Stimulus and Response

Why Plants and Animals do what they do.

It's another way of saying "cause and effect in the natural world"

Today's objectives

- After today you will be able to:
  - Define Stimulus
  - Identify a stimuli as **internal** or **external**
  - Define Response
  - Define Homeostasis

What is a stimulus?

- Stimulus: any change in an organism's environment that causes the organism to react. We can also call this the "cause"
  - Stimulus- singular
  - Stimuli- plural

- Example: An animal is cold so it moves into the sun
- Example: Getting a drink when you feel thirsty

2 types of Stimuli

- There are **Internal** Stimuli and **External** Stimuli

External Stimulus

- An **External Stimulus** is a stimulus that comes from outside an organism
- Examples:
  - You feel cold so you put on a jacket
  - A snake lunges at a rabbit, so the rabbit runs away
  - A dog feels the heat of the sun, so it goes to lay in the shade

  - Temperature, predators, presence of food or water, etc.

Internal Stimulus

- An Internal Stimulus is a stimulus that comes from inside an organism
- Examples:
  - You have an infection so you run a fever
  - A giraffe feels thirsty so it drinks some water
  - A lion is tired so it takes a nap

  - Germs, dehydration, lack of energy, pain, etc.

Internal or External Stimuli?

- You have a stomach ache and throw up
  - Internal
- A bird is thirsty and drinks some water
  - Internal
- A squirrel sees a cat and runs up a tree
  - External
- You smell food and start to salivate
  - External
- There is dust in the air so you cough/sneeze
  - External

What is a response?

- Response: how the organism reacts to a stimulus and results in a change in behavior. We can also call this the "effect"

- Example: An animal is cold so it moves into the sun
- Example: Getting a drink when you feel thirsty

Examples of stimuli and their responses

- You are hungry so you eat some food
- A rabbit gets scared so it runs away
- You are cold so you put on a jacket
- A dog is hot so it begins to pant
- It starts raining so you take out an umbrella

Do plants respond to stimuli?

- Yes!
- Have you ever seen an indoor plant on a windowsill growing toward the window? When a plant grows toward the sun, we call this **phototropism**.
- Usually plants grow up because that's where the sun is. Sometimes the sun isn't "up" so it adjusts

Tropisms

- Plant's growth response toward or away from a stimulus
  - Positive = toward the stimulus
  - Negative = away from the stimulus
- Hydrotropism – roots grow toward water
- Phototropism – leaves/stems grow toward light
- Thigmotropism – plant grows toward OR away from pressure
- Geotropism – stems grow away from gravity, roots grow with gravity

