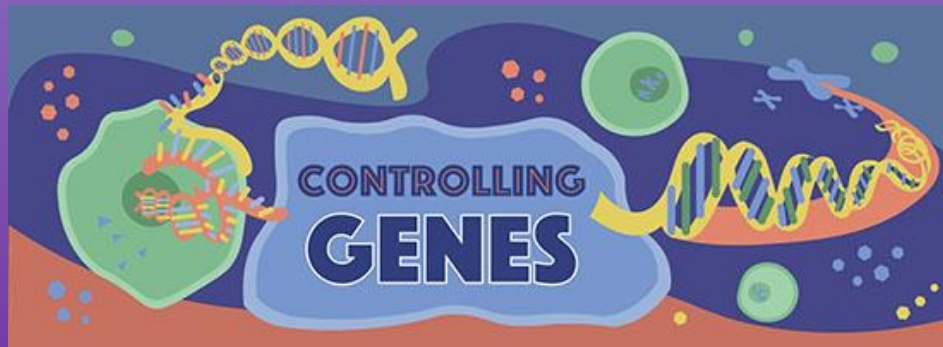
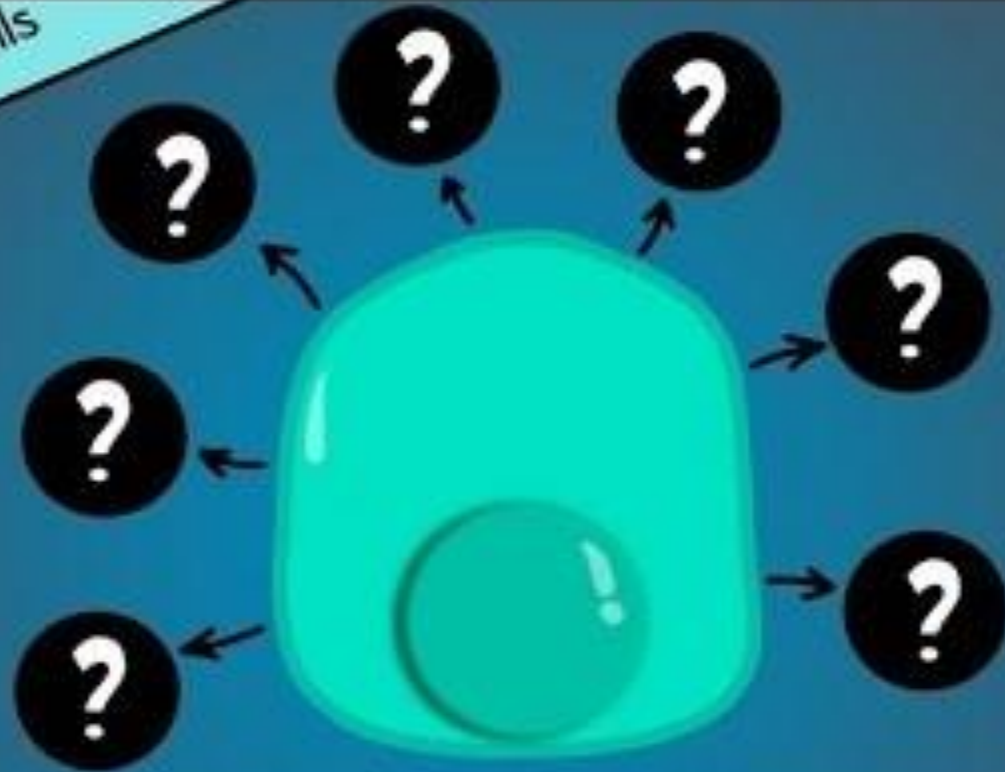


# Cell Differentiation & Gene Regulation



What is cell differentiation?

