

#### intRoduction

Imagine your body as an amazing, busy city-one where every part has a job to do, and each system works together to keep everything running smoothly. Now picture a plant-how its roots, leaves, and flowers team up to help it grow and reproduce. These systems might seem like they're doing their own thing, but in reality, they're all working together to make life possible. Let's explore how the systems in both animals and plants team up to keep life going.

HELLO

The Animal Body: Teamwork at Its Best!

Every part of your body plays an important role in keeping you healthy. The immune system defends against invaders like germs, the digestive system provides the energy you need, and the circulatory system delivers oxygen and nutrients to every part of your body. These systems don't work alone—they interact and depend on each other to do their jobs well. For example, when you breathe in oxygen, your respiratory system helps it enter your blood, and the circulatory system moves it to the muscular system to keep you active and strong.

But it doesn't stop there! Your nervous system keeps everything in check, making sure your heart beats, your body moves, and your temperature stays steady.

Your endocrine system even helps your body know when it's time to grow or reproduce! Together, these systems help you stay healthy, move, grow, and defend yourself against illness.

The Plant Body: Growth, Reproduction, and Survival Plants, too, have an incredible system of teamwork that helps them survive. Xylem carries water from the roots to the leaves, and phloem moves sugars back down from the leaves to help the plant grow. When you look at a flower, you're seeing the reproductive system of the plant, where the stamen and pistils help it produce seeds to create new plants.

Plants also respond to their environment in incredible ways! Phototropism makes plants grow toward the light, while geotropism helps their roots grow down to find water and nutrients. And when plants touch something, like a vine wrapping around a tree, that's thigmotropism at work!

#### What's Coming Up?

In this unit, you'll learn how the systems in both animals and plants work together to help organisms survive, grow, and reproduce. You'll explore how systems like the digestive, respiratory, circulatory, and immune systems interact in animals. Then, you'll dive into the xylem, phloem, reproductive structures, and hormones in plants. You'll discover how energy flows through both animals and plants, and how environmental factors like light, touch, and gravity influence their growth and survival.

Ready to explore how the body and plants work like perfect teams? Let's dive in and discover the science behind all the systems that make life happen!

#### VOCABULARY



Vocabulary Word	Definition
Auxins	
Cell	
Cellular Reproductio n	
Circulatory System	m
Cytokines	





Vocabulary Word	Definition	3223
Digestive System		
Endocrine System		
Excretory System		
Feedback Loop		
Feedback Mechanism	m	
Fertilization		
Flower		
Geotropism	A /	
Gibberellin		

Vocabulary Word	Definition
Homeostasis	
Hormones	
Immune System	
Integumenta ry System	
Interaction	
Lymphatic System	
Muscular System	
Negative Feedback	
Nervous System	

Vocabulary Word	Definition	
Nutrient Absorption		
Nutrients		
Organ		
Organelle		
Organism		
Organ System		
Ovary	$\sim$	
Pathogen		
Phloem		

Vocabulary Word	Definition
Phototropis m	
Pistil	
Pollination	
Positive Feedback	
Regulation	
Reproductive System	
Respiratory System	
Response	
Roots	

Vocabulary Word	Definition	
Seed		
Shoot System		
Skeletal System		
Stamen		
Stimulus		
Stoma		
Thigmotropi sm	my (n	
Tissue	A	
Transport		





#### PHENOMENON

#### Mission Log - Sol 145

#### The Shifting Balance

Location: Mars HAB – Bio–Dome 4, Agricultural Sector The alarm blares, sending your team into a frenzy. In Bio–Dome 4, where all experiments on Martian soil and life systems take place, something is wrong. The air feels thick, almost suffocating. The plants–those that were thriving–are beginning to wilt. The small algae culture that was providing oxygen to the entire dome is losing its green hue, turning a sickly yellow.



In the animal habitat, the changes are just as alarming. The newly introduced small mammal species seems lethargic. Their bodies are weaker, and many are refusing to eat. Even the larger, more resilient species are showing signs of distress. The habitat's circulatory system was adjusted to match Earth-like conditions, but now, the animals are struggling to maintain their body temperature, and respiratory systems are malfunctioning.

