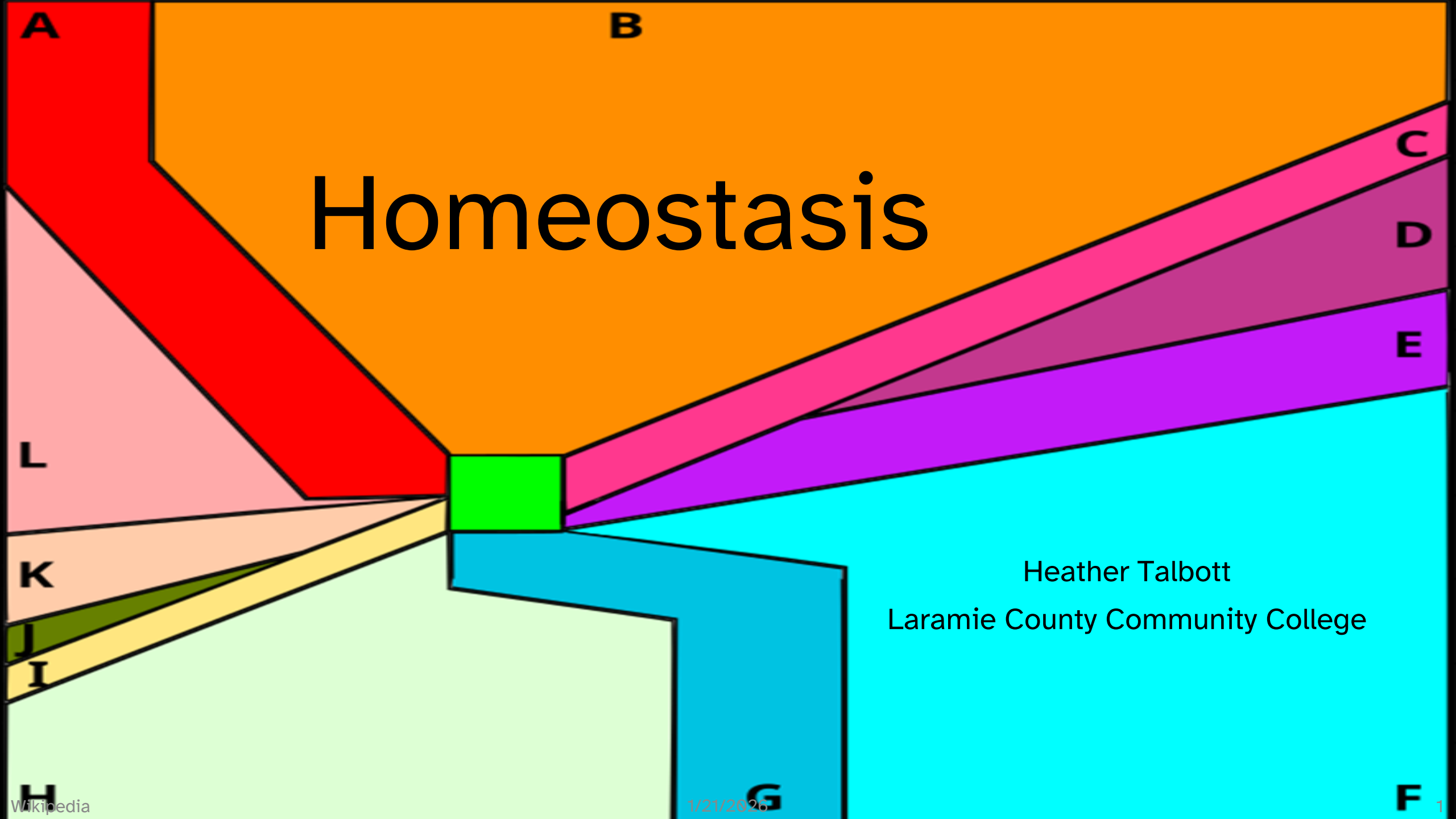


Homeostasis



Heather Talbott
Laramie County Community College

Ways of Knowing (WoK)

- **Aesthetics:** the study of sensory and emotional experience, including perceptions of beauty, art, and taste.
- **Ethics:** the study of moral values and obligations—what ought to be done, including concepts of right and wrong, good and bad.
- **Religion:** the exploration of meaning and purpose, including beliefs about ultimate reality and the supernatural, and why things exist.
- **Science:** a systematic study of the natural world through observation, experimentation, and measurable evidence.



Science is a Unique WoK

Science is unique because it is:

- **Testable:** ideas are examined through experiments or observations that produce data.
- **Falsifiable:** claims can be shown to be wrong if evidence contradicts them.
- **Repeatable:** results can be obtained again by others using the same methods.
- **Most objective:** conclusions are based on evidence rather than personal beliefs or opinions.



Key Features of Science

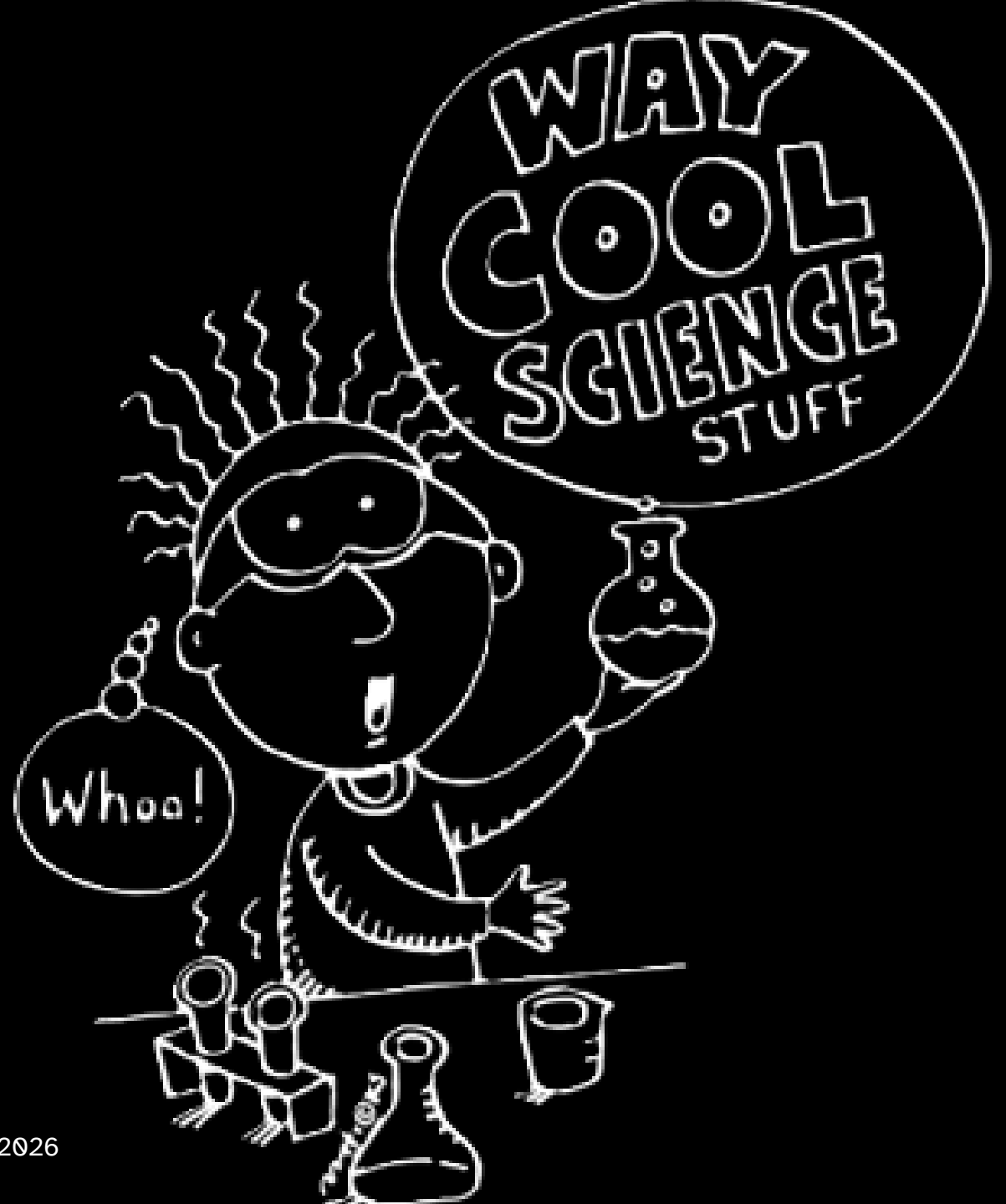
Key features of scientific method:

