CELL DIFFERENTIATION

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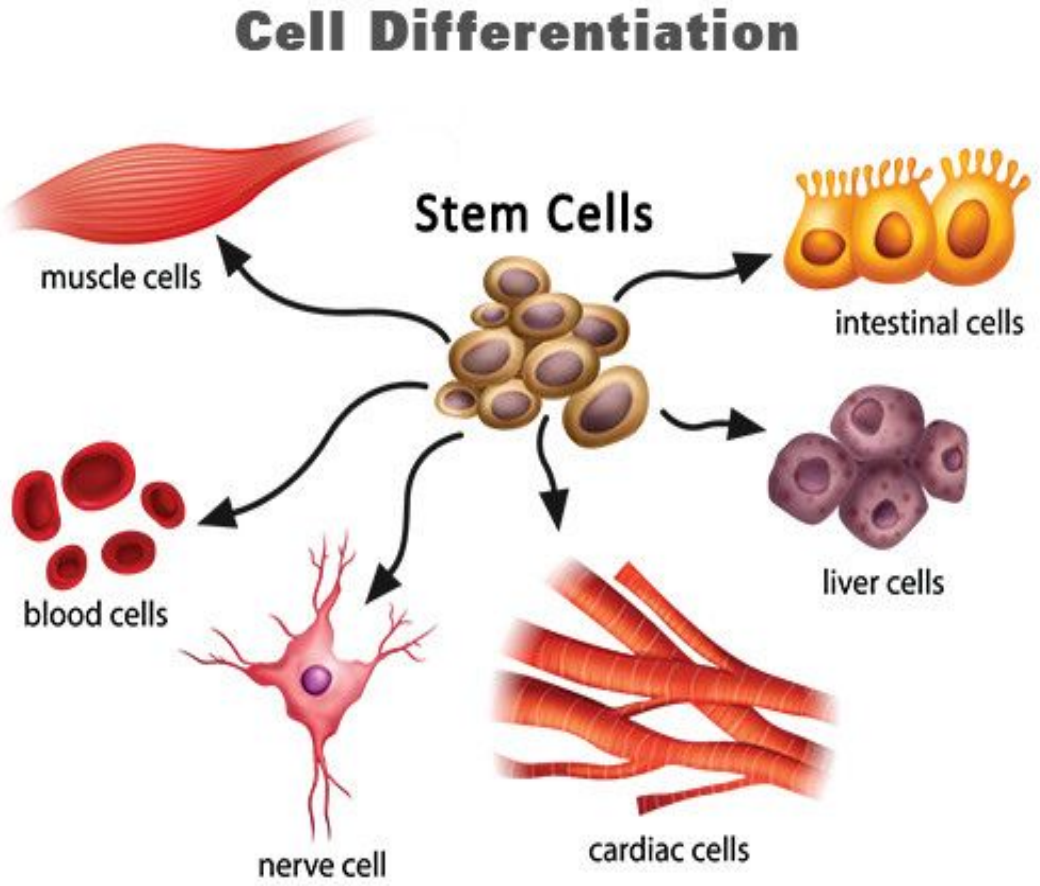
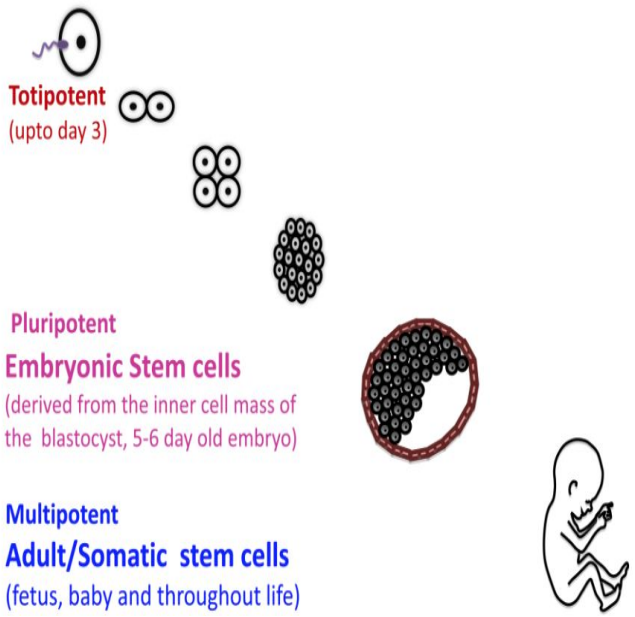
