTASIS**--the process by which an organism's metabolic activities are in a state of balance *ex. body temp, blood sugar levels*

Term	Function	Example
Respiration		
Regulation		
Reproduction		
Excretion		
Growth		
Nutrition		
Transport		
Synthesis		

Station 1: Nutrition

1. Why is energy important to a living organism?

____

2. What is the name of the process that plants use to make their own food using energy from the sun?

____

3. Which of the following is another example of an autotroph?
   a) mushroom   b) grasshopper   c) cactus

Explain your choice.

____

____

4. Give 2 more examples of *autotrophs*.
   1. __________________________________
   2. __________________________________

5. Which of the following is another example of a heterotroph?
   a) pine tree   b) goldfish   c) sunflower

   Explain your choice.

   ____

   ____

6. Give 2 more examples of *heterotrophs*.
   1. __________________________________
   2. __________________________________

7. Why do living things need food?

____

8. What happens to food in the process of digestion?

____

Station 2: Transport

Write Yes (Y) or No (N) to record if your partner was able to smell the scent.

Balloon 1	Balloon 2	Balloon 3

1. What did the balloon represent?

____

2. What did the smell represent?

____

3. Could you and your partner identify all the scents?

____

4. What is accomplished by the transport process?

____

5. In most animals, digested food is transported to all the cells of the body by which system?

____

Station 3: Respiration

1. What process is taking place in the Barf Bag?

____

2. What gas is being produced in the Barf Bag?

____

3. Name another real-life activity that uses a process similar to the Barf Bag?

____

4. What is accomplished by the process of respiration?

____

6. What is the difference between breathing and respiration?

____

Station 4: Excretion

1. What do the yellow beads represent?

____

2. What is excretion?

____

3. Why do complex organisms need a specialized system?

____

4. Where do metabolic wastes come from?

____

Station 5: Regulation

1. What did you feel while you were balancing on one foot?

____

2. What kinds of thing did you observe your classmates doing while they were balancing on one foot?

____

3. Did it become more or less difficult to balance as time went on? Why do you think this is?

____

4. What did your foot in the air want to do when balancing?

____

5. What did your foot on the ground want to do when you were balancing?

____

6. How was your body trying to maintain homeostasis (regulation)?

____

7. What does homeostasis mean?

____

8. What are some environmental factors (stimuli) that organisms respond to?

____

9. What are two internal factors that organisms respond to?

____

Station 6: Synthesis

1. Small molecules are _______________ to form large molecules by the process of synthesis.

2. Draw your protein below using the building blocks, amino acids

Station 7: Growth

1. How do all organisms begin life?

____

2. What is the difference between growth and development?

____

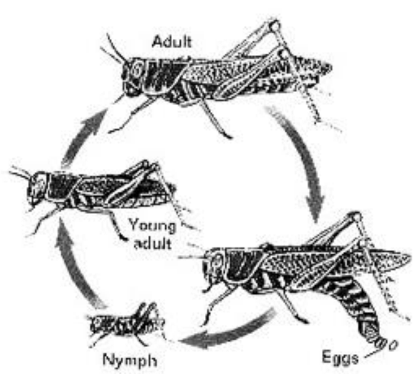
3. Do unicellular organisms GROW? Do unicellular organisms DEVELOP?

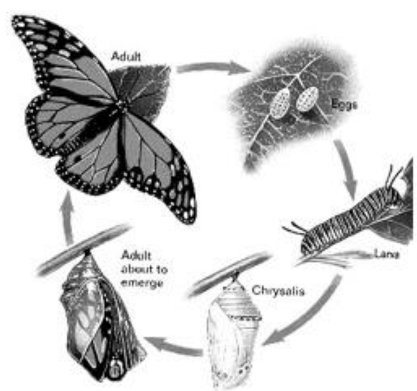
____

4. Do multicellular organisms GROW? Do multicellular organisms DEVELOP?

____

5. Identify which graphic BEST shows *growth* and which BEST shows *development*.





_________________________ _________________________

6. List the three ways an organism could grow
   - ______________________
   - ______________________
   - ______________________
7. How is the growth of a living thing different from the growth of a nonliving thing?