- **Empirical:** grounded in direct observation and measurement.
- **Predictive:** used to make testable predictions about natural phenomena.
- **Self-correcting:** ideas change as new evidence emerges.
- **Transparent:** methods and results are shared for review and critique.



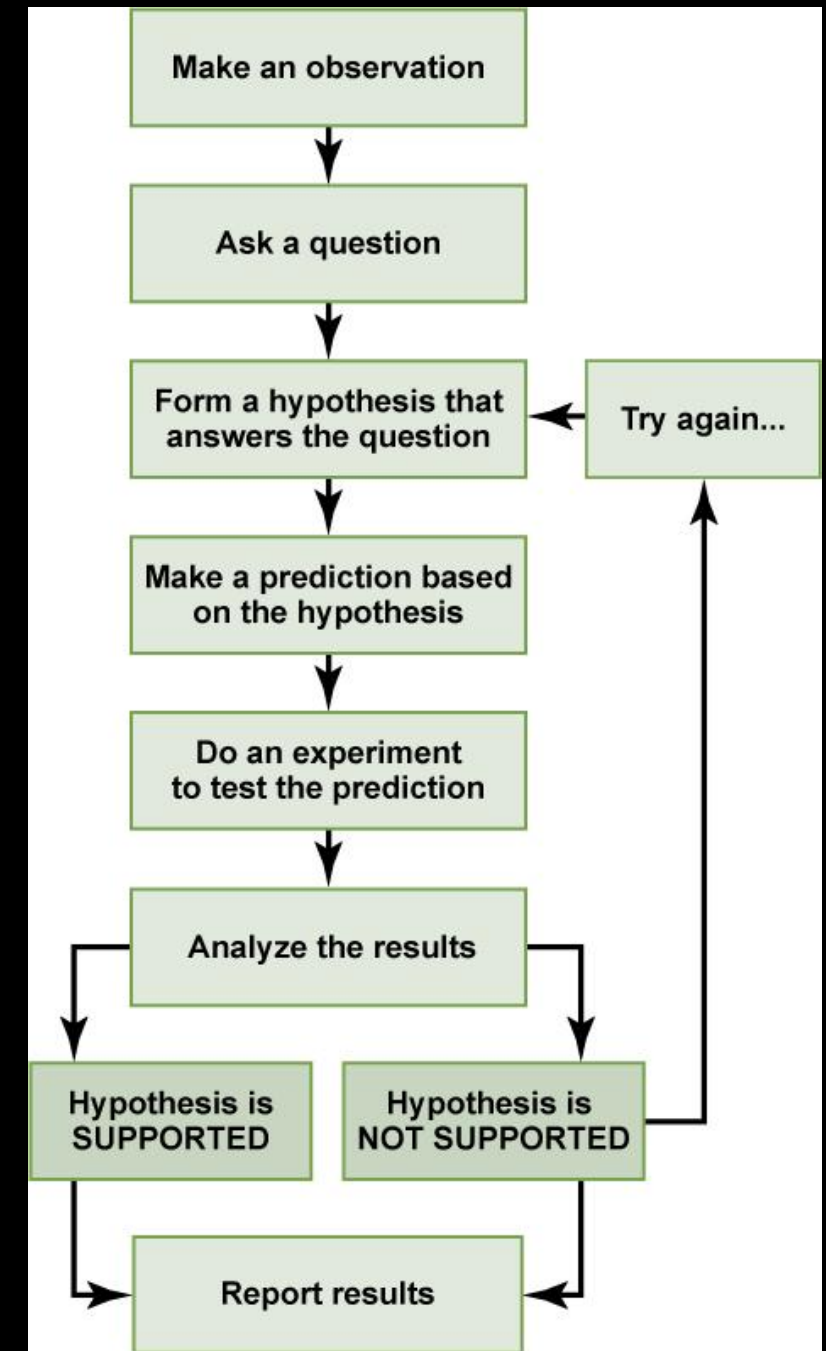
You & Science

You use the scientific method every day!