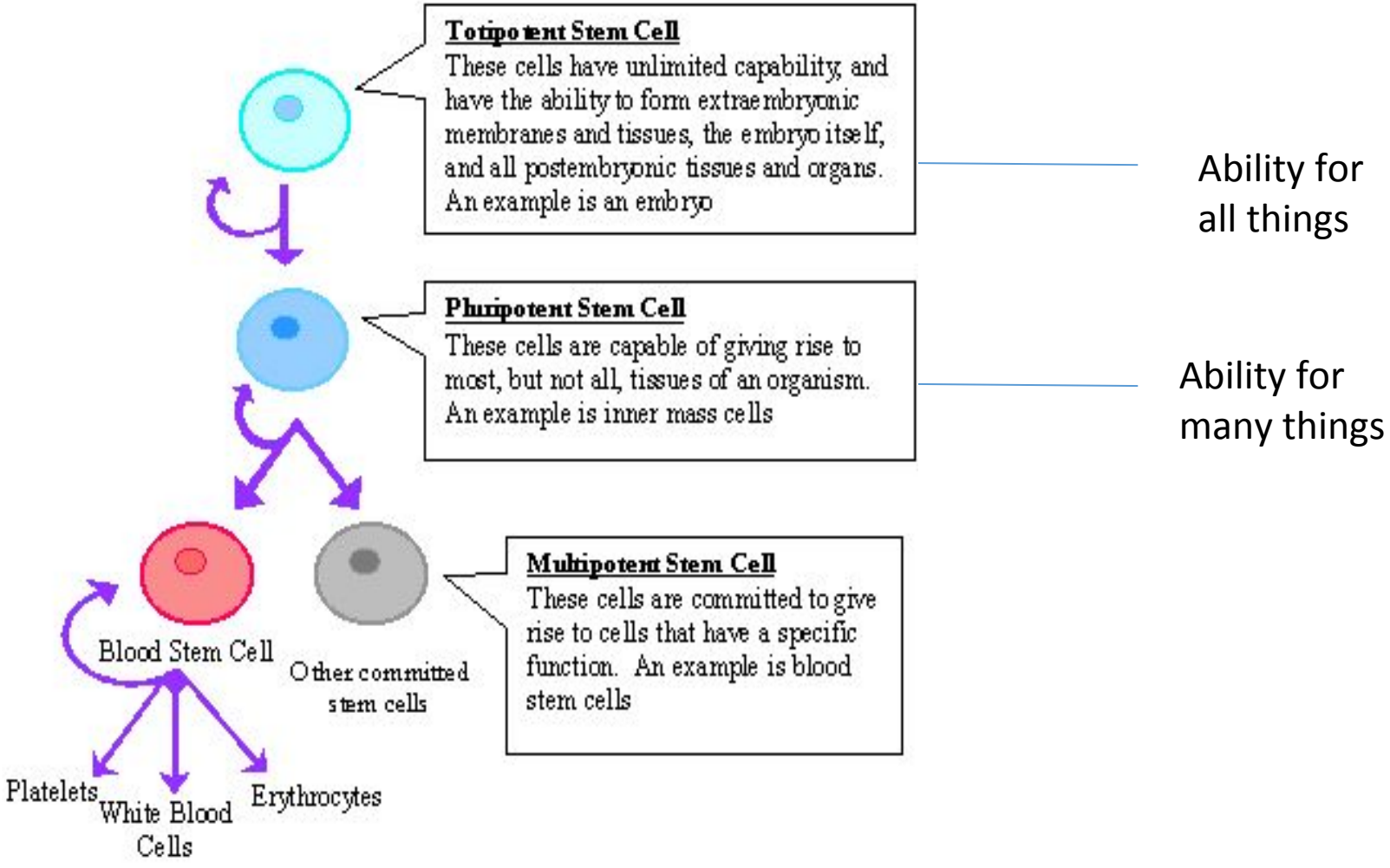
It is a biological process whereby unspecialised cell develops in to a specialized cell