____

Station 8: Reproduction

1. Must EVERY member of a particular species (one kind of organism) be able to reproduce in order for the species to survive? Explain why or why not.

____

2. What would happen if all individuals in a species were sterile (not able to have babies)?

____

3. Reproduction is NOT essential for the survival of an individual _____________________ but is essential for the survival of the _________________________.
4. What is meant by extinction?

____

5. List 3 organisms that produce asexually?
   - _________________________
   - _________________________
   - __________________________
6. List 3 organisms that produce asexually?
   - _________________________
   - _________________________
   - __________________________

Station 9: Immunity

1. What happened when you added the magnetic tape to the jar and mixed it with the salt and iron filings?

____

2. How is this similar to a real antibody response in our body?

____

3. How is the secondary immune response different from the primary immune response?

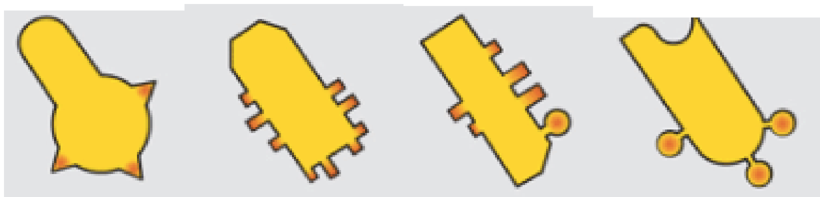
____

4. What's a pathogen?

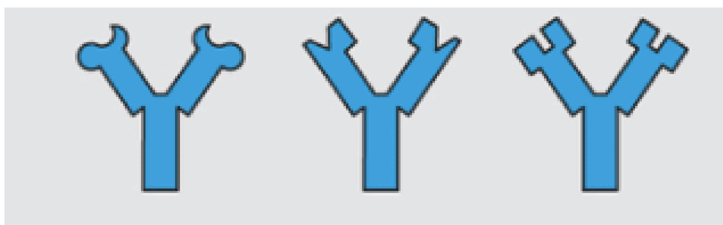
____

5. Draw a line to match the antigen to the appropriate receptor at the specific bonding site below.

Antigens



Antibodies

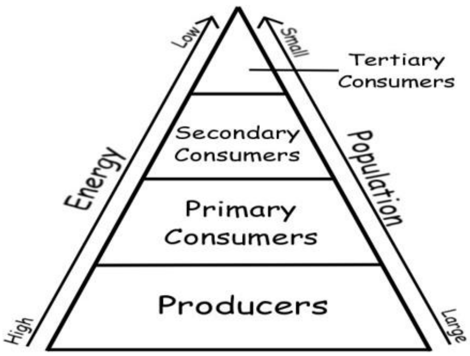


Station: Nutrition

Nutrition includes all the activities by which an organism obtains food from the environment and breaks it down into a form that can be absorbed and used as **Energy** by its cells.

Energy is the ability to make things change. Energy is important because it powers life processes. It provides organisms with the ability to maintain balance, grow, reproduce, and carry out other life functions.

As you'll learn, energy doesn't just flow through individual organisms; it also flows through communities of organisms, or ecosystems, and determines how organisms interact with each other and the environment.



Eating and breaking down food to releases nutrients. Nutrients from food are absorbed into the body and are used for **energy, synthesis and growth**. Green plants, using energy from sunlight, can make their own food by the process of photosynthesis. All animals, either directly or indirectly, depend on green plants for food. Food is used by living things to provide energy, cell parts and to serve as raw materials to make chemical cells. The two different processes by which living things take in materials from its environment for growth and repair are **autotropic** and **heterotrophic**.

A dandelion is an example of an autotroph.

