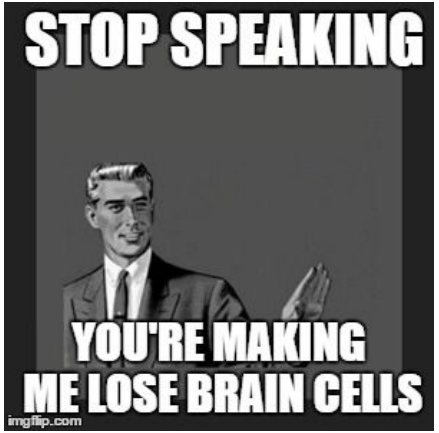
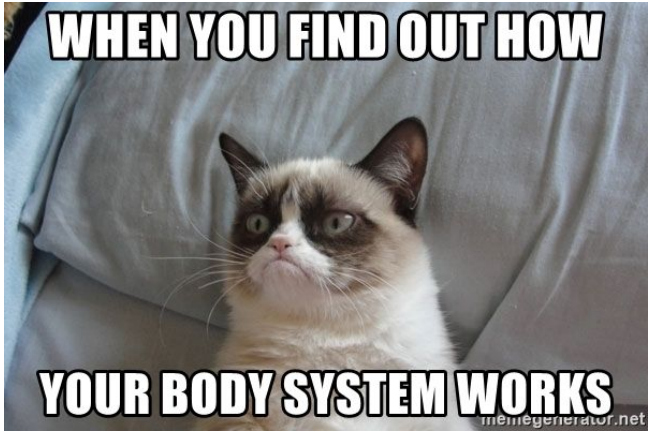
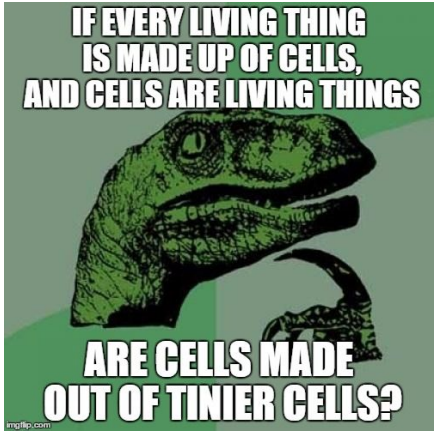
Unit 3
Cells and Systems







Grade 8 - Unit 2 - **Cells and Systems** Concepts

Animals

Cells
↓
Tissues
↓
Organs
↓
Systems

Unicellular

Plants

Roots
↓
Shoots

Structures & Functions

Plant Cell

Animal Cell

Osmosis Diffusion
Respiration

Technology
(The Microscope)

Multi-cellular

Variation

Specialization of cells – tissues – organs and organ systems

C H A R A C T E R I S T I C S

of Living Things

Cellular
Need Energy
Grow
Respond
Reproduce
Adapt

Integumentary System
Covers all Body Systems

Respiratory System
Exchanging Gases

CO_2 out

Oxygen in

Nervous System
Peripheral and Central

Controls Heartbeat

Muscular System

Pumps Heart

Circulatory System
Moves Nutrients

Digestive System
Break down nutrients

Excretory System
Eliminate wastes

Skeletal System
Supports all Body Systems

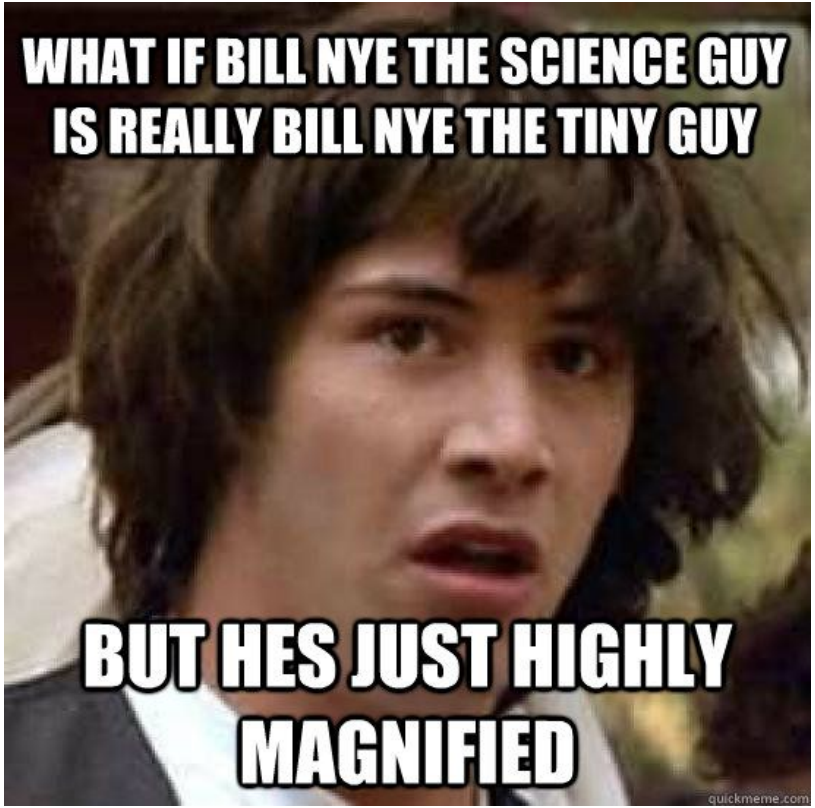
Disease Affects Living Things

Research	Discoveries	Vaccines	Medicines	Technologies
Lifestyles	Nutrition	Exercise	Stress	Substance Abuse

Microscopes

A **microscope** is an optical instrument used for viewing very small objects, typically magnified several hundred times.

The microscope was first patented in 1590. This opened up a whole new area of science.



Fun fact!

It is unsure who created the first microscope.