Cell potency to differentiation : Totipotent, Pluripotent and multipotent cell

- The fertilised egg or zygote has the ability to give rise to every type of cell in the adult body and hence referred as totipotent
- Later in the development of animals the cellular descendants of the zygote lose their totipotency and become determinate into specific types of cells.



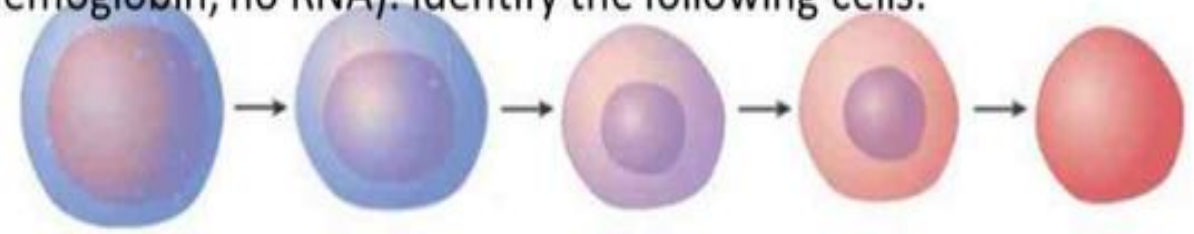


Status of genome during cell differentiation

Two types :

Changes in genome during cell differentiation:

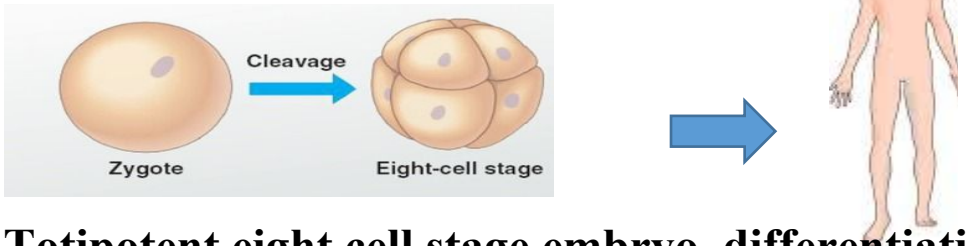
The overall trend in RBC maturation is large, pale nucleus to darker, smaller nucleus to loss of nucleus; increase in cytoplasm; gradual decrease in size; cytoplasm from intensely blue (full of RNA) to grayish (mixture of RNA and hemoglobin) to reddish (full of hemoglobin, no RNA). Identify the following cells.



RBC Cell differentiation

Genomic equivalence during cell differentiation:

No information is lost from the nucleus of cells as they pass through the early stage of embryonic development.
Ex: the eight cell stage embryo regarded as totipotent has the capacity of each cell to give whole organism

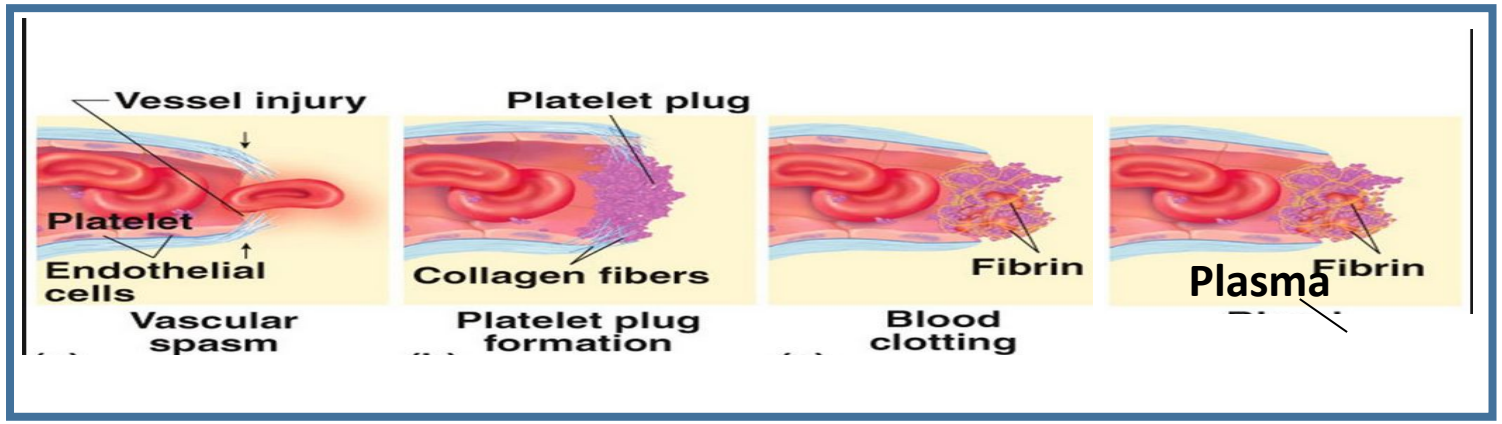


Totipotent eight cell stage embryo differentiation

HOMEOSTASIS

Greek word homoios (same) stasis (to stand)