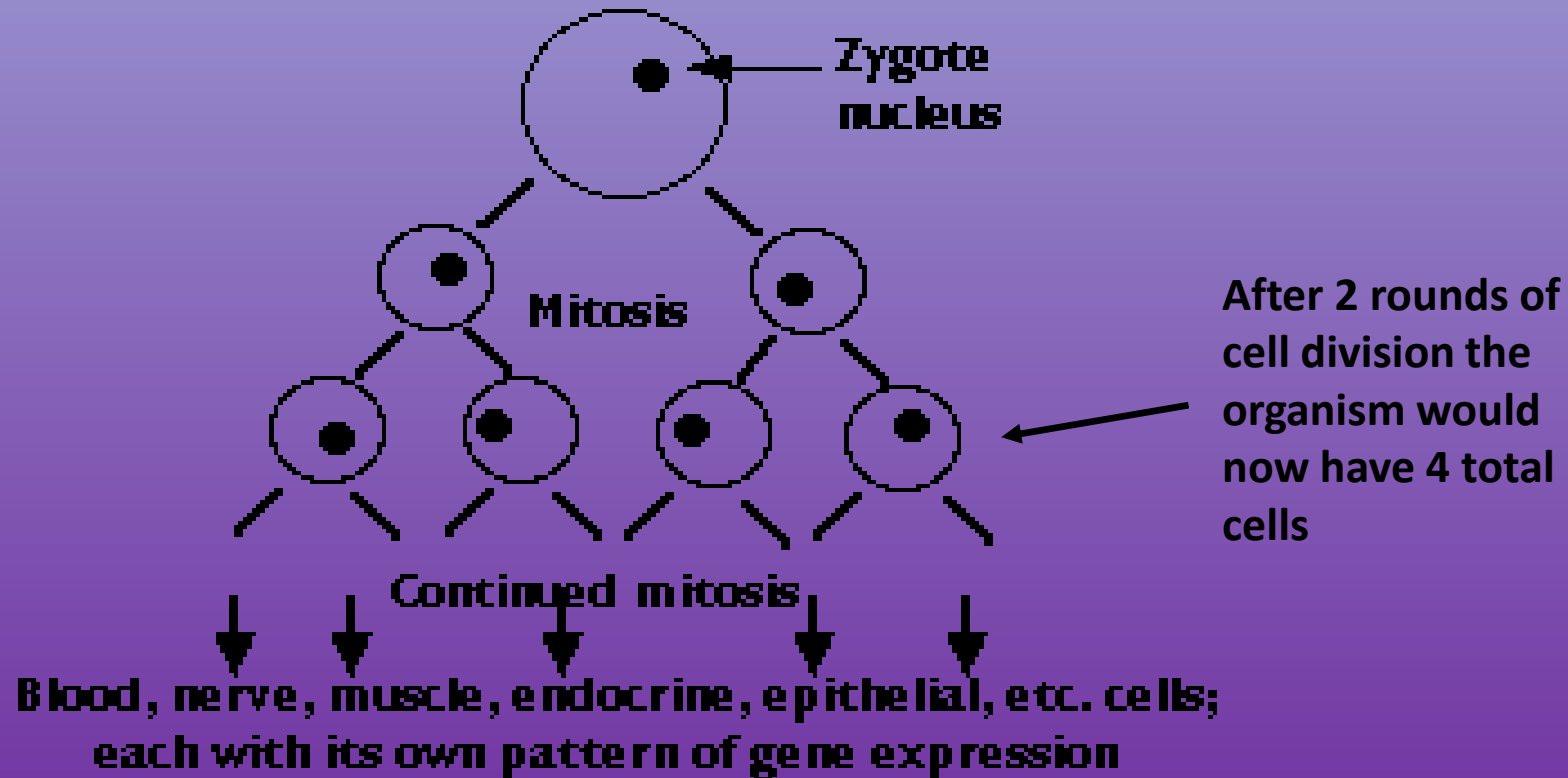
Featuring Stem Cells



**How Cells Become Specialized**  
with the Amoeba Sisters

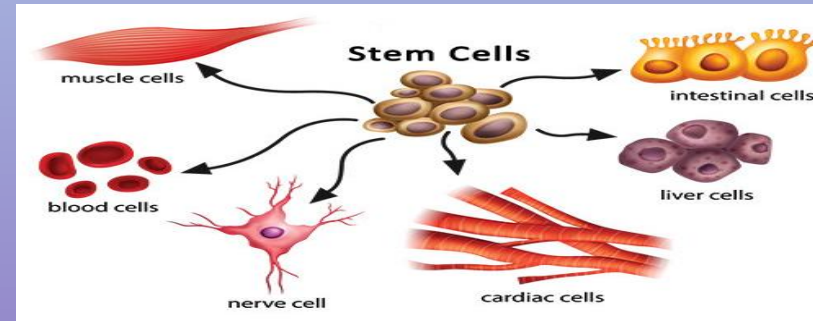
# Cell Differentiation

- After fertilization the zygote begins to undergo Mitosis to grow.