Some historians say it was Hans Lippershey, most famous for filing the first patent for a telescope.

Other evidence points to Hans and Zacharias Janssen, a father-son team of spectacle makers living in the same town as Lippershey.

Microscopes

There are four types of microscopes!

1. Stereoscopic Microscopes

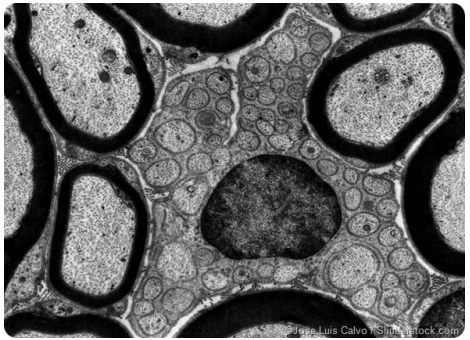
A stereo, or dissecting, microscope provides a three-dimensional view of the specimen.

It does this with separate objective lenses and eyepieces for each eye. They have lower magnification when compared to compound microscopes, but they also have a longer working distance.

2. Transmission Electron Microscopes

The transmission electron microscope is a very powerful tool. In TEM A high energy beam of electrons is shone through a very thin sample, and the interactions between the electrons and the atoms can be observed.

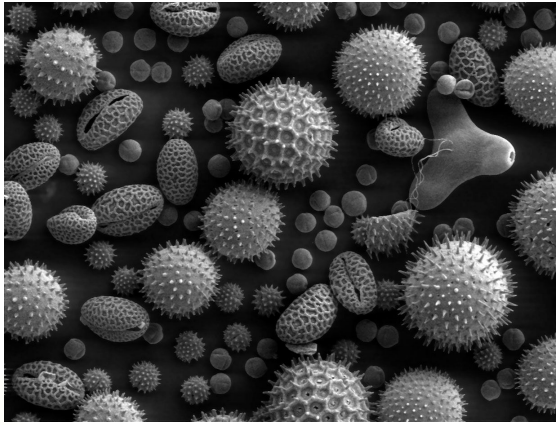
Chemical analysis can also be performed.



3. Scanning Electron Microscopes

A scanning electron microscope (SEM) scans a focused electron beam over a surface to create an image.

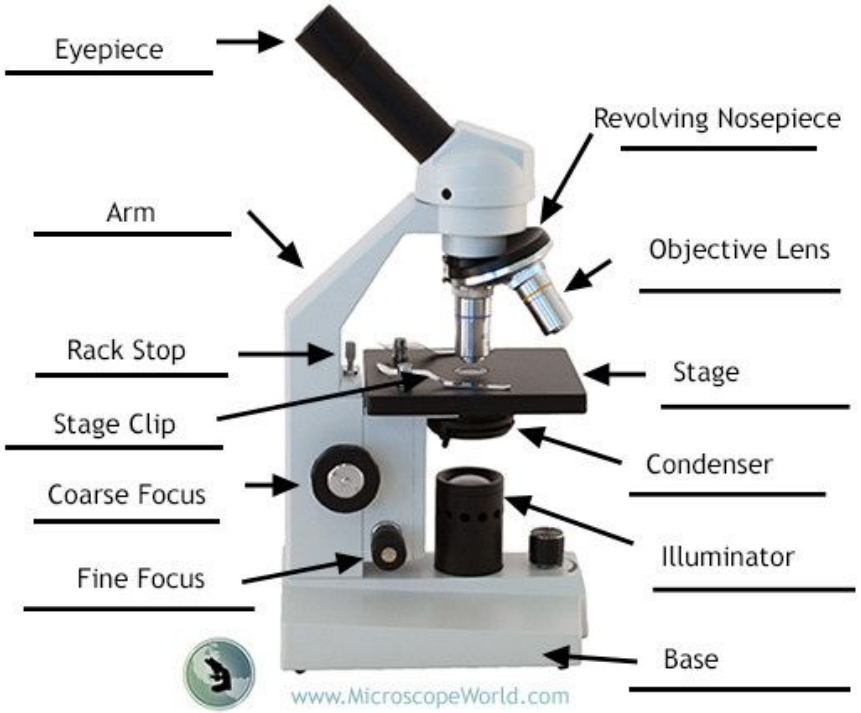
The electrons in the beam interact with the sample, producing various signals that can be used to obtain information about the surface topography and composition.



4. Compound Microscopes

A compound microscope is an instrument that is used to view magnified images of small objects on a glass slide.

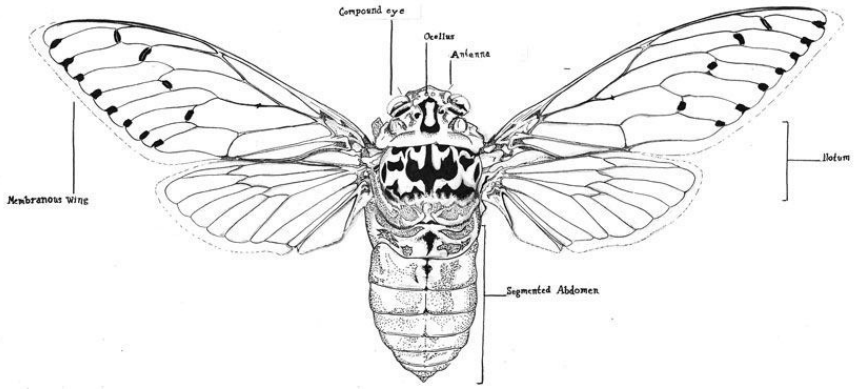
It can achieve higher levels of magnification than stereo or other low power microscopes.



Scientific Drawings

Scientific drawings are an important part of the science of biology and all biologists must be able to produce good quality scientific drawings regardless of their artistic ability.

Scientific drawings are used as a way to demonstrate your observations of a specimen in a simple way.