- Homeostasis is the tendency of organisms to auto-regulate and maintain their internal environment in a stable state.
- For example, during blood clotting, a cascade of homeostasis events occurs leading to prevents blood loss



Primary Homeostasis **Secondary Homeostasis** **Tertiary Homeostasis**

Why do we need homeostasis

- Cell depend on the body environment to live and function.
- Homeostasis keeps the body environment under control and keeps the conditions right for the cells to live and function.
- Without the right conditions certain processes like osmosis and enzymes will not function properly

Disrupted Homeostasis resulted various diseases due to

1) Deficiency (cell not getting all they need)
2) Toxicity (cells being poisoned by things they do not need)

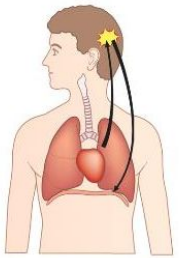
Temperature Regulation By Fever

Homeostasis

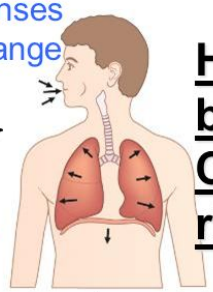
- Ability to maintain stable internal state

Example: Body Temperature

Example:

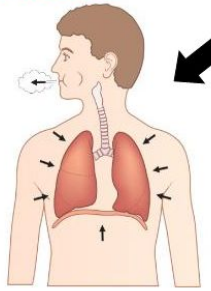


Receptor Senses change



Holding breath, CO_2 levels rise

Nervous
Respiratory
Muscular



Control system gets information

Control system forces exhale, inhale

Effector Responses

O_2 / CO_2 level returns to normal

Regulating Body Temperature - on a Cold Day

Marshall Cavendish

Shivering occurs when insufficient heat is produced

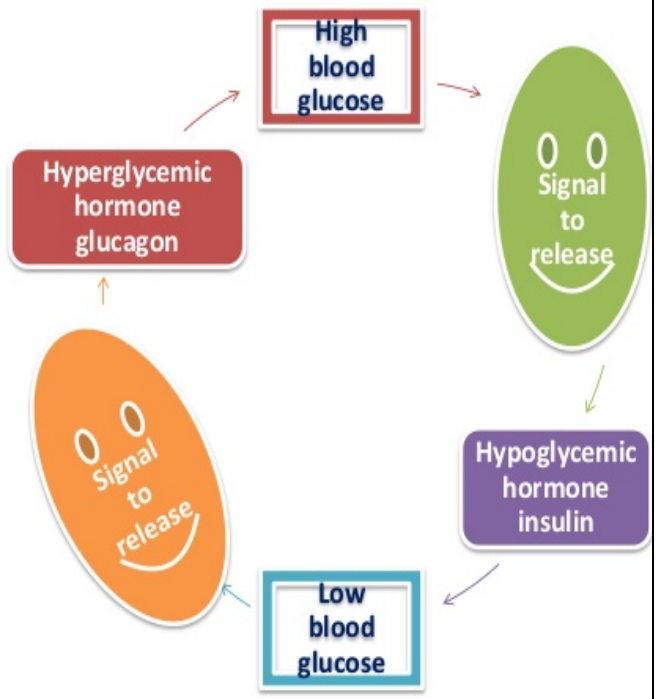
Stimulus
Blood and skin temperatures fall

Receptor
Temperature receptors detect changes and send nerve impulses to the brain

