

## Development Introduction

## Introduction

- Development describes the changes in an organism from its earliest beginnings through maturity.

```

graph TD
    A[Gamete Formation] --> B[Fertilization]
    B --> C[Cleavage]
    C --> D[Gastrulation]
    D --> E[Organogenesis]
    E --> F[Growth]
    
```

Question 1

Shortly after fertilization, the zygote undergoes a series of rapid cell divisions. This is called

- Meiosis
- Gastrulation
- Organogenesis
- Cleavage

## Fertilization

- Fertilization is the initial event in development in sexual reproduction.
- Union of male and female gametes.
- Recombination of paternal and maternal genes.
- Restoration of the **diploid** number (two sets of chromosomes).

## Zygote

*Fertilized egg*

- The diploid cell resulting from fertilization is now called a **zygote**.

Photo courtesy of K. Wynne

- Photos in the following slides illustrate development in the starfish (Phylum Echinodermata).

## Cleavage

- Cleavage – rapid cell divisions following fertilization.
- Very little growth occurs while the cells are dividing.

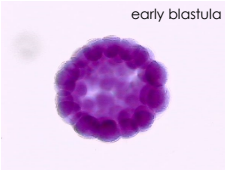
Photos courtesy of K. Wynne

### Blastula

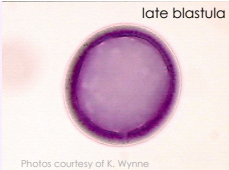
*Hollow ball of cell*

- As divisions continue, a fluid filled cavity, the **blastocoel**, forms within the embryo.
- The resulting hollow ball of cells is now called a **blastula**.

early blastula



late blastula



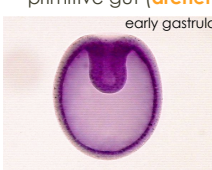
Photos courtesy of K. Wynne

### Gastrulation


*Denting the hollow ball of