A heterotroph is an organism that eats other organisms as food. Heterotrophs can be herbivores, omnivores, carnivores, scavengers, or decomposers. Another term for heterotroph is consumer.

An alligator is an example of a heterotroph.

Digestive System

The Mouth Starts Everything Moving. Your **digestive system** started working even before you took the first bite of your pizza. And the digestive system will be busy at work on your chewed-up lunch for the next few hours — or sometimes days, depending upon what you've eaten. This mechanical process, called **digestion**, allows your body to get the nutrients and energy it needs from the food you eat. So let's find out what's happening to that pizza, orange, and milk.

- Ingestion : Taking in of food into the body
- Digestion: Breaking down of food into simpler substances
- Egestion : Removal of undigested water material
- Absorption: Digested food is absorbed into cells

2

Station: Transport

Transport involves the absorption and distribution of essential materials through an organism to be distributed and absorbed into cells.

The process by which usable materials are taken into the living thing (*ABSORPTION*) and distributed throughout the living thing (*CIRCULATION*)

In a unicellular organism (single celled organism), needed materials and wastes can pass directly between the environment and the cells of the organism. In a multicellular organism (multiple celled organism), a specialized system (circulatory system) is needed to move these materials between cells of the organism and the environment. This system involves a heart and blood vessels.

Smelly Balloon Simulation

Materials

- *Eyedropper*
- *2 oils*
- *Balloon*
- *Balloon pump*

Procedures

1. Use an eyedropper to carefully add a small amount of a scented oil to a balloon.
2. Inflate the balloon with your mouth or a balloon pump and tie off the balloon.
3. Repeat steps 1 and 2 to make separate balloons for the two remaining scents.
4. Smell each balloon and guess their scents.
5. Have your friends smell the balloons and guess their scents.

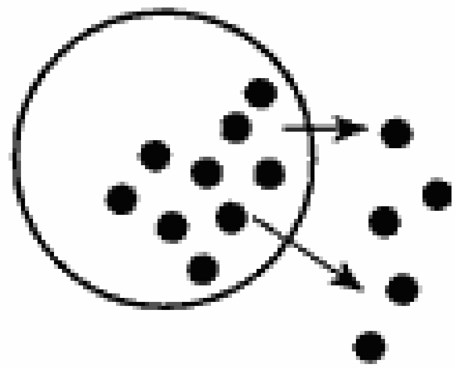
Write Yes (Y) or No (N) on your note packet to record if your partner was able to smell the scent.

Balloon 1	**Balloon 2**	**Balloon 3**

Transport Diffusion

Air gradually leaked out of the tied balloon. This is because the tiny air molecules inside the balloon move through the pores of the balloon's skin, in a process known as diffusion.

Air always **diffuses** from areas of higher pressure to areas of lower pressure. An inflated balloon has greater air pressure inside it, so the air gradually diffuses into the lower air pressure surrounding the balloon.



Particles are moving from a high concentration (inside balloon) to a lower concentration (outside of balloon).

3

Station: Respiration

The process of respiration releases energy from food by a complex series of chemical reactions, these reactions occur within all the cells of the organism. This energy released by this process is used for the life processes. This energy is in the form of ATP which is a form cells can use, useable energy. Respiration generally requires the presence of oxygen. The common use of the term "respiration" is known as breathing, the process by which air is moved into and out of the lungs. Breathing is a physical process of inhalation and exhalation of air, whereas respiration is a chemical process.

- Releases energy, ATP, by breaking down nutrients.

Barf Bag Simulation

Ingredients:

- *1 packet of yeast*
- *1 small cup of warm water*
- *½ cup of your choice of cereal*

Procedures

1. Mix all ingredients in a snack sized Ziploc bag.
2. Remove all air. Seal.
3. Mix well and let stand on covered table for 15 minutes

4

Station: Excretion

Excretion is the process by which the wastes of metabolism are removed from the organism. Metabolic wastes are ones that came from the cells. In a unicellular (one-celled) organism, these wastes can pass out of the organism directly into the environment. In more complex organisms, the wastes must be carried away from the cells (by the transport system) and eliminated from the organism by a specialized excretory system. When complex organisms release waste they will be toxic to the neighboring cells, so they must be removed.