Corrective Mechanism
Decrease in heat loss and increase in heat production

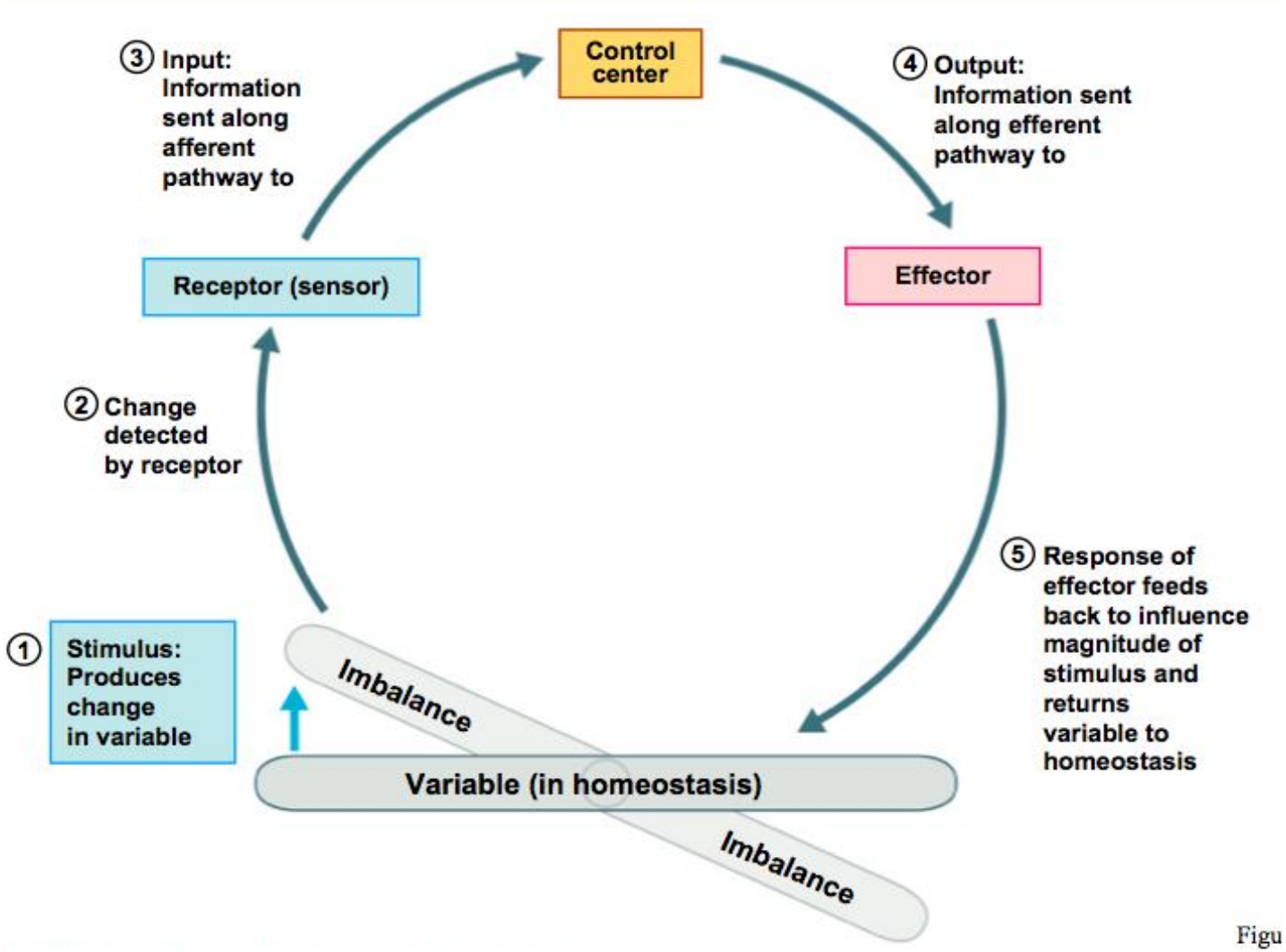
Hypothalamus of brain is
stimulated and sends nerve impulses to relevant body parts

The pancreas detects the change in blood glucose concentration and releases the appropriate hormone



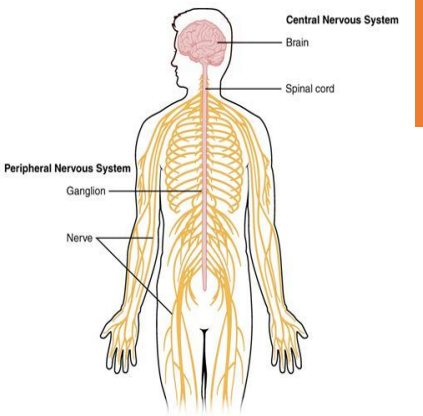
Homeostasis regulation

It is the body's attempt to maintain a constant internal environment. Maintaining a stable internal environment requires constant monitoring and adjustments as conditions change. This adjusting of physiological systems within the body is called **homeostatic regulation. This involves 3 parts or mechanisms**