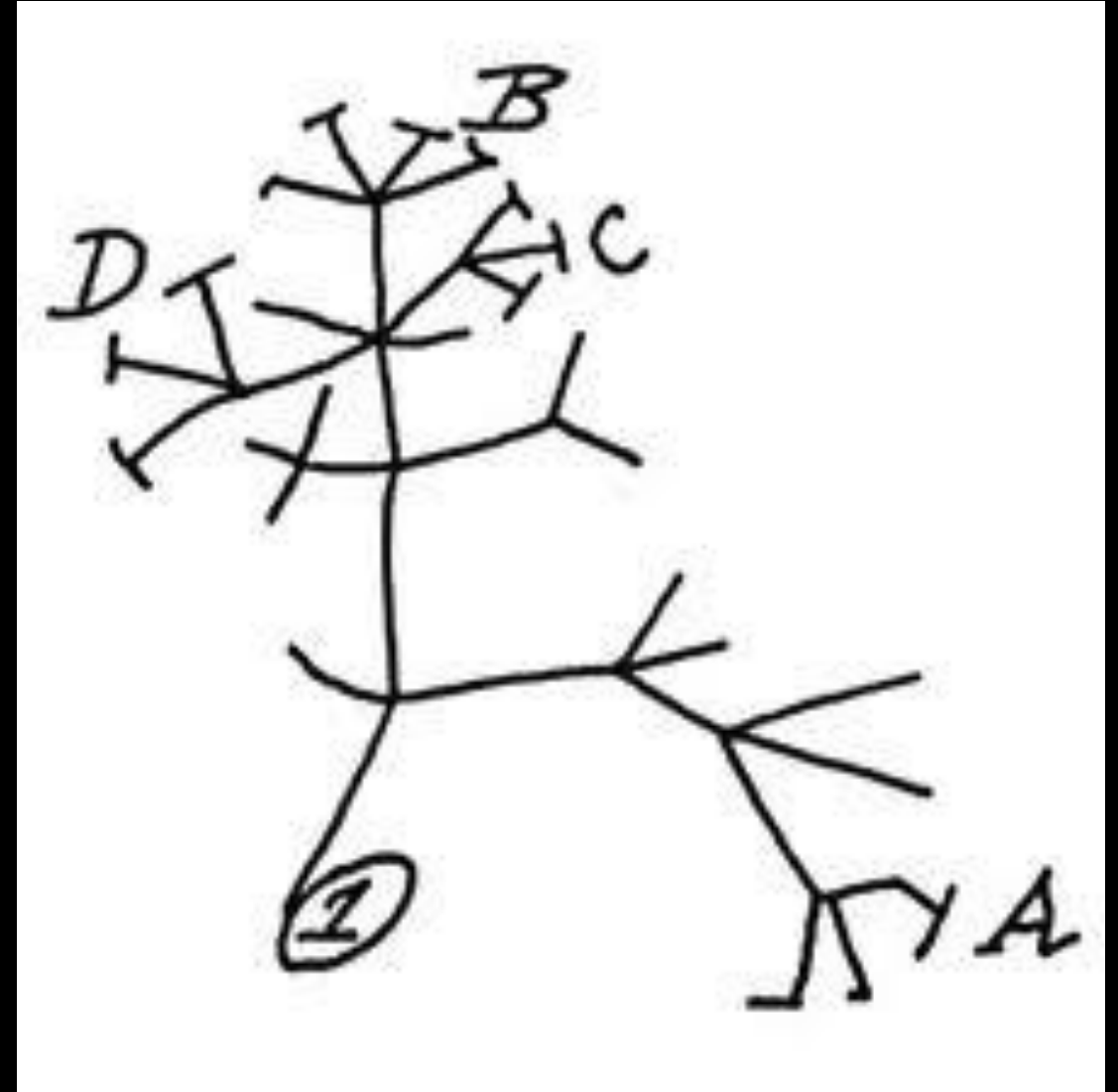
Scientific Method

- **Scientific method:** a series of well-defined steps to help determine if an explanation for a phenomenon is supported
- If a hypothesis is not supported by experimental data, a new hypothesis can be proposed.



Science Terms

- **Scientific hypothesis:** a proposed explanation of an observable phenomenon
 - A hypothesis can be supported or refuted through experimentation
 - A hypothesis can be falsified, but not proven to be true; “best answer yet”
- **Scientific theory:** an idea/explanation that has been tested extensively, and still has not produced evidence to reject it
- **Scientific law:** generalizes a body of observations
 - Scientific laws describe things, but they do not explain them



Properties of Life

- **Life:** a self-sustaining chemical system capable of Darwinian evolution (NASA, 2026)
 - Based on chemistry
 - Store and pass on information
 - Use energy from their environment to stay organized and functioning
 - The main elements found in living things are: carbon, hydrogen, oxygen, nitrogen
 - Water is essential
 - Life changes over time

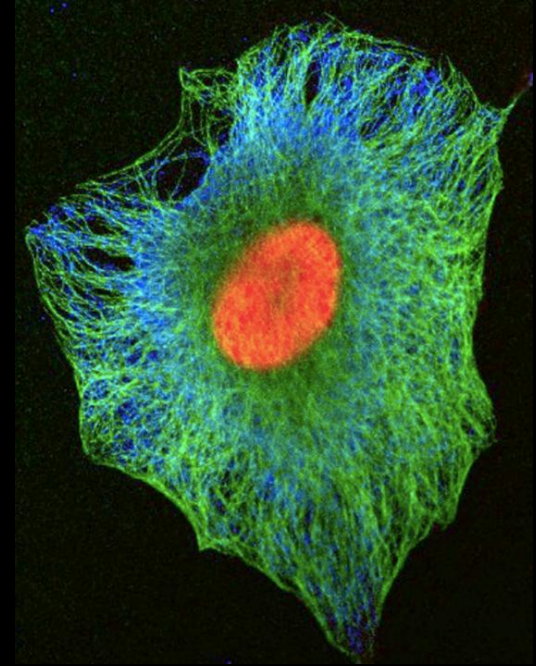
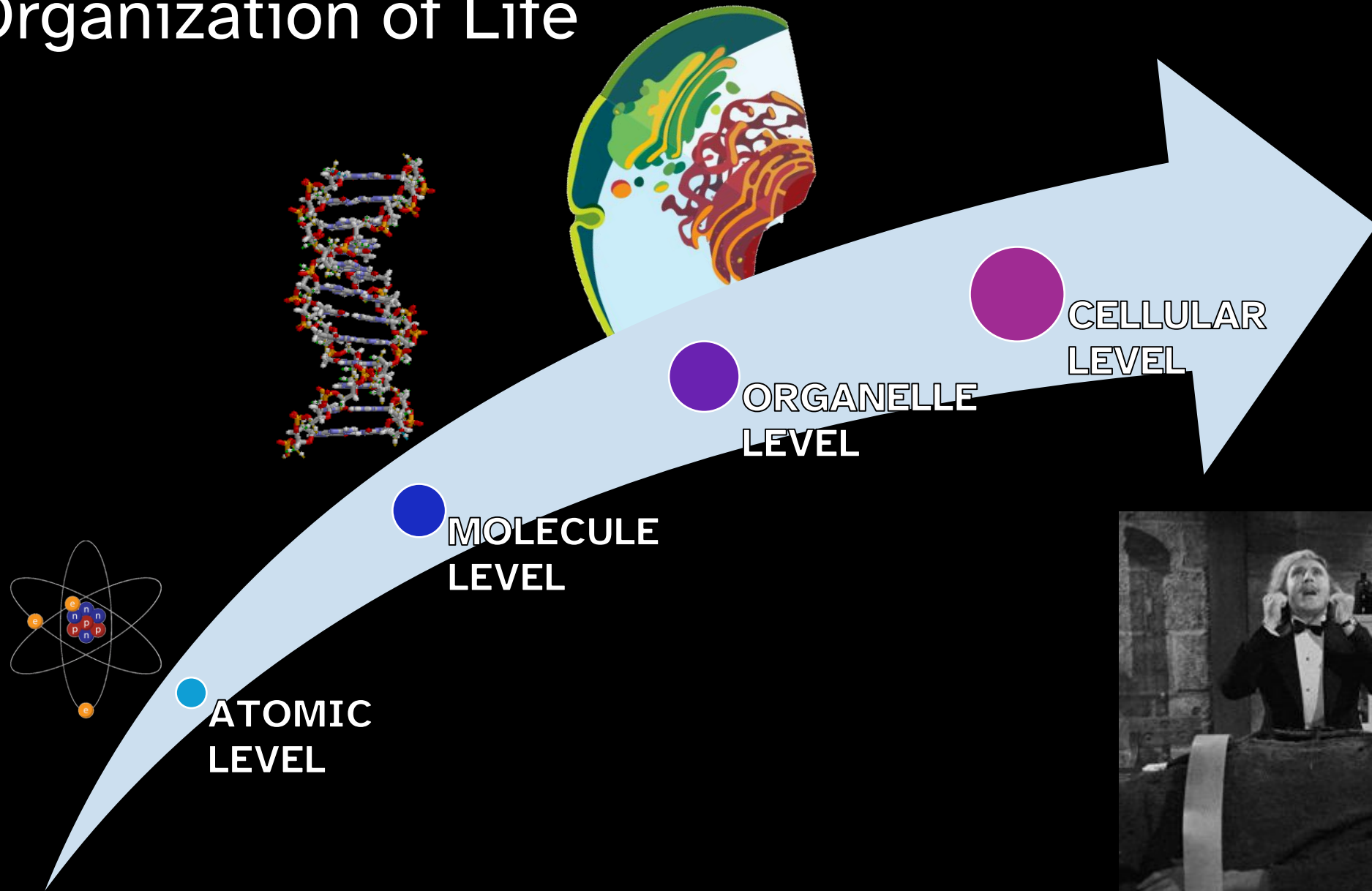