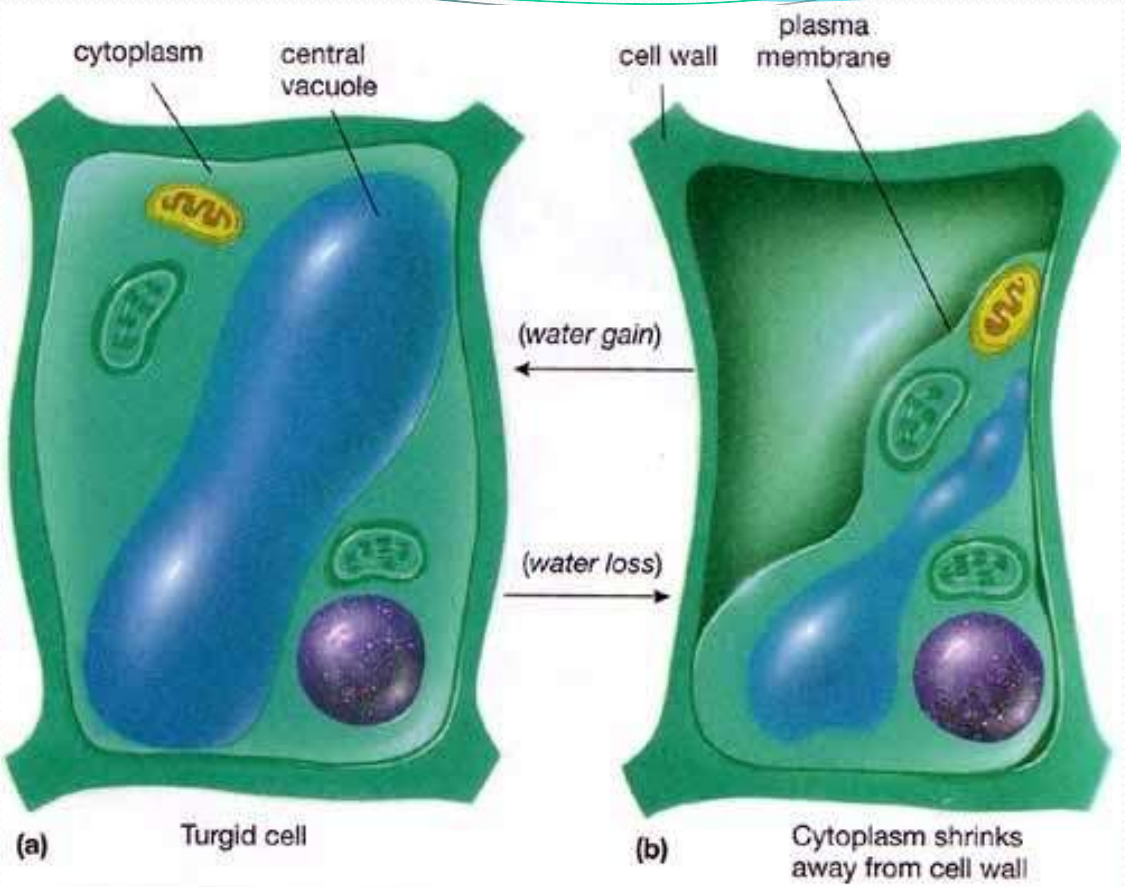
Plant stimuli and response

- What's happening here? What caused the plant to wilt?

Wilting

- When the plant doesn't get enough water, the vacuoles in the plant cells (which hold water, remember?) become empty and shrink.
- This means the vacuoles aren't full, so they don't push out against the cell wall anymore, causing the plant to wilt.
- We call this outward pressure "Turgor Pressure"

Wilting


cytoplasm
central vacuole
cell wall
plasma membrane
(water gain)
(water loss)
(a)
Turgid cell
(b)
Cytoplasm shrinks away from cell wall

Morning glory

- Morning glory flowers also respond to sunlight as a stimulus. They open and close each day based on sunlight.

Homeostasis

- **Homeostasis** is the maintenance of a stable internal environment.
- What does that mean?
- If your body is in homeostasis, everything in your body is balanced, and internal conditions remain stable and relatively constant. Our bodies do many things to keep us in homeostasis.
- Homeo = same
- Stasis = state of balance

Homeostasis

- Examples of maintaining homeostasis:
  - Mammals are warm blooded, which means we need to maintain a fairly constant internal temperature. Humans need to stay around…
  - 98.6° F
  - Just like when you set the thermostat in your house, and the air conditioning or heater adjusts to stay at the correct temperature. Your body does the same thing.

Homeostasis

- Another Example:
  - Your body regulates blood sugar throughout the day using glucagon and insulin
  - What happens if your body can't regulate your blood sugar?
  - The person might develop diabetes

Homeostasis

- Another example:
  - The kidneys are used to remove excess water and ions from the blood. These are then expelled as urine. The kidneys perform a vital role in homeostatic regulation in mammals, removing excess water, salt, and urea from the blood.
  - Sleeping is also a function to keep your body in homeostasis. Your body needs sleep and will make you sleep if you are sleep-deprived.

Homeostasis

- One more example:
  - When bacteria or viruses that can make you ill get into your body, your immune system kicks in to help maintain homeostasis. It works to fight the infection before it has the opportunity to make you sick, ensuring that you remain healthy.