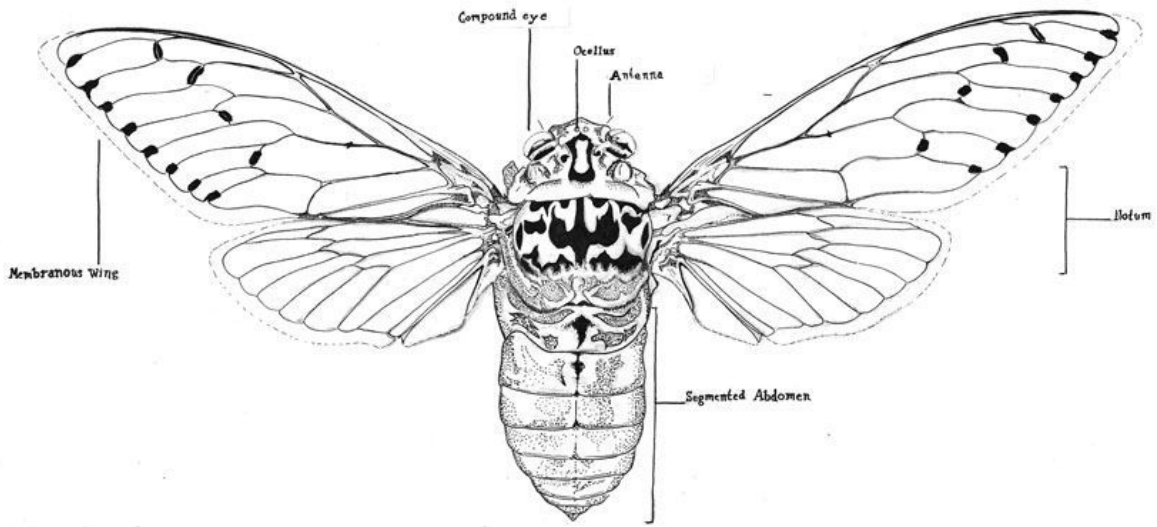


Scientific Drawings Rules

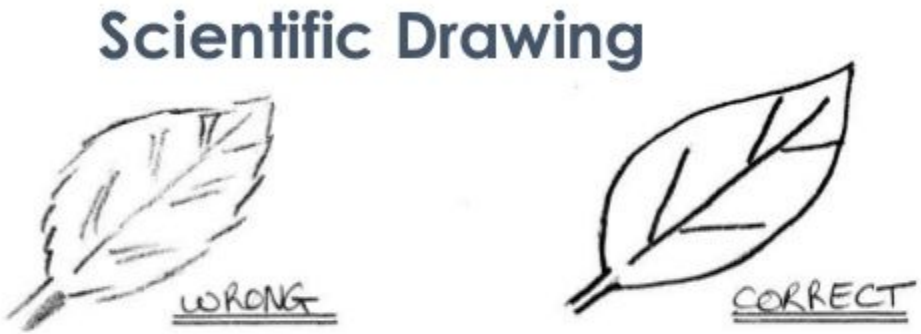
While drawing remember the rules for scientific drawings;

1) Look at the specimen carefully and examine the significant features that will be included in the drawing
2) Draw only what you see. Do not include what you think you should see
3) All drawings must be done in pencil
4) Drawings must be large and clear so that features can be easily distinguished
5) No more than two drawings should be on a single page
6) Always use distinct, single lines when drawing
7) To illustrate darker areas on a specimen, use stippling or dots. Do not shade in any area of your drawing
8) Include a title, magnification, and labels
9) Be sure to underline scientific names

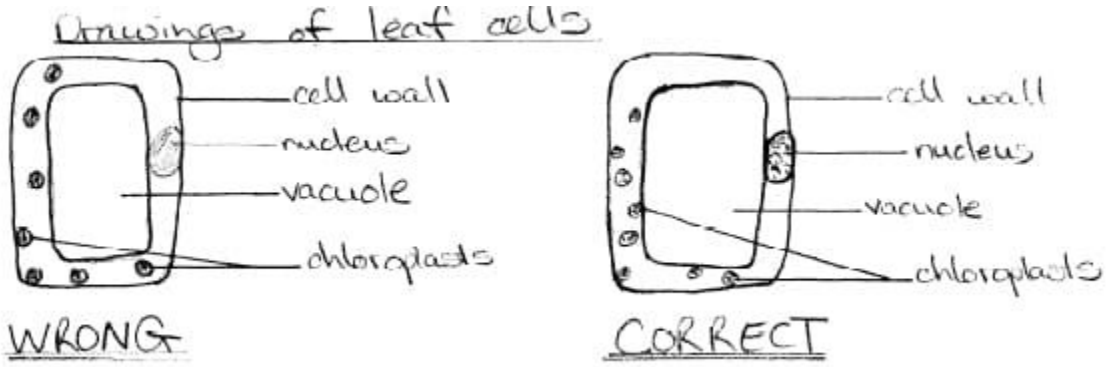
Example


Compound eye
Ocellus
Antenna
Membranous Wing
Notum
Segmented Abdomen

What is incorrect?



What is incorrect?



What are you made of?

Section 1.0: Living things share certain characteristics and have structures to perform functions.