It seems that something is off. The careful balance of energy flow, nutrient absorption, and defense mechanisms in both the plants and animals is failing. You suspect the two systemsplant and animal-are connected, and that the problem might be one of their interdependencies, but the question is: what is causing the disruption?

Your mission? To uncover what is causing this failure by analyzing how the plant systems (roots, stems, xylem, phloem) and animal systems (immune, respiratory, digestive) interact. The plants were doing their job-producing oxygen, filtering carbon dioxide, and transferring water-but something has broken the connection. How are the digestive and circulatory systems of the animals involved in this crisis? Are the plant roots absorbing enough water for the animals' nutrient needs? Key Questions to Investigate:

- How do the digestive, circulatory, and muscular systems of the animals interact to regulate oxygen and carbon dioxide exchange?
- How are the endocrine, immune, and respiratory systems of the animals being affected by the plant's failure to produce oxygen properly?
- Are the plants failing because they are unable to absorb the necessary nutrients, or is the problem deeper within the root and vascular systems?
- Can the nervous, skeletal, and immune systems of the animals adapt to environmental changes caused by plant stress?
- How are the plant's hormones and reproductive systems being impacted by changes in the environment? Could this affect the plant's ability to reproduce and pass on nutrients?

Your investigation will require a detailed analysis of the nutrient and energy flow in both the plants and animals within the biosphere. Is the imbalance caused by the plant systems failing to provide the nutrients the animals need, or is it a cumulative effect of each system not being able to work together The clock is ticking. Each system's failure affects the next, and if you don't uncover the cause soon, the entire dome could be at risk. Time to break down the complex web of interdependent systems and find the solution before the failure spreads. Are you ready to restore balance?

## ANIMAL SYSTEM INTERACTIONS

#### How Body Systems Work Together Body systems work like a team. Each has a job, but they must **cooperate** to keep the body **balanced**, safe, and alive.

Respiratory + Circulatory +

#### **Muscular Systems**

 Work together to bring oxygen in and push carbon dioxide out..

- The lungs take in oxygen → the heart and blood carry it → muscles use it to move.
- The diaphragm (a muscle)
   helps us breathe in and out.
- Digestive + Circulatory + Muscular
   Systems
  - The digestive system breaks
     food into nutrients.
  - The **muscles** move **food** through the **digestive** tract.
  - The blood picks up the nutrients and carries them to cells.







- Excretory + Circulatory Systems
  - The kidneys clean the blood and remove waste.
  - The blood brings waste to the kidneys to filter it out as urine.
- Nervous + Muscular + Skeletal Systems (Injury Prevention)
  - The **nervous** system **senses** danger and **sends** quick **messages**.
  - The muscles and bones react to keep
    - us from getting **hurt** (e.g., pulling your
    - hand away from something hot)..

- Immune + Integumentary + Respiratory
   Systems (Defense)
  - The skin blocks pathogens.
  - The respiratory system makes mucus to trap invaders.
  - The immune system uses white blood
     cells to destroy bacteria and viruses.



- Reproductive + Endocrine + Nervous
   Systems
  - The reproductive system makes sperm and egg cells.
  - The endocrine system releases hormones to start puberty.
  - The nervous system controls timing and behaviors related to reproduction.

- How do the skeletal and muscular systems work together to enable movement in the body?
- How do the respiratory and circulatory systems collaborate to transport oxygen throughout the body?



- What functions do the digestive and excretory systems serve in processing and eliminating waste, and how do they interact?
  - How does the nervous system interact with other body systems to maintain homeostasis?
  - Can you describe a daily activity and explain which body systems are involved and how they work together during this activity?