Death and Dying

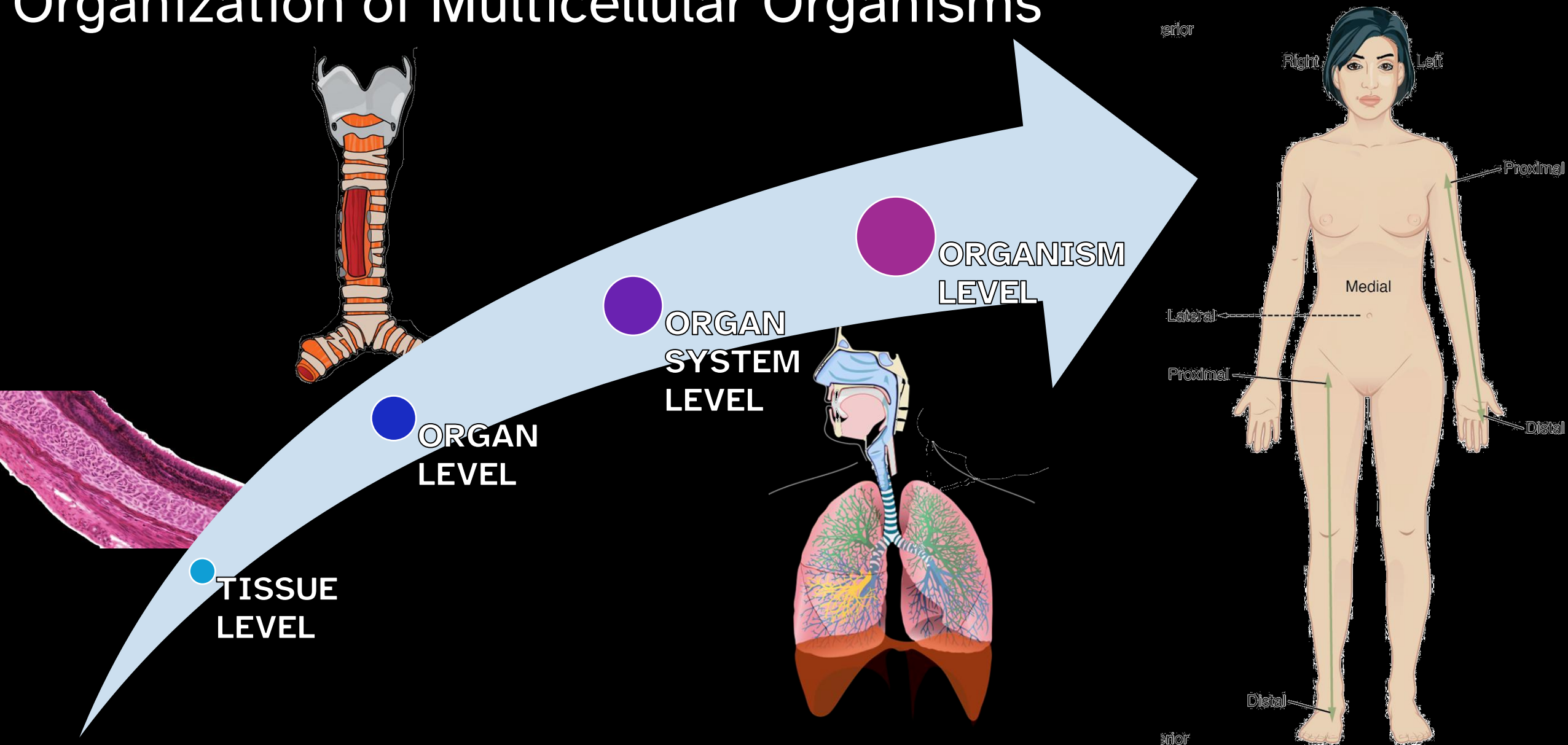
- **Death:** irreversible loss of essential bodily functions one or more of the following:
 - Irreversible cessation of circulatory and respiratory functions
 - Irreversible cessation of all functions of the entire brain, including the brain stem, is dead
- **Dying:** biological process leading to death
 - More sleep, less activity
 - Decreased appetite & thirst
 - Loss of bowel & bladder control
 - Breakdown of muscles & skin
 - Withdrawal & detachment
 - Declining/Irregular vital signs
 - Unconsciousness



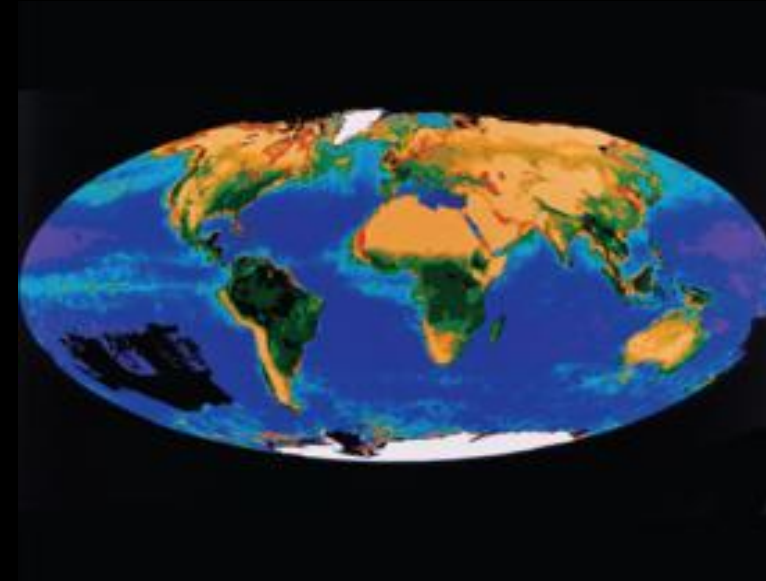
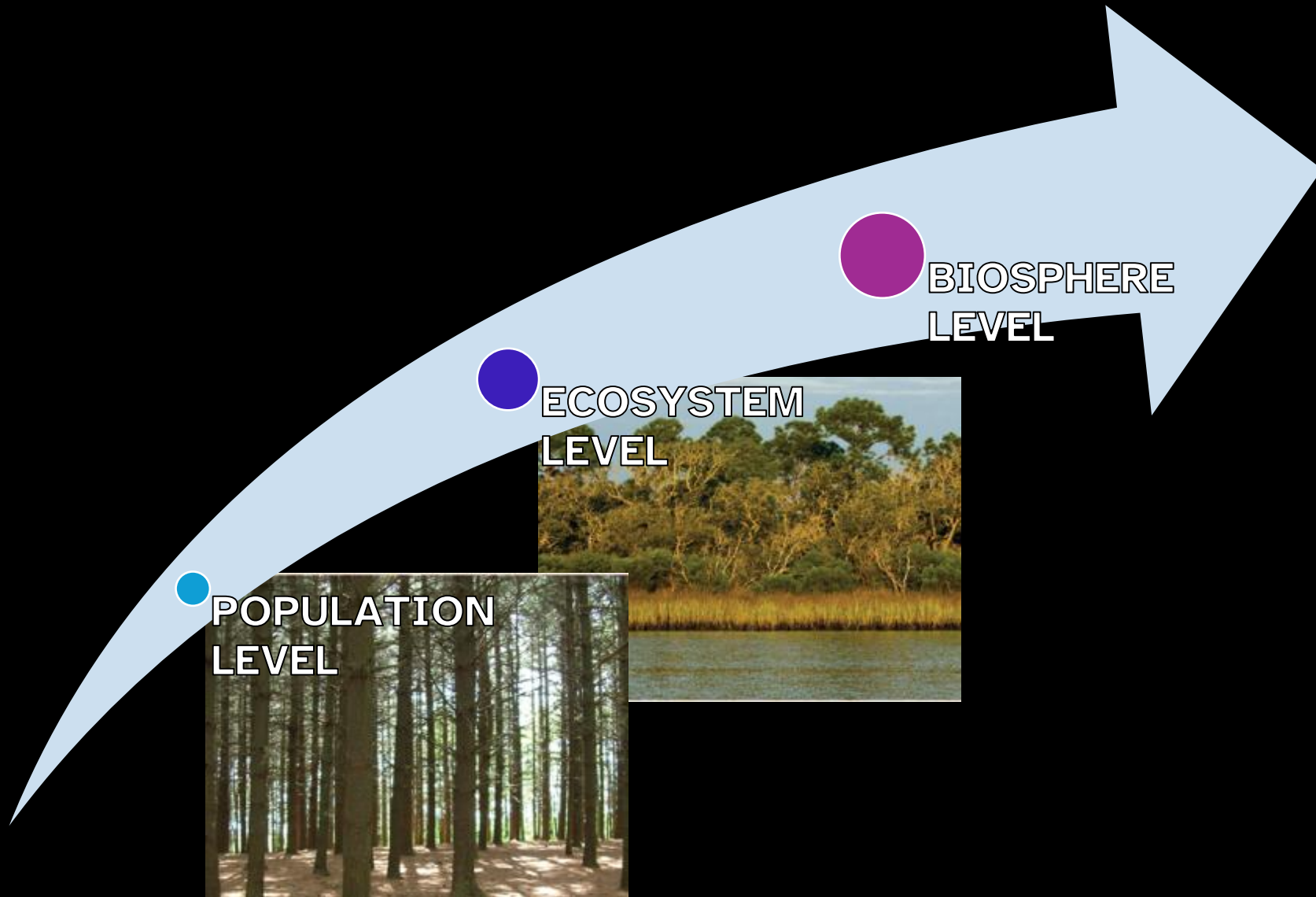
Organization of Life