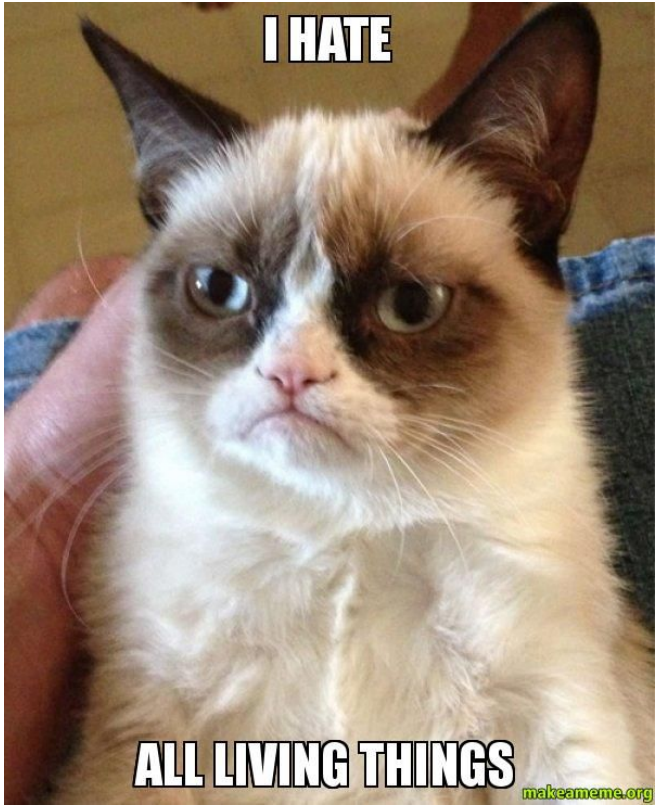
Learning Outcomes:

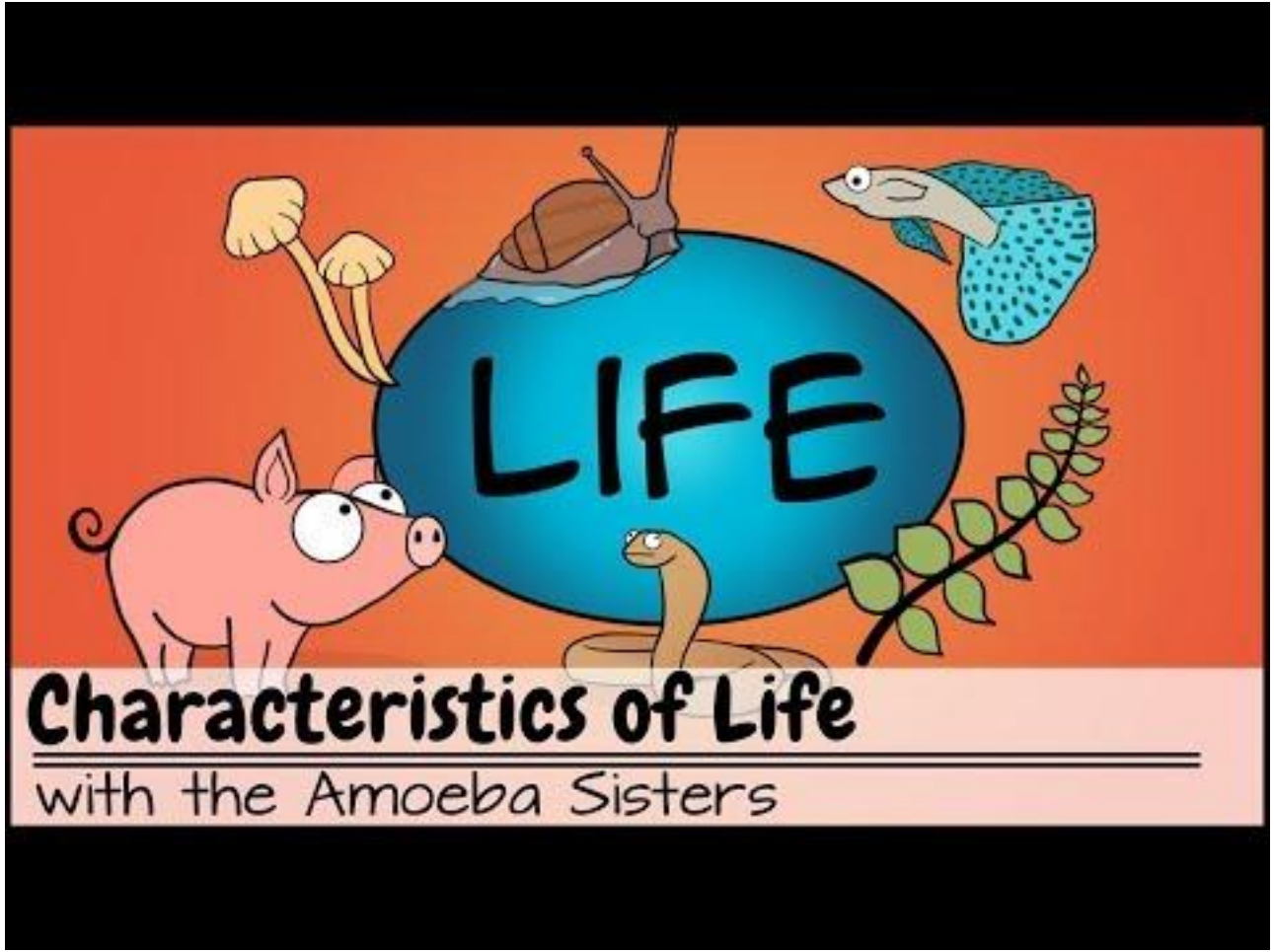
- Describe characteristics of living things
- Analyze general structure of living things

7 Characteristics of Living Things

An individual living creature is called an **organism**. There are 7 characteristics that all living organisms share. All organisms;

1) Are made up of one or more cells
2) Require energy
3) Grow and develop
4) Reproduce
5) Respond to their environment
6) Maintain homeostasis
7) Possess adaptations that evolved over time




LIFE
Characteristics of Life
with the Amoeba Sisters

1. Cells

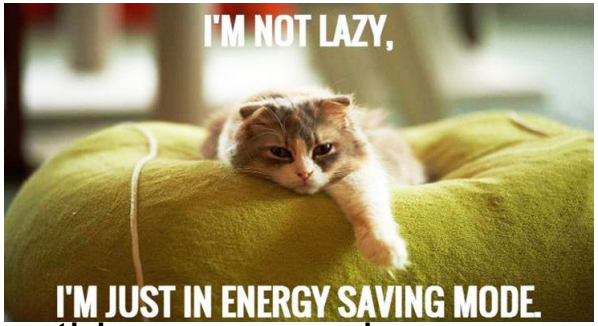
A cell is the basic unit of structure and performs all the processes that life depends on.