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#### **Circulatory System**

- Heart: Pumps blood
- Blood: Carries oxygen, nutrients, and waste
- Blood vessels: Move
   blood throughout the
   body

#### CIRCULATORY SYSTEM

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## **RESPIRATORY SYSTEM**

- Nose/Mouth: Brings in air
- Trachea: Sends air to

the **lungs** 

• Lungs: Exchange

oxygen **and** carbon dioxide

• Diaphragm: Muscle

that helps you breathe

## DIGESTIVE SYSTEM

- Mouth: Chews food mechanical and chemical digestion
- Esophagus: Pushes food to stomach
- Stomach: Uses acid to break down
   food mechanical as well
- Small intestine: Absorbs nutrients
  - circulatory in villi.
- Large intestine: Removes water and forms waste
- Liver: Makes bile to break down fat
- Pancreas: Makes enzymes to help digestion - regulate blood sugar

## EXCRETORY SYSTEM

• Kidneys: Filter waste

from **blood** 

- Ureters: Carry urine to the bladder
- Bladder: Stores urine
- Urethra: Sends urine out

of the body

## IMMUNE / LYMPHATIC SYSTEM

• White blood cells: Attack

and destroy pathogens

Lymph nodes: Filter

harmful substances

- o Mucus membranes: Trap
  - dirt and bacteria

## MUSCULAR SYSTEM

- Skeletal muscles: Move the body
- Smooth muscles: Work inside organs (like the stomach)
- Cardiac muscle: Makes the heart beat
- Tendons: Connect muscles to bones



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#### SKELETAL SYSTEM

• Bones: Support and

protect the body

• Joints: Allow

movement

• Bone marrow:

Makes blood cells

#### NERVOUS SYSTEM

Brain: Controls thoughts,

emotions, and actions

- Spinal cord: Sends
   messages between brain
   and body
- Nerves: Carry signals all over the body

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## INTEGUMENTARY SYSTEM

• Skin: Protects against germs,

keeps water inside

- Hair and nails: Protect and insulate
- Sweat glands: Help cool the





## ENDOCRINE SYSTEM

 Glands (like pituitary, thyroid, adrenal): Release hormones
 Hormones: Control

growth, energy use, mood, and reproduction – **chemical messengers** 

## **REPRODUCTIVE SYSTEM**

- Ovaries (female): Make eggs and hormones
- Uterus (female): Grows and supports baby
- Testes (male): Make sperm and hormones



## HOMEOSTASIS AND FEEDBACK MECHANISMS

- What is Homeostasis?
- Homeostasis is the way the body keeps its internal environment stable, even when things outside the body change. It helps the body stay in balance so everything works properly.
  - **Example**: When you get hot, your body **sweats** to cool you down.
    - When you get cold, your body shivers to warm up.
    - Both are ways the body keeps a normal temperature—that's homeostasis
- What is a Feedback Mechanism?
  - A **feedback mechanism** is how the body uses signals to either

increase or decrease a process to maintain homeostasis.

- Negative Feedback
  - Definition: A negative feedback mechanism reverses a change to bring the body back to normal.

- The body detects a change → responds in the opposite direction to fix it. Keeps things stable and balanced
- Example: If your body temperature rises, your body sweats to cool down.If your blood sugar gets too high, your body releases insulin to lower it.
- Negative feedback helps the body fix changes and stay in balance.



- Positive Feedback
- Definition: A positive feedback mechanism makes a change bigger or stronger until a goal is reached.
  - The body by responds increasing the change instead of stopping it
  - Usually happens for a short time to complete a process
  - Example:
    - During childbirth, the body releases
       more oxytocin to make the muscles
       contract harder until the baby is
       born.
    - This continues until the process is finished, then it stops.
  - Positive feedback pushes the body in the same direction to finish a job.