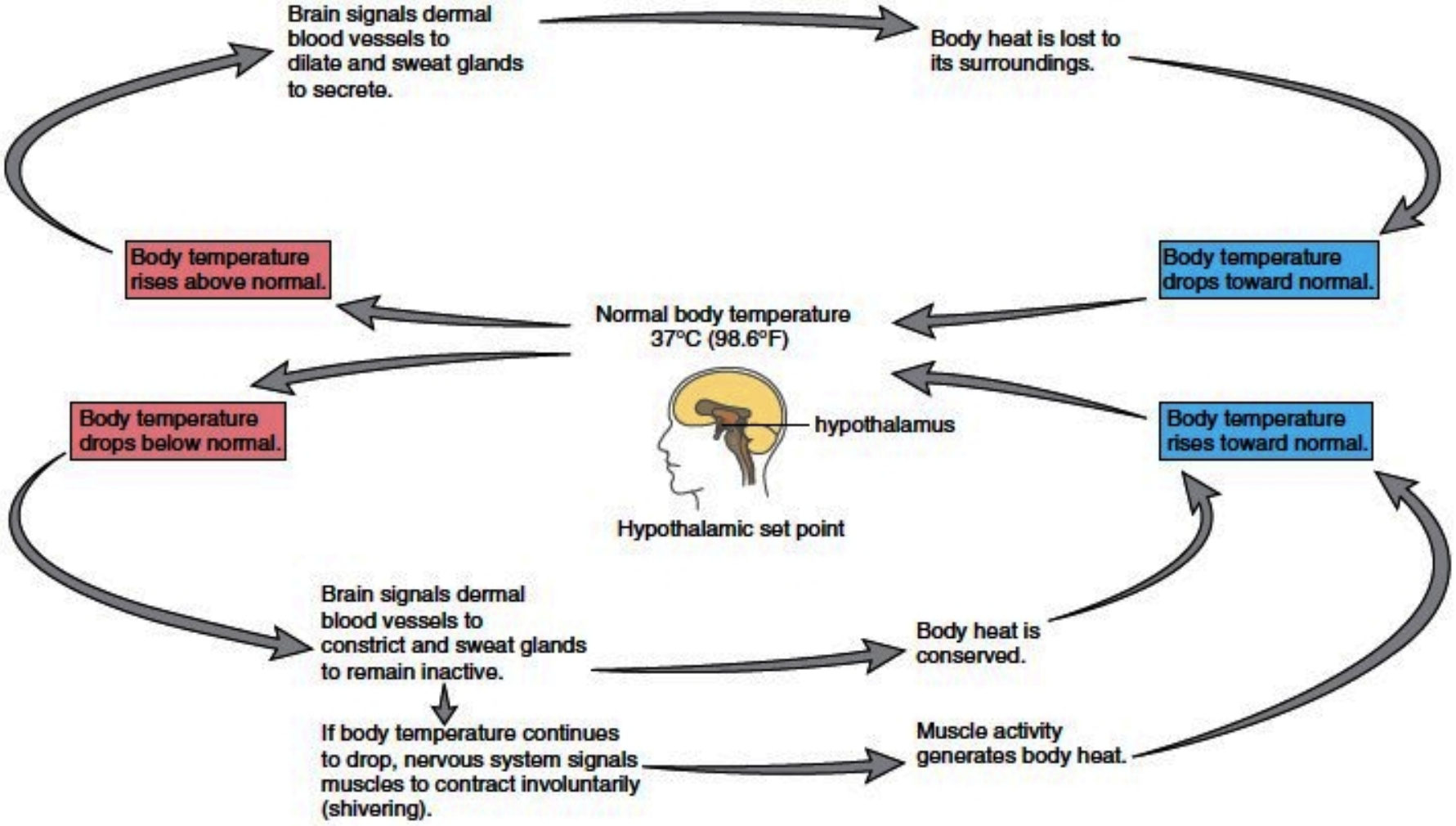
Figu

Types of homeostasis



1.Extrinsic homeostatic System:

- **Extrinsic regulation** is when the activities of an outside system (mostly nervous or hormone) regulate homeostasis



2. Intrinsic homeostatic System:

Local controls usually involve only one organ or tissue. When muscles use more O_2, and also produce more CO_2, intrinsic controls cause dilation of the blood vessels allowing more blood into those active areas of the muscles. Eventually the vessels will return to "normal".

Questions

1. Explain the term differentiation?
2. Define the terms totipotency, pluripotency and multipotency?
3. Elaborate the term homeostasis with an example? What are the consequences of an imbalanced homeostatic state in the body?
4. What are the different ways in which homeostasis is regulated in the body? Give example