All living organisms are made of one or more cells, and all cells are created by cells.

If you look closely at any organism you can see that it is made of cells. Non-living things are NOT made of cells.

Exceptions: A piece of wood. Why?

2. Energy



Energy is the ability to make things move or change. Everything an organism does requires energy.

Plants and animals obtain nutrients, substances that provide the energy and materials that organisms need to grow, develop, and reproduce, from their food and environment.

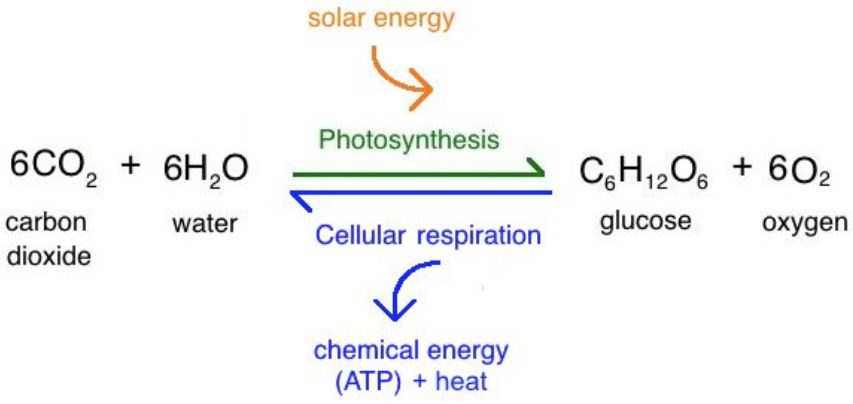
Plants use the energy of the sun to make their own food

Animals get their food from the environment around them.

Photosynthesis and Cellular Respiration

Photosynthesis is the process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water.

Cellular respiration is the process of oxidizing food molecules, like glucose, to carbon dioxide and water.



Fun Fact!

Living things that make or produce their own food, like plants are called **autotrophs.**

Living things that consume food, like animals are called **heterotrophs.**

Metabolism

The entire amount of chemical energy used by plants and animals to carry out their life processes is called **metabolism**.

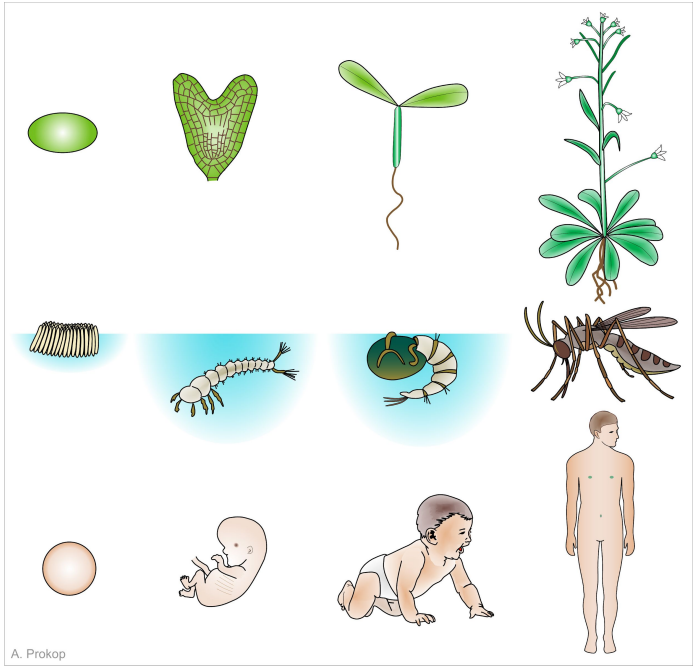
The chemical reactions provide energy for vital processes and for synthesizing new organic material.

3. Growth and Development

All living organisms grow and develop. However, growth and development of living organisms are not the same things.

Growth is the increase in size and mass of that organism. Cell growth includes **repair**. As cells grow old, they wear off. Sometimes they suffer injury and bruises, but they are able to repair themselves by growing new cells in a process called **Mitosis**.

Development involves transformation of the organism as it goes through the growth process. Example: Egg → Tadpole → Frog



Growth and Development

Cell growth includes repair. As cells grow old, they wear off. Sometimes they suffer injury and bruises, but they are able to repair themselves by growing new cells in a process called Mitosis.

Growth and Development

Aging is a process of living things as they get close to the end of their lifespan, their ability to carry out life functions reduce.

Eventually, they die to end the process of life.

What happens when you stop smoking?

4. Reproduce

Reproduction is the process where all living things come from other living things.

It is not necessary for the survival of the individual organism, but for the type of organism.

5. Response to Environment

All living things adapt and respond to their environment. Although organisms respond to stimuli in different ways the pattern of events is always;

Stimulus → Detection → Coordination → Response

A **stimulus** is anything that causes a response in an organism.
Example: A car moving too close to you.

The organism's reaction to this stimulus is called a **response**.
Example: You jumping out of the way.

Receptors

Receptors are specialised cells that detect a stimulus.