- Removing metabolic wastes from an organism.
- Metabolic wastes are materials the organism does not need or has too much of.

Kidney Simulation

Materials

Item Key	**What it represents**
Water	Blood
Large Red Beads	Red Blood Cells
Large White Beads	White Blood Cells
Large Green Beads	Proteins
Small Green Beads	Amino Acids
Small Blue Beads	Glucose
Small White Beads	Salt
Small Yellow Beads	Urea
Green Spoon	Amino Acid Transporter Protein
Blue Spoon	Glucose Transporter Protein
White Spoon	Salt Transporter Protein
Eye Dropper	Cell Membrane (osmosis)
Styrofoam Bowl	Nephron
2 Plastic Cups	Blood in Renal Artery & Renal Vein
Filter Screen	Glomerulus

Procedures

1. Start with all the beads and water in the *Renal Artery* cup. Put the filter canvas over the bowl (AKA the nephron and glomerulus) and pure the "blood"(water) over it.

2. Right away the large blood components (red blood cells, white blood cells, and proteins) are caught in the filter. Move those into the *Renal Vein* cup.

3. Use the correct *transporter proteins* (labeled spoons) to move the glucose, amino acids, and some of the salt out of the kidney and into the *Renal Vein* cup. This models reabsorption by the body (AKA diffusion).****Each spoon can only move that ONE specific molecule.****

4. Last step… What's missing from the "blood" in the *Renal vein*. There's no water! Use the pipette to simulate *osmosis* and move water from the *nephron* to the *renal vein.*

5. What didn't have a transport spoon? These substances are excreted as *urine*. And that's it. What's left in the bowl is urine! It travels through the ureter and into the bladder.

5

Station: Regulation

An organism must respond to changes in the internal environment as well. Internal conditions include the level of water, nutrients, and minerals inside the body. It also refers to body temperature and hormone levels. Adjustments to internal changes help organisms maintain a stable internal environment. The regulation of an organism's internal environment to maintain conditions suitable for life is called homeostasis. Or you can just think of it as keeping everything in BALANCE! For example, you have a "thermostat" in your brain that reacts whenever your body temperature varies slightly from 37°C (about 98.6°F). If this internal thermostat detects a slight rise in your body temperature on a hot day, your brain signals your skin to produce sweat. Sweating helps cool your body.

- Involves a number of coordinated activities that serve to maintain internal stability (**homeostasis**) in the constantly changing environment.
- Two major systems are involved: the nervous system and the endocrine system.
  - Nervous: conduct electrical impulses to communicate messages throughout body
  - Endocrine: Hormone released to signal other areas of organism such as to active or deactivate.

Hormones provide feedback to the brain to affect neural processing.

- Responding to internal and external factors (stimuli).
- Regulation makes changes to life functions as necessary.
- Helps maintain homeostasis, a stable environment.

Balancing Act Simulation

You and your partner will time each other balancing on 1 foot

How to balance: Your arms should be parallel to the floor, one leg bent behind the body at ninety-degree angle, straight body, and no movement.

Procedures

1. Start timer for 2 minuets
2. Observe your classmates/partner

6

Station: Synthesis

Making large complex molecules from simpler or smaller molecules. Proteins, starches, fats and DNA are complex substance made through synthesis. Process by which smaller, simple substances are combined chemically to form larger, more complex substances

Protein Synthesis

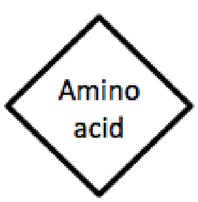
- Other than water, protein is the most plentiful substance in the human body, so you can see why it is such an important nutrient for us to consume. Protein is made up of building blocks called **amino acids**.
- Proteins are long chains of amino acids. There are thousands of different proteins in the human body. They provide all sorts of functions to help us survive.
- Proteins are made inside cells. When a cell makes a protein it is called protein synthesis. The instructions for how to make a protein are held in DNA molecules inside the cell nucleus.

