CONCEPT: EARLY DEVELOPMENTAL STEPS

● Fertilization is the _____ step of development

1. In fruit flies, after fertilization there are 13 nuclear divisions that occur without cell division

   - 9th division: Nuclei begin to migrate to one side of the embryo

   - 10th division: Nuclei at posterior pole are enclosed in membranes – become primordial germ cells

2. During interphase of the 14th division the **blastoderm** layer of embryonic tissue is created

   - The blastoderm is one cell deep and forms ~3 hours after fertilization

3. **Gastrulation** begins, which forms the three major germ layers

   - **Endoderm**: Will form the lining of the gut

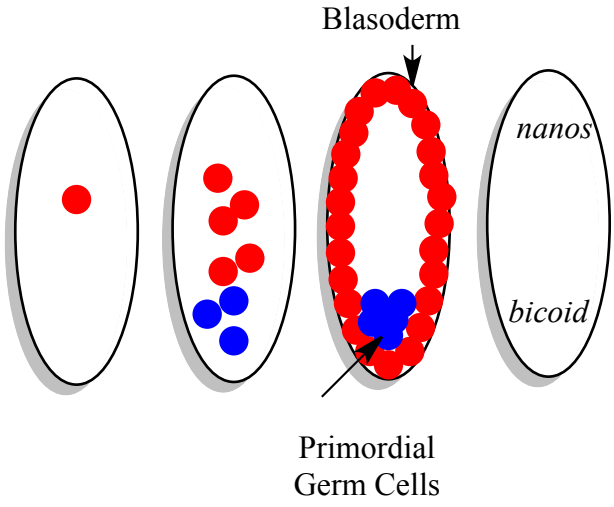
   - Mesoderm: Will form inner tissues, like blood cells, muscles, etc…

   - Ectoderm: Will form the outer layer of the organism (skin, nervous system, teeth)

4. Segmentation begins after _____

   - Anterior-posterior formation and HOX genes

EXAMPLE:



Cell-Cell Interactions

● Proper development is entirely dependent on cells _____ to signals from other cells or their environment

□ During very early development, different cellular regions must respond differently to the same molecule

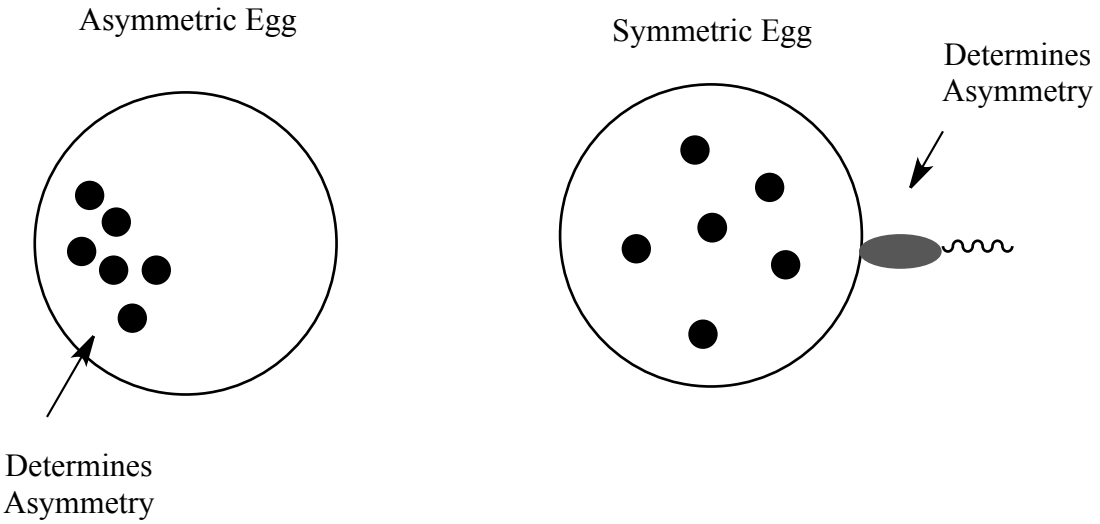
- If the egg itself is asymmetric, then different egg regions promote development differently

- Ex: *Drosophila* eggs have nurse cells, which express *bicoid*, only at the anterior end

- If the egg is symmetric, then fertilization via sperm controls asymmetry

- Ex: *C. elegans* determine anterior/posterior based on the side the sperm enters the egg

EXAMPLE:



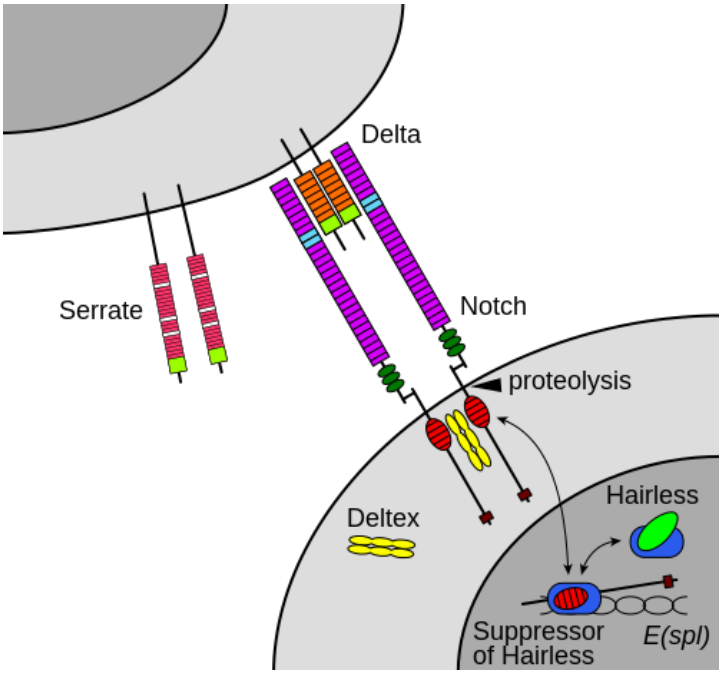
□ During later development, cells must be able to respond to different _____

- **Juxtracrine signaling** is when a ligand attached to one cell can bind a receptor on another cell

- **Paracrin signaling** is when the ligand from one cell is secreted, and then binds receptor on another cell

□ Often, a ligand binding to a receptor initiates a cell signaling cascade

EXAMPLE: Notch Signaling Pathway



PRACTICE:

1. Which of the following is not a germ layer formed during gastrulation?
    a. Endoderm
    b. Mesoderm
    c. Exoderm
    d. Ectoderm

2. Which of the following characteristics describes the blastoderm embryonic tissue?
    a. Contains 13 cells
    b. Is one cell layer deep
    c. Will develop into primordial germ cells
    d. Forms outer later of the organism

3. True or False: Gastrulation occurs after segmentation
    a. True
    b. False

4. True or False: Patterning of asymmetric eggs is first controlled through contact with sperm.
    a. True
    b. False