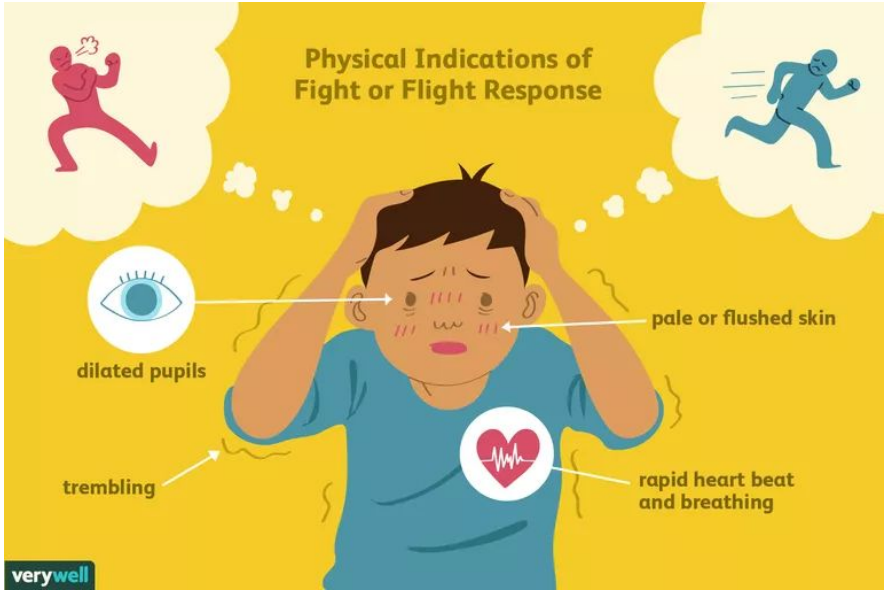
Some receptors can detect several different stimuli but they are usually specialised to detect one type of stimulus.

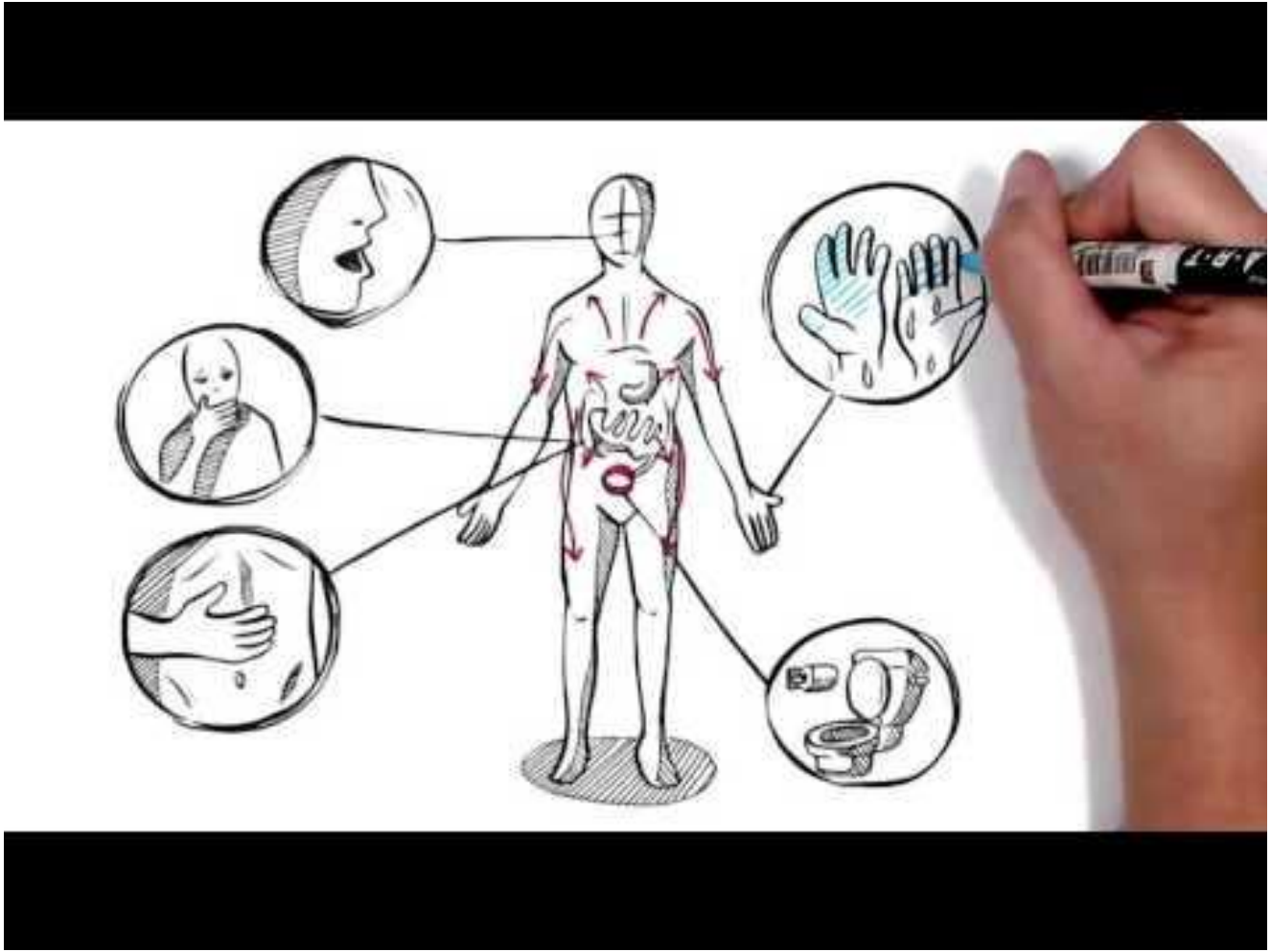
For example light is detected by photoreceptors in the eye, sound is detected by vibration receptors in the ears, and body position is detected by receptors in the ears.