- Organs:
  - Roots: Absorb water and

minerals from the soil;

anchor the plant

- Stems: Hold up the plant;
   transport water and sugar
   between roots and leaves
- Leaves: Make food
   (photosynthesis); exchange
   gases with the air

- Tissues
  - Dermal Outer covering (protects the plant)
  - Ground Storage support, and photosynthesis
  - Vascular Xylem and phloem
     (transports water and sugar)
    - Xylem: Carries water and minerals up from the roots (Xy = High)
    - Phloem: Carries sugar up and down from the leaves (Phlo = Low)



#### THE FLOWER

• Flowers - Help the

#### plant **reproduce**

- Stamen (male):
   Makes pollen
   (includes anther
   and filament)
- Pistil (female):

Makes **seeds** (includes **stigma**,

- style, ovary)
  Petals: Attract
  - pollinators like
  - bees and
  - butterflies



- Definition: Tropisms are how plants grow in response to changes in their surroundings (stimuli). These movements help the plant survive.
- Phototropism
  - Trigger: Light
  - Response: Stems and leaves grow toward light to get more energy for photosynthesis
  - **Example:** A sunflower turning to face the sun
  - Hormone: Auxins move to the dark side of the plant, causing it to bend toward the light

#### TRoPisms

- Geo/Gravitropism
  - Trigger: Gravity
  - **Response: Roots** grow **down**, into the soil to absorb water and minerals **Stems up**
  - **Example:** Carrot roots growing deep underground
  - Hormone: Auxins also help roots know which direction is "down"

#### • Thigmotropism

- Trigger: Touch
- Response: Vines or tendrils wrap around objects for support
- **Example:** A pea plant climbing a fence
- Hormone: Auxins signal the plant to curl and cling when touched

 What is a tropism, and why is it important for plant survival? Describe how a plant benefits from responding to its environment with movements like phototropism or gravitropism.



- How do positive and negative tropisms differ, and can you give one example of each from the video? Which plant responses move toward a stimulus, and which move away?
- Can you think of a real-life environment where plant tropisms would be especially important? How might tropisms help a plant survive in a crowded forest or a windy, rocky slope?
- If a plant was placed in total darkness or flipped upside down, how might it respond over time? Predict how tropisms like phototropism and gravitropism would guide the plant's growth in unusual conditions.



#### HORMONES

- Plant Hormones and What They Do
  - Auxins: Make stems and roots grow longer; involved in all tropisms
  - **Gibberellins:** Start **seasonal** growth like **sprouting** or flowering
  - Cytokinins: Help cells divide and grow strong walls
  - Ethylene gas: Helps fruit ripen (bananas turning yellow)





- How do auxins influence plant growth, and what role do they play in phototropism?
- In what ways do gibberellins affect plant development, particularly in stem elongation and seed germination?
- What is the function of cytokinins in plant growth, and how do they interact with auxins to determine plant structure?
- How does ethylene influence fruit ripening and leaf abscission in plants?
- What role does abscisic acid play in plant responses to stress, such as drought conditions?

#### Animal Adaptations

Sense organs (eyes, ears, nose, skin) help

animals collect information

- Nervous system sends fast signals so animals can act quickly
- Behavioral and physical adaptations help animals avoid danger, find food, or attract mates
  - Example: A rabbit's strong back legs help it run from predators

#### ADAPTATIONS



- Plant Adaptations
  - Bright petals attract pollinators
  - Waxy leaves prevent water loss in dry places
  - Spines on cacti protect the plant and reduce water loss
  - Deep roots help plants find water underground
  - Tropisms help plants move toward light, water, or support



#### SUMMARY

- 1. How do body systems in animals work together to perform essential functions?
  - One way animal body systems work together is when...
  - This coordination helps the body by...

2. How do feedback mechanisms like negative and positive feedback help maintain balance in animals?

- Negative feedback helps the body maintain homeostasis by...
- A good example of positive feedback is...

3. How do plant hormones coordinate to control growth and survival?

- Plant hormones like auxins and gibberellins influence growth by...
- These hormones help the plant survive because...
- 4. How do plants respond to environmental changes using internal signals?
  - Plants respond to their environment by...
  - For example, when conditions change, the plant...

5. How do animal and plant systems compare in how they respond to stress or environmental changes?

- Both plants and animals react to stress by...
- In animals, the response involves..., while in plants...

6. Why is it important for systems-whether in plants or animals-to work together rather than alone?

- It's important for systems to work together because...
- A great example of this is when...

#### RESOURCES



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# **Plant Systems**