Synthesis Simulation

Procedures

1. In your note packet, combine amino acids to create protein.
2. Draw 10 amino acids to represent a chain like structure
3. Ensure each corner of the square are touching

Protein Building Block = .



7

Station: Growth

Adults don't always look like the babies of a species. All organisms begin their lives as single cells. Over time, these organisms grow and take on the characteristics of their species. Growth results in an increase in the amount of living material and the formation of new structures.

All organisms grow, and different parts of organisms may grow at different rates. Organisms made up of only one cell may change little during their lives, but they do grow. On the other hand, organisms made up of numerous cells go through many changes during their lifetimes. Think about some of the structural changes your body has already undergone in your short life. All of the changes that take place during the life of an organism are known as its development.

- Growth is an increase in the size of an organism resulting from the synthesis of food substances. Increasing size by adding cells, by cells getting larger, or replacing cells.
- Young organisms: adding cells to increase
- Mature organisms: grow new cells to replace cells that die and are lost.

A snowball grows when you roll it over fresh snow! Why isn't it a living thing? The growth of the snowball is not internal. It does not grow by producing more cells like organisms. It just adds on more material to the outside. Someone has to roll the snowball. It won't grow bigger by just sitting there and it certainly cannot change liquid water or solid ice into new snow from which it can grow larger. This is one of the differences between growth of a living thing and growth of a nonliving thing.

8

Station 8: Reproduction

Perhaps the most obvious of all the characteristics of life is reproduction, the production of offspring. Organisms don't live forever. For life to continue, organisms must replace themselves. Reproduction is not essential for the survival of an individual organism. However, it is essential for the continuation of an organism's species. A species is a group of similar-looking organisms that can interbreed and produce fertile offspring. If individuals in a species never reproduced, it would mean an end to that species' existence on Earth.

- Making more of a species.
- Allows genetic materials to be passed down.

There are two basic kinds of reproduction: sexual and asexual. Sexual reproduction requires that two cells (sperm and egg) unite to produce the first cell of the new organism. Organisms reproducing sexually do not always have "sex!" In many cases sperm and egg are released into the water where they meet. Most familiar organisms – from maple trees to birds and bees – reproduce sexually. In asexual reproduction, a single organism can reproduce without the aid of another, such as a bacteria or sea sponge. Sometimes these organisms can just divide themselves in two!

1. asexual reproduction--involves one parent and the offspring are identical to the parents
2. sexual reproduction--involves two parents and the offspring is a combination of both parents

9

Station: Immunity

The immune system

Helps to protect us against diseases caused by tiny invaders (called pathogens) such as viruses, bacteria, and parasites. The immune system is made up of specialized organs, cells, and tissues that all work together to destroy these invaders. Some of the main organs involved in the immune system include the spleen, lymph nodes, thymus, and bone marrow.

How does it work?

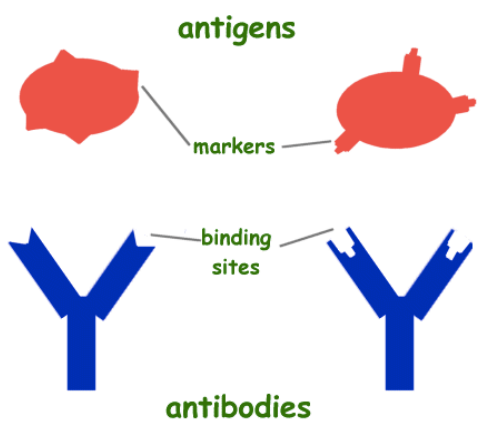
The immune system develops all kinds of cells that help to destroy disease causing microbes. Some of these cells are specifically designed for a certain kind of disease. All throughout the body, disease fighting cells are stored in the immune system waiting for the signal to go to battle. The immune system is able to communicate throughout the entire body. When pathogens are detected, messages are sent out, warning that the body is being attacked. The immune system then directs the correct attacking cells to the problem area to destroy the invaders.