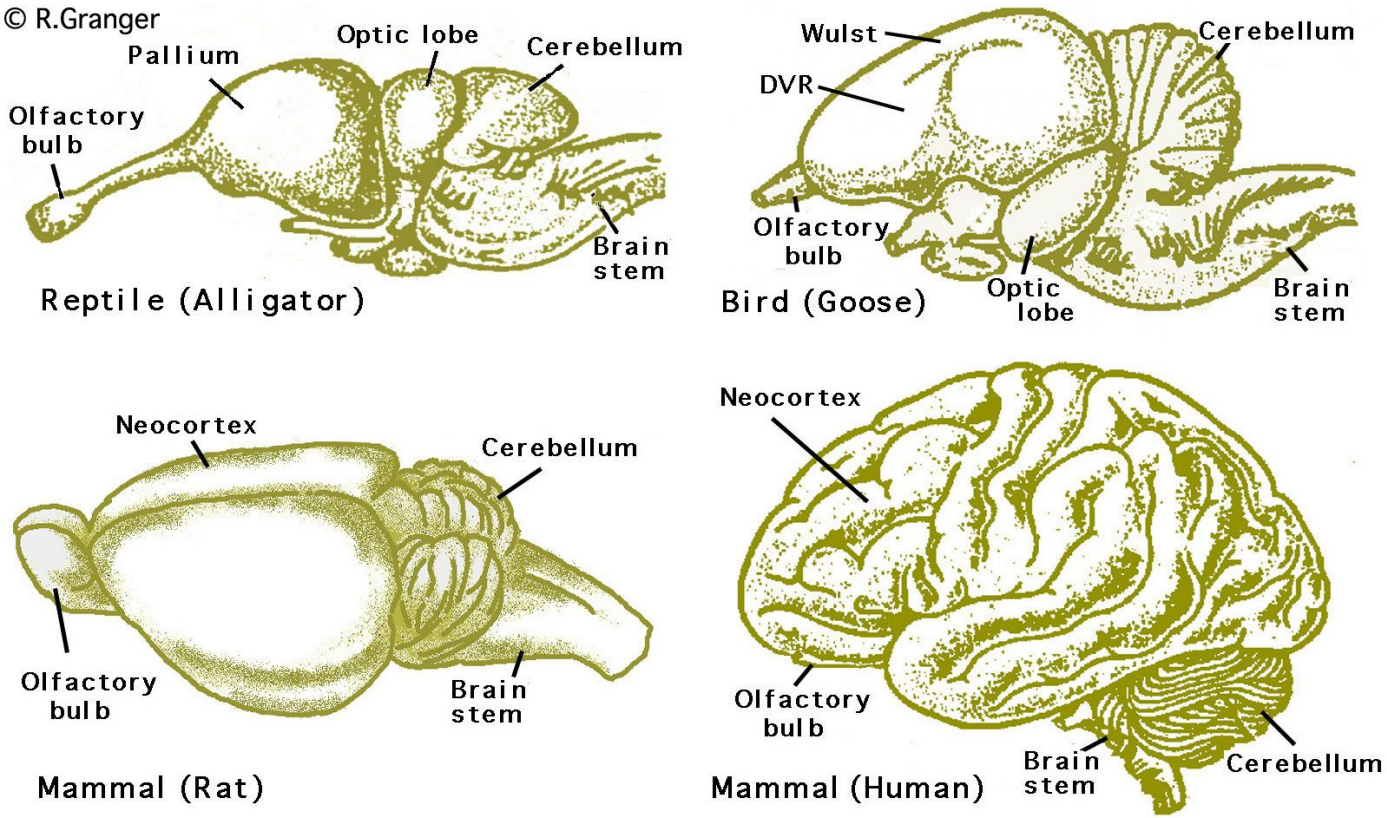
Fight or Flight or Freeze

The fight-or-flight-or-freeze response plays a critical role in how we deal with stress and danger in our environment. Essentially, **it is the response that prepares the body to either fight, flee, or freeze and hide from the threat.**

During this response eyes begin to dilate, the heart starts beating rapidly and blood is redirected to important extremities.






© R.Granger
Pallium
Optic lobe
Cerebellum
Olfactory bulb
Brain stem
Reptile (Alligator)
Wulst
Cerebellum
DVR
Olfactory bulb
Optic lobe
Brain stem
Bird (Goose)
Neocortex
Cerebellum
Olfactory bulb
Brain stem
Mammal (Rat)
Neocortex
Olfactory bulb
Brain stem
Cerebellum
Mammal (Human)

Fun Fact!

During the 1890s, Russian physiologist, Ivan Pavlov was researching salivation in dogs in response to being fed. He inserted a small test tube into the cheek of each dog to measure saliva when the dogs were fed.

Pavlov noticed that his dogs would begin to salivate whenever they heard the footsteps of his assistant who was bringing them the food.

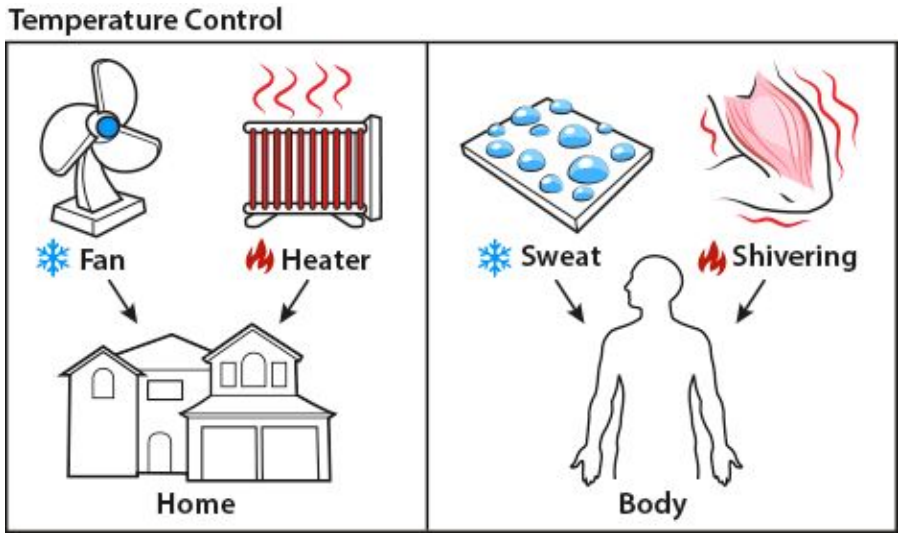
So, what was the stimulus and response?