Organization of Multicellular Organisms



Ecological Organization



Oxygen is Required

- **Oxygen:** air is about 20% O₂, key to chemical reactions
 - Essential for ATP production
 - Neurons are especially sensitive to lack of oxygen
 - Brain damage can occur within 5 minutes w/o O₂
 - Death is likely within 10 minutes w/o O₂



Nutrients are Required

- **Nutrient**: an ingested substance essential to human survival.
 - **Water**
 - 70% of adult mass
 - Survive a few days w/o H₂O
 - **Food**: energy-yielding and body-building nutrients
 - Survive several weeks w/o food
 - **Carbohydrates**: sugars, primarily energy-yielding
 - **Lipids**: fats, primarily energy-yielding
 - **Proteins**: primarily body-building
 - **Nucleic acids**: primarily body-building
 - **Micronutrients** (vitamins and minerals)
 - Survival depends on micronutrient but often can survive w/o for several weeks



Temperature Requirements

- **Temperature range:** the chemical reactions upon which the body depends can only take place within a narrow range of body temperature
- **Core body temperature:** 37°C (98.6°F) \pm a degree
 - External temperature: general range of 20 - 31°C (68°F to 88°F)
- Acute (short-term) ability to manage hotter and colder temperatures
- **Controlled hypothermia:** clinically induced hypothermia performed in order to reduce the metabolic rate of an organ or of a person's entire body.

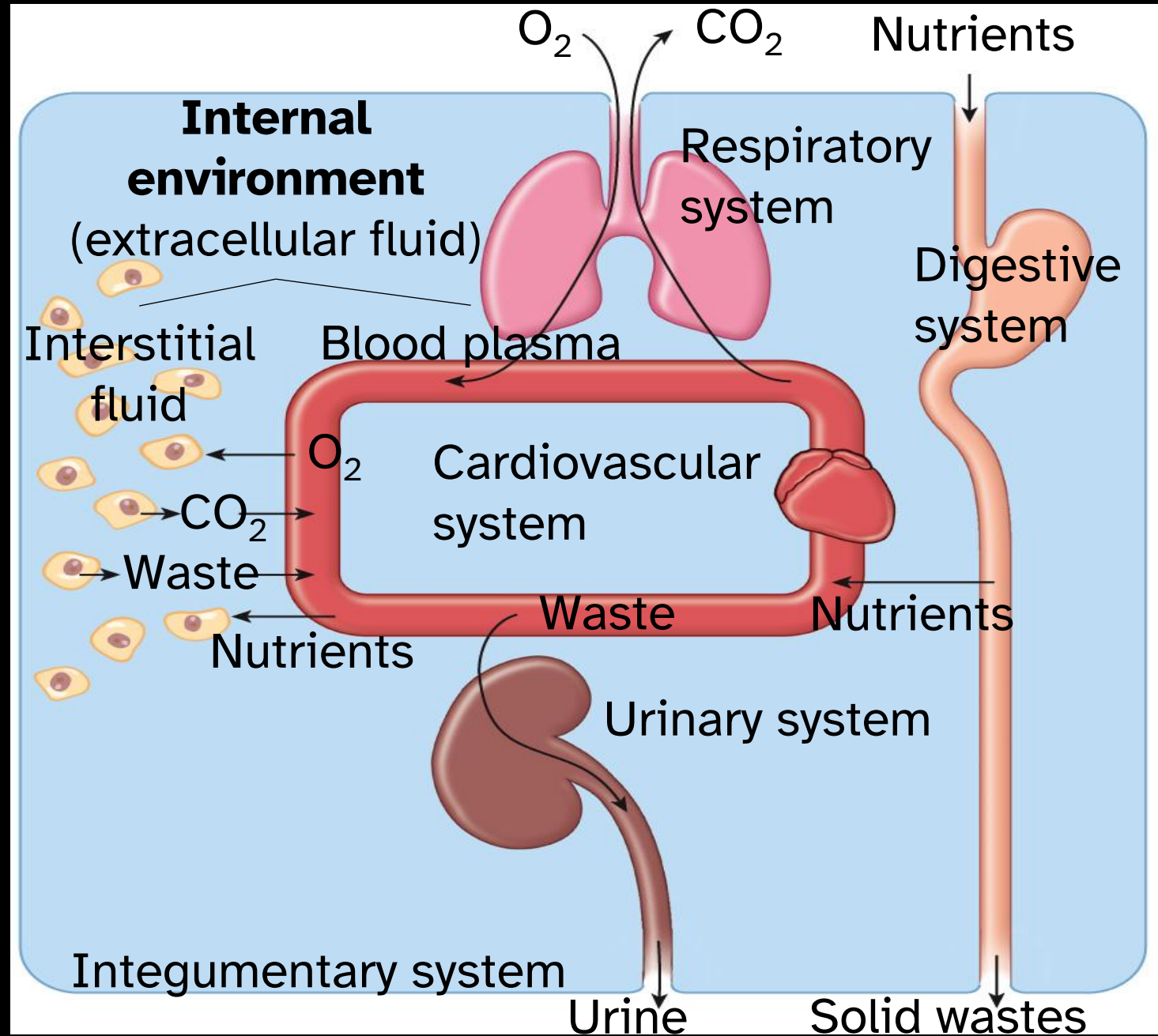


Pressure Requirements

- **Atmospheric Pressure:** pressure exerted by the mixture of gases (primarily nitrogen and oxygen) in the Earth's atmosphere
 - This keeps gases within your body dissolved.
- **Altitude sickness:** the atmosphere at high altitudes exerts less pressure, causing less gas to be dissolved in your blood, causing shortness of breath, confusion, headache, lethargy, and nausea.
- **Decompression Sickness:** a condition in which gases dissolved in the blood or in other body tissues are no longer dissolved, expanding, and creating gas bubbles.
 - Sometimes called “the bends,” as a reference to the joint pain