Antigens and Antibodies

Scientists call the invaders that can cause disease antigens. Antigens trigger an immune response in the body. One of the main immune responses is the production of proteins that help to fight off the antigens. These proteins are called antibodies.

How do the antibodies know which cells to attack?

In order to work properly, the immune system must know which cells are good cells and which are bad. Antibodies are designed with **specific binding sites** that only bind with certain antigens. They ignore "good" cells and only attack the bad ones. You can see from the picture below that the antibodies each have a specially designed binding site. They will only bind with the antigen that has a "marker" that matches up perfectly.



How Vaccines Work

Vaccines introduce microbes that are already killed or modified so we don't get sick. However, the immune system doesn't know this. It builds up defenses and antibodies against the disease. When the real disease tries to attack, our body is ready and can quickly neutralize the antigens.

Antibody Simulation

Materials:

- *Plastic wrap (about 1 foot).*
- *Twist ties (3)*
- *Glass jar with lid, 16 oz*
- *Table salt (1 cup)*
- *Magnet*
- *Measuring cup*
- *Measuring tablespoon*
- *Iron filings (1 tbsp.)*
- *Piece of paper*

1. Take one piece of magnetic tape and put it in the jar, resting on top of the mixture. Then put the lid back on the jar tightly and flip it ten times.
2. Carefully remove the magnetic tape from the jar.
    a. You may need to carefully tilt the jar to grasp the tape.
    b. Only grab it by the twist tie or twisted plastic, and try not to touch the iron filings.
    c. As you take it out of the jar, gently turn the piece of tape upside down, so that any salt trapped in the twisted plastic wrap falls back into the jar.
    d. If necessary, gently shake the tape to remove the extra salt, but do not shake it so hard that you remove the iron filings.
3. Examine the magnetic tape. Does it look like more iron filings are stuck to the tape than salt?
4. Hold the magnetic tape over the piece of paper, untie the twist tie, and carefully open up the plastic wrap so the salt and iron filings fall onto the paper.
5. Use the paper to carefully funnel the iron filings and salt back into the jar and secure the lid. Mix the iron filings and salt again by flipping the jar ten times.
6. Now you will simulate a second attack with the same pathogen. In the model, this represents the immune system's memory cells making more antibodies when they encounter the same type of pathogen again.
7. Repeat steps 5–10, but this time put all three pieces of tape in the jar, as shown in Figure 6. You will also need to measure and record the combined mass of all three magnetic tape pieces with and without attached salt and iron filings.

Teacher Set Up

Make the "antibodies,"

a. Label the pieces of magnetic tape 1, 2, and 3 by writing large, bold numbers on the paper backing.
b. Put each magnetic tape square in the middle of a plastic wrap square, with the adhesive side (covered by paper) facing up.
c. Pull the ends of the plastic wrap together around each magnetic tape square, twist them together, and secure them with a twist tie.
d. Make sure there are no openings in the plastic wrap surrounding any of the magnets (so that salt or iron filings cannot get through and reach the magnetic tape).

8.

Figure 2. Completed antibody models.

9. Measure 1 cup of salt and pour it into the glass jar. Then measure 1 tbsp. of iron filings and add it to the jar, as shown in Figure 3, left.
10. Put the lid on the jar tightly, and then mix the salt and iron filings together by flipping the jar upside down and then right-side up again about ten times, or until the iron filings appear evenly dispersed throughout the salt (Figure 3, right).

Figure 3. After mixing the iron filings and salt together, the iron filings should appear only as specks throughout the jar.