6. Homeostasis

Homeostasis is the tendency to resist change in order to maintain a stable, relatively constant internal environment.

When an organism responds to stimuli, the internal conditions of the organism must be maintained.

For example temperature can be regulated by sweating and shivering.



Structure and Function

Living things are composed of different structures that allow them to perform different functions.

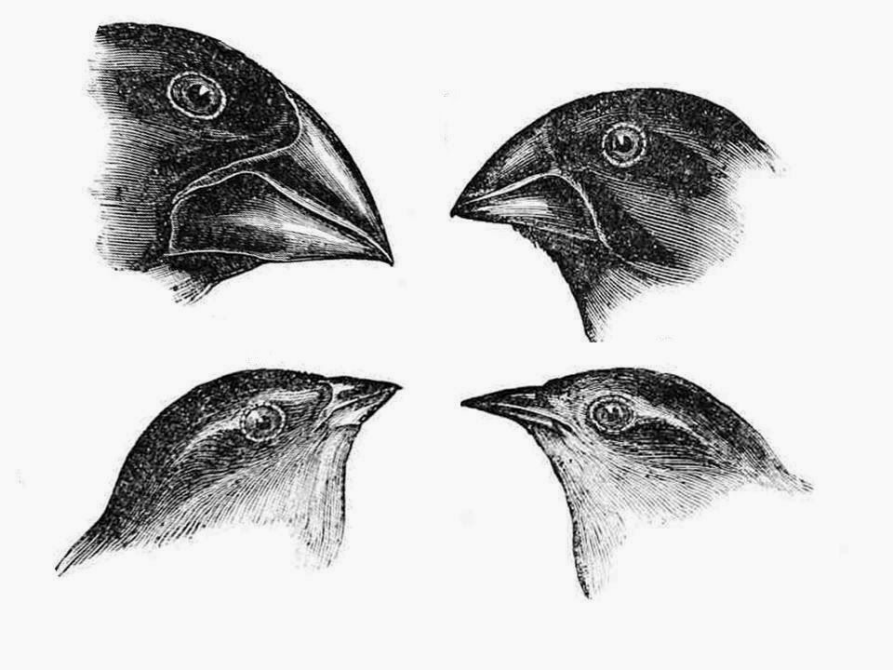
For example the wings of birds allow them to fly.

It is possible for one structure to have many different functions.

Darwin’s Finches

On his visit to the Galapagos Islands, Charles Darwin discovered several species of finches that varied from island to island, which helped him to develop his theory of natural selection.

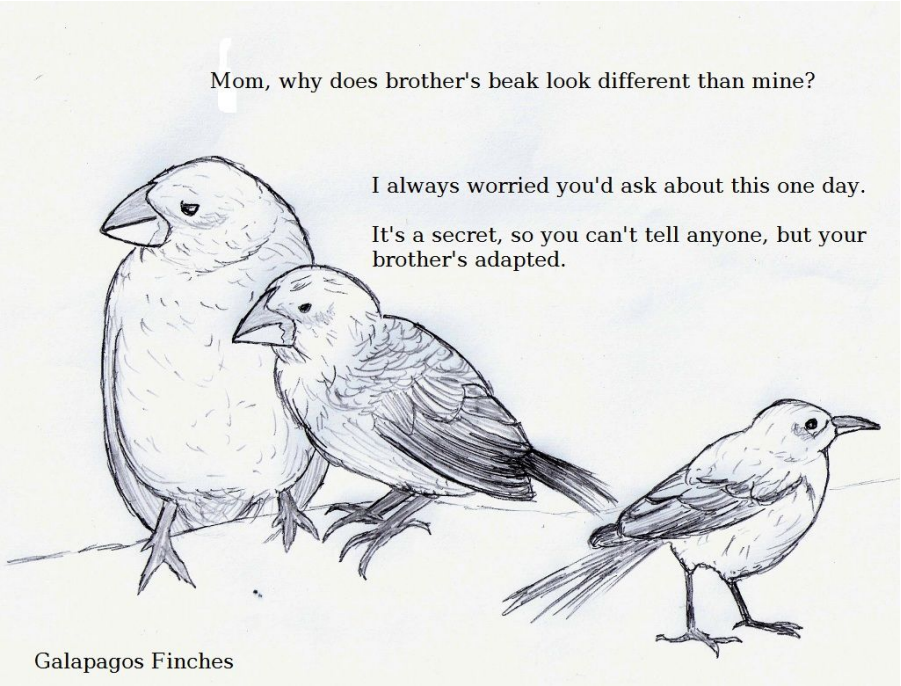
From these findings Darwin developed his theory of natural selection.



7. Adaptations

An adaptation is a mutation, or genetic change, that helps an organism, such as a plant or animal, survive in its' environment.

Due to the helpful nature of the mutation, it is passed down from one generation to the next. As more and more organisms inherit the mutation, the mutation becomes a typical part of the species.



Adaptations

Adaptations can be **structural**, meaning it is a physical part of the organism. Example: Meerkats have developed an immunity to scorpion stings that can paralyze a grown man or kill a small child.

Or, they can be **behavioural** which affects the way an organism acts. Example: Bird calls and migration are behavioral adaptations that help birds survive winter and find mates.

Birds!

Adaptations Assignment