Physiology Overview



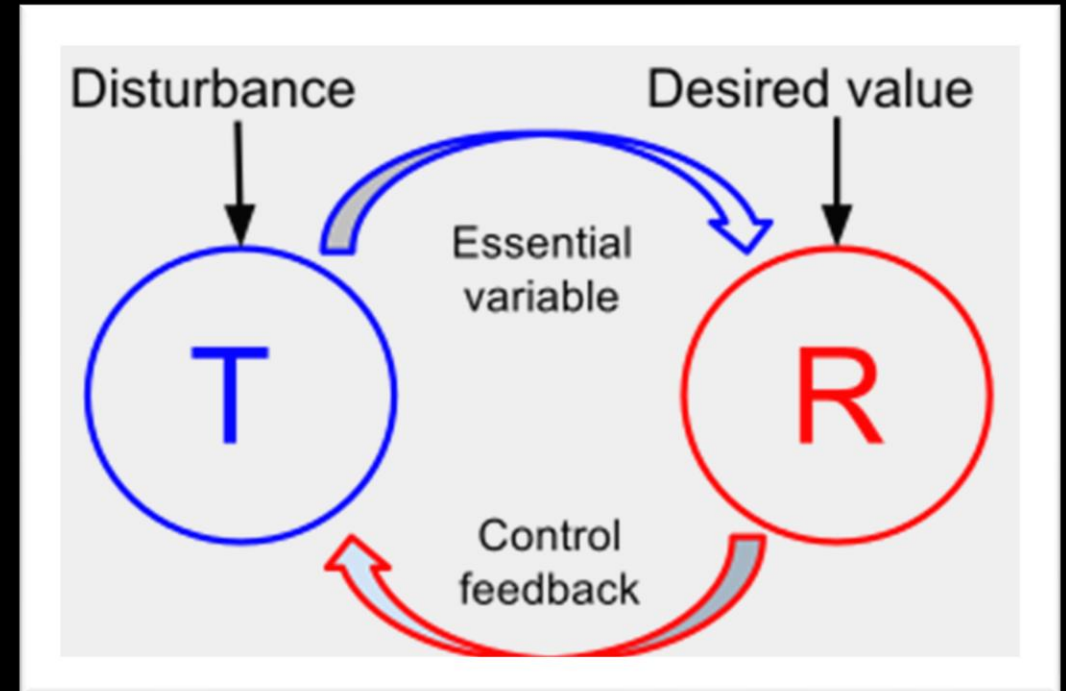
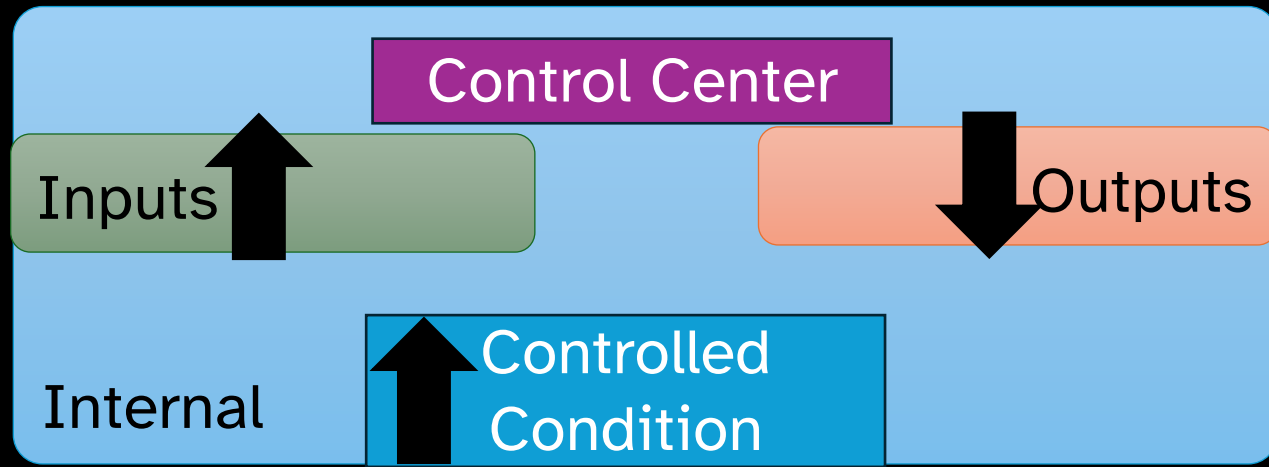
Homeostasis

- **Homeostasis**: the condition of equilibrium (balance) in the body's internal environment due to constant interaction of the body's regulatory processes
- The survival of the body is dependent on the precise regulation of the chemical composition at the cellular and tissue levels
- **Set point**: the physiological value around which the normal range fluctuates
- **Normal range**: the restricted set of values that is optimally healthful and stable



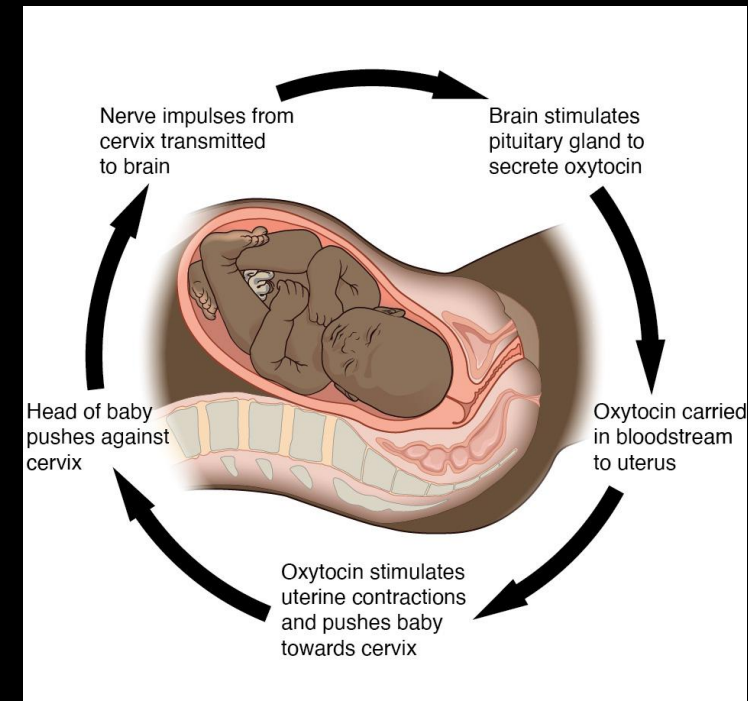
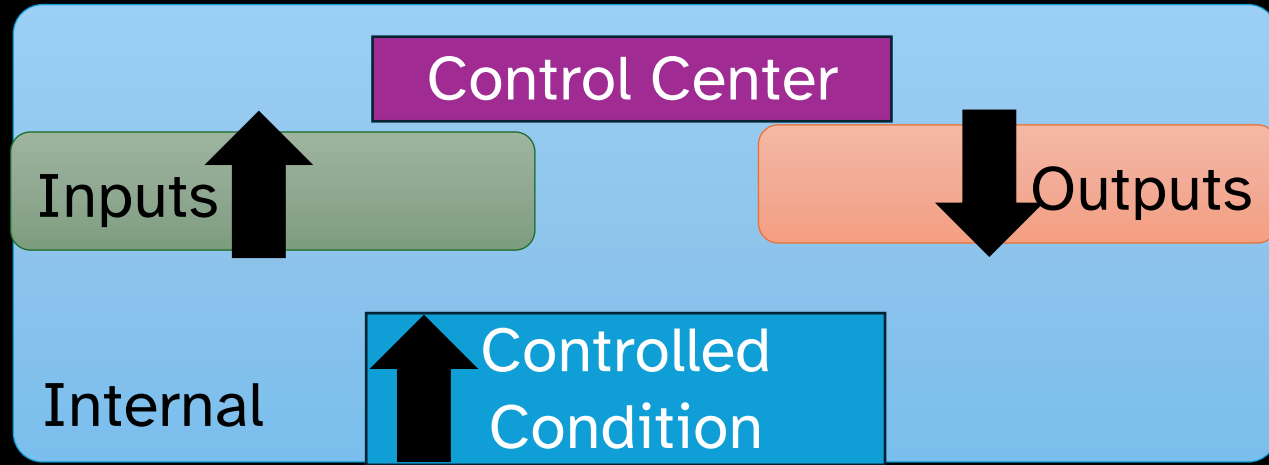
Feedback Systems/Loops 1