- As the embryo grows cells begin to specialize



# Cell Differentiation

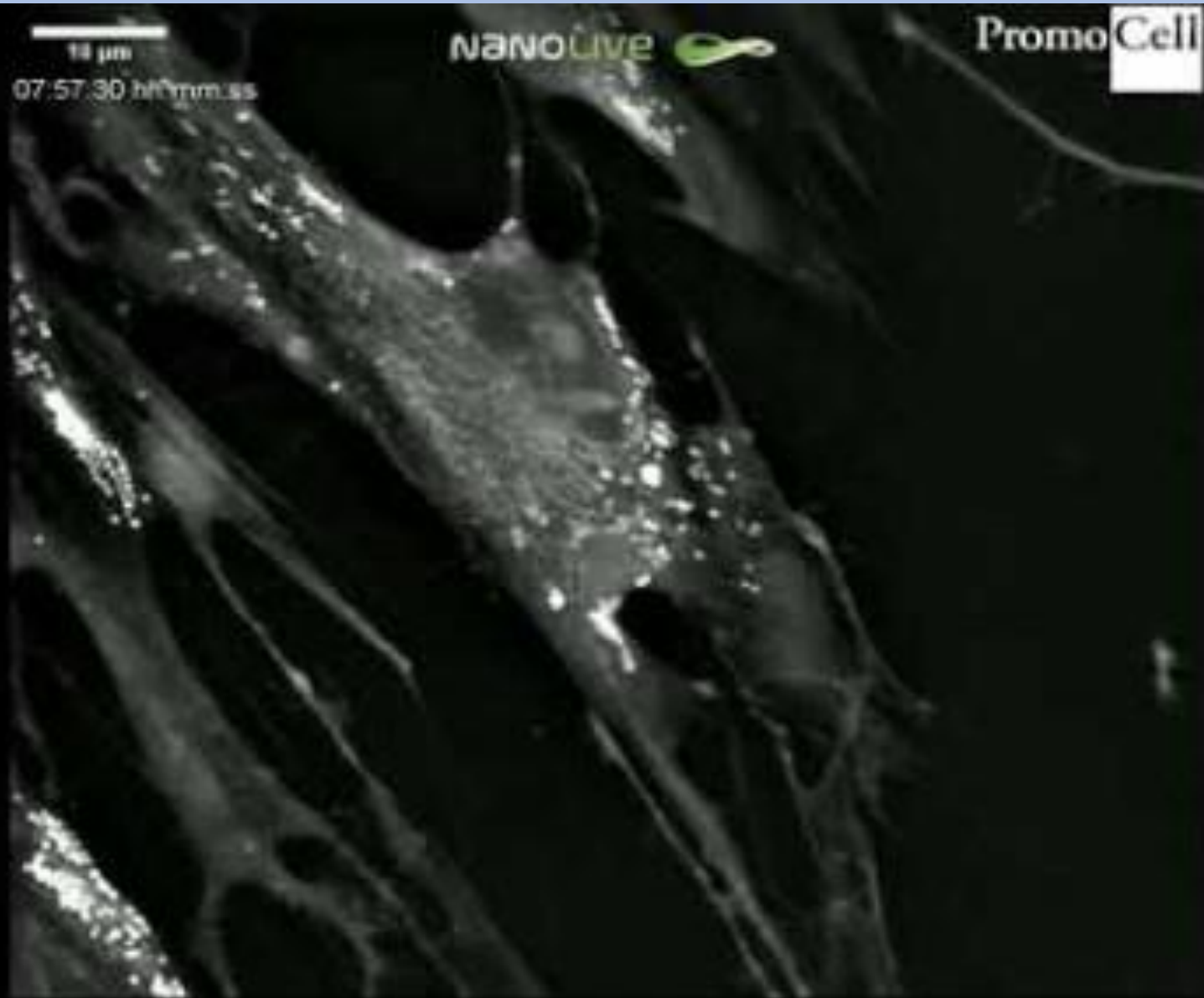
- All multicellular organisms have different types of cells
  - Muscle
  - Nervous
  - Different types of organs
  - Etc...