- **Feedback system:** the end product/result of a pathway regulates the progress (often initiation) of the pathway
- **Negative feedback:** a mechanism that maintains body parameters within their normal range by reversing deviations from the set point
- **Negative feedback:** the end product turns down/inhibits/downregulates the pathway
- Most physiological pathways use negative feedback



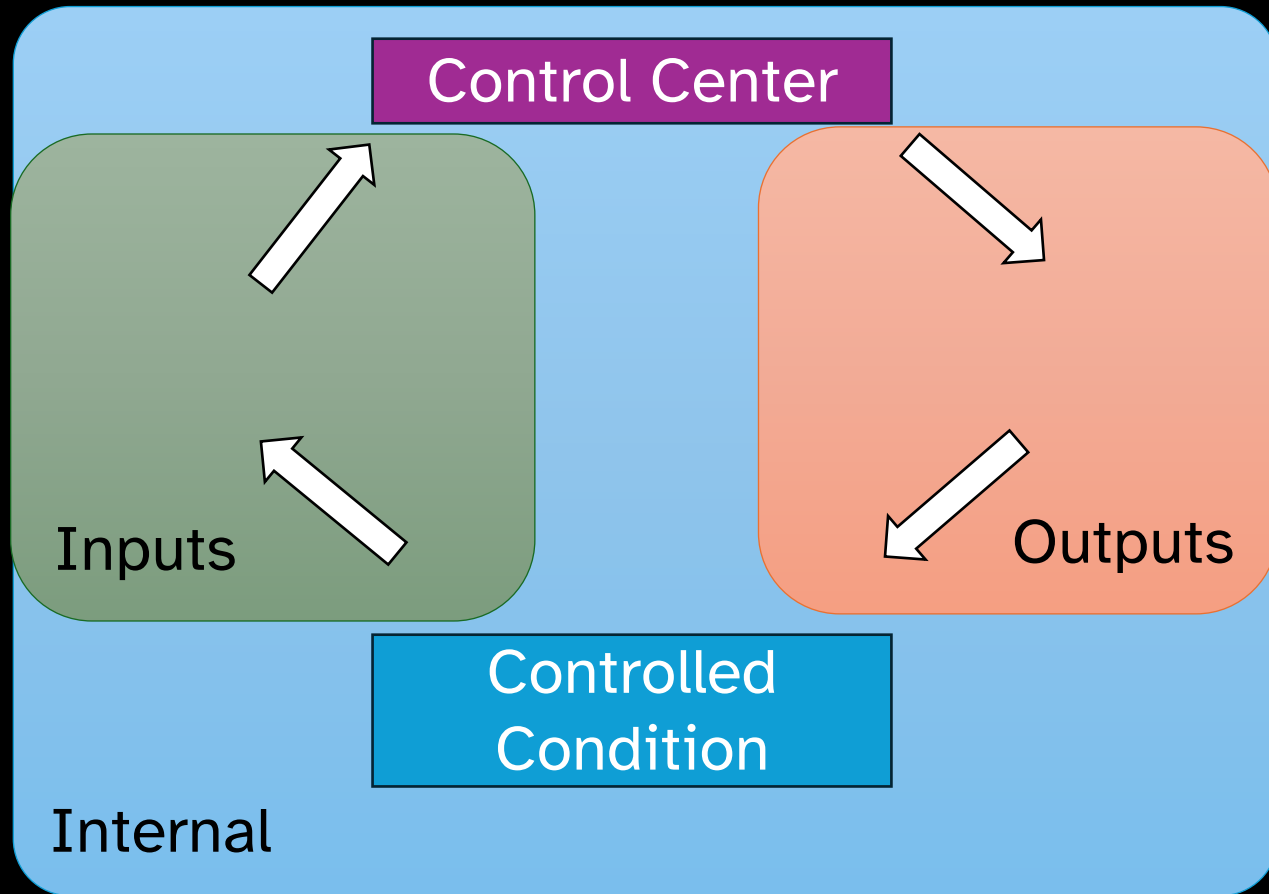
Feedback Systems/Loops 2

- **Feedback system:** the end product/result of a pathway regulates the progress (often initiation) of the pathway
- **Positive feedback:** intensifies a change in the body's physiological condition rather than reversing it.
- **Positive feedback:** the end product turns up/stimulates/upregulates the pathway
 - Only a few physiological examples
 - Can only be “reset” when there is a dramatic ending event