- Different types of cells have different functions
- Cells start to differentiate almost immediately after fertilization

*How do cells know what type of cell to become?*

## Stem Cell Differentiates into a Neuron



Human mesenchymal stem cell  
differentiating into neuron

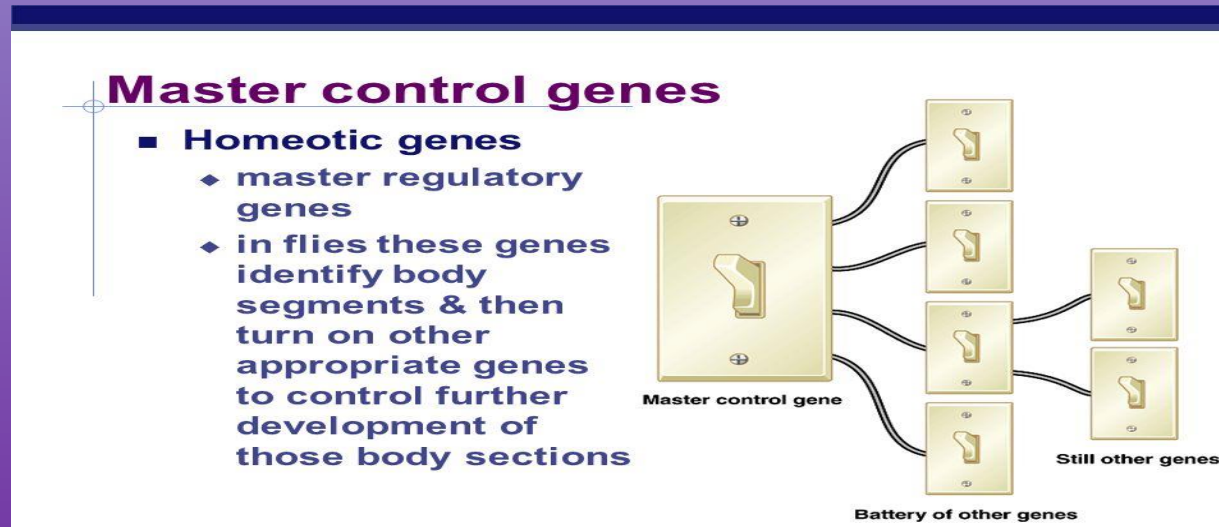
Single Cell to Entire Organism

**aeon**  
VIDEO



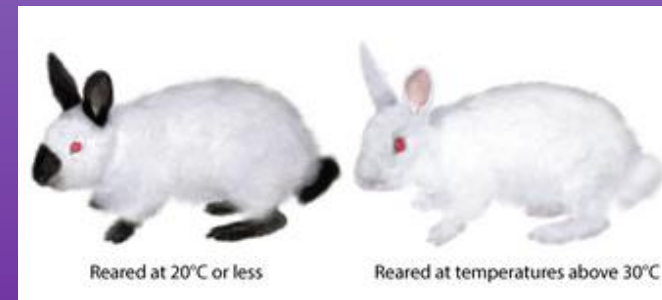
# Regulatory Genes

- Allow for cell differentiation in eukaryotes
- A sort of “on off switch” for gene expression
  - Turned on and off based on internal and external signal detection
  - By turning genes on and off cells can specialize



# Gene Regulation and Expression

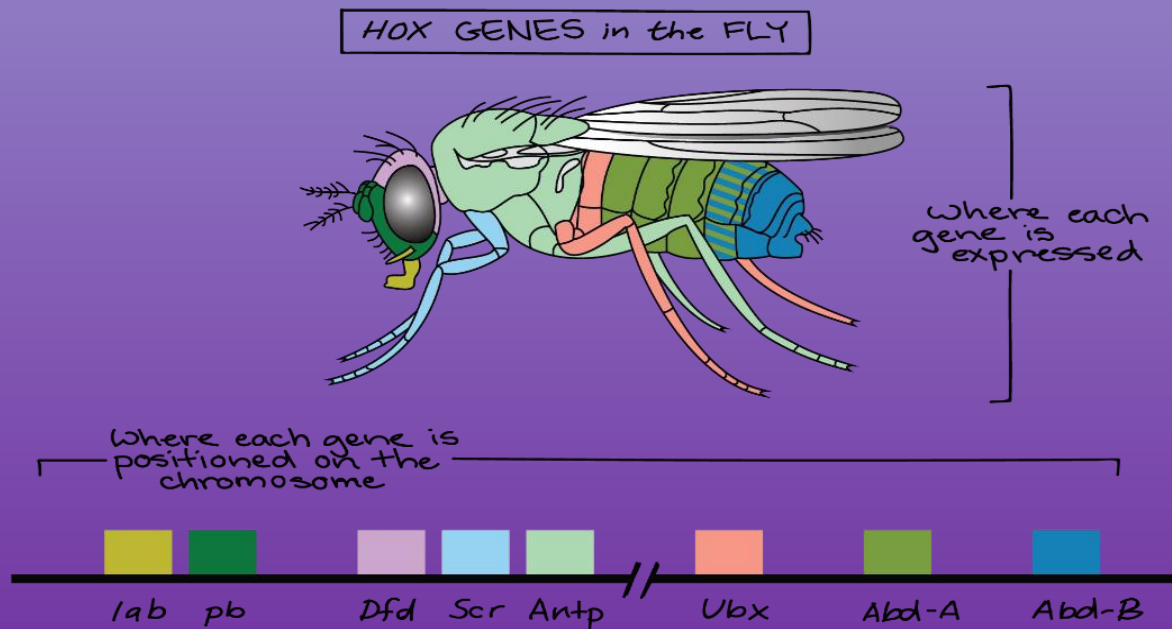
- What causes these genes to turn on or off?
  - Environmental factors
    - **Food/Drugs**
      - Human growth hormone. Amplifies the signals that turn on genes that promote growth
    - **Climate/Temperature**
      - *Example:* Identical rabbits raised in different climates will have different coat colors
    - **Resource availability**
      - *Example:* certain bacteria will turn on the gene to allow them to digest lactose only if they detect lactose in their environment
    - **Exposure to toxins**
    - **Stress**





# Regulatory Gene Example

- Hox Genes:
  - Lay out the basic body forms of many animals, including humans, flies, dogs and worms.
  - They set up the head-to-tail organization. (What goes where and in what order)



# Regulatory Gene Example

- Mutated Hox genes can lead to body parts being in the wrong place/order