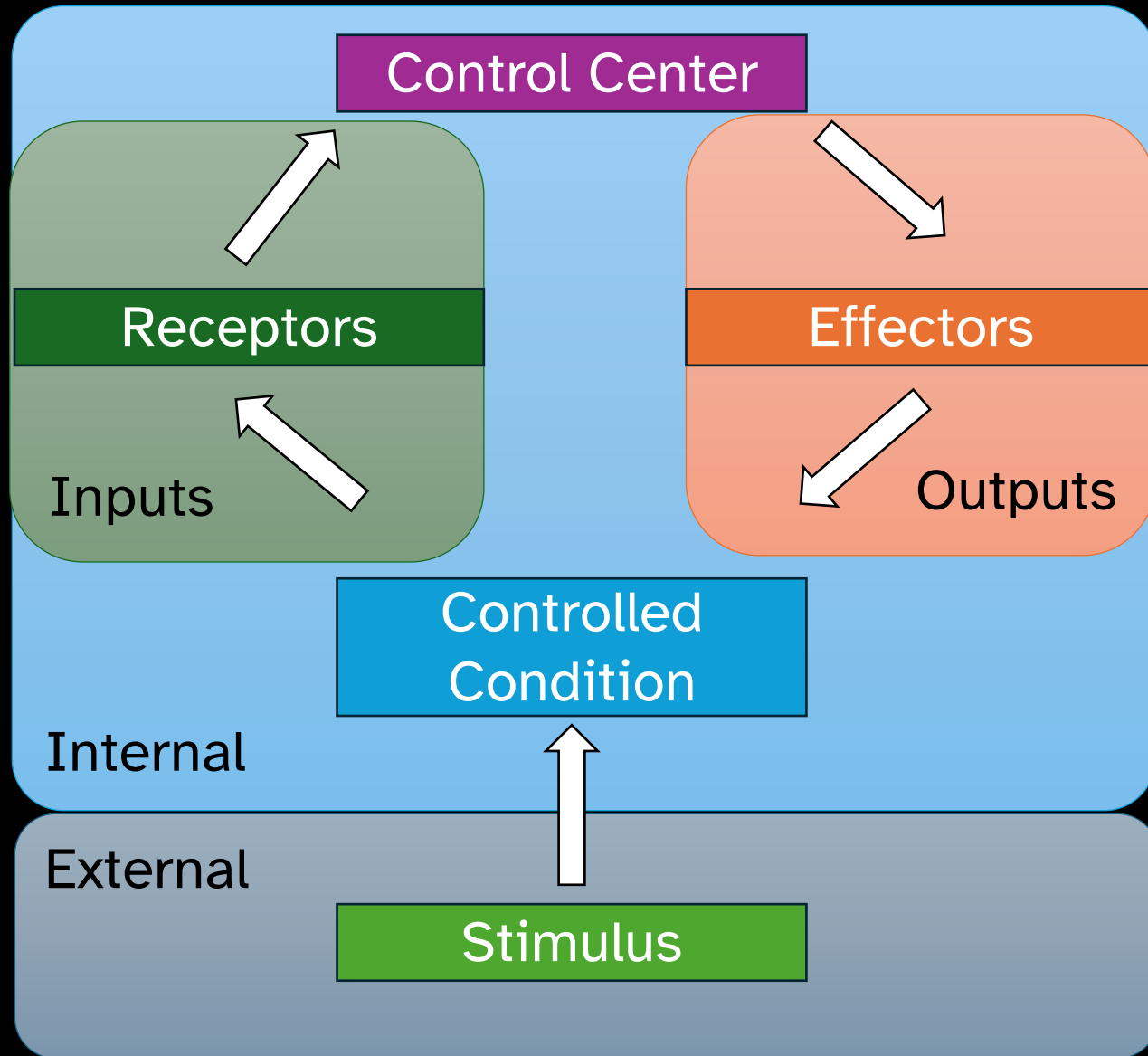
Parts of a Feedback System 1

- **Controlled condition:** a body condition that changes
- **Control center:** sets a range of values within which a controlled condition should be maintained by monitoring inputs and outputs



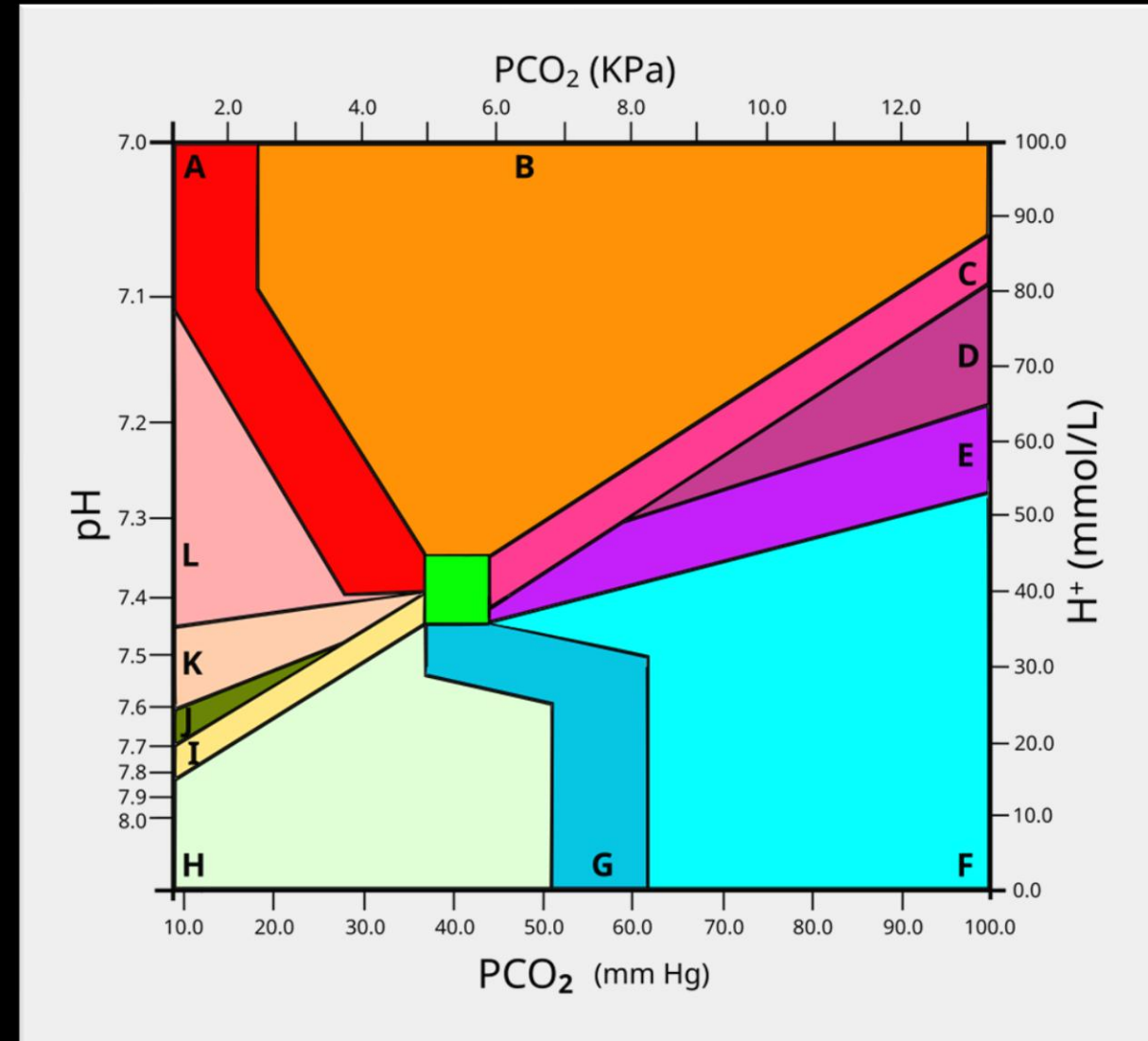
Parts of a Feedback System 2

- **Sensor/Receptor:** a body structure that monitors changes in a controlled condition and sends input to the control center
- **Effector:** a body structure that receives output from the control center and produces a response or effect that changes the control condition
- **Stimulus:** some external situation that disrupts the body's homeostasis



Homeostasis Example

- **pH:** acidity of blood
- **PCO₂ (mm Hg):** pressure of CO₂ (carbon dioxide) in blood
- **Green Box:** shows normal range of pH and PCO₂
- Other colors specific atypical conditions are described by the relationship of pH and PCO₂



References

- Breton, Ashley (2025)
- Dingess, Paige (2025)
- Grammarly. (2026). Grammarly (Version 14.1268.0) [Software]. <https://www.grammarly.com/>
- OpenAI. (2026). ChatGPT (GPT-5) [Large language model]. <https://chat.openai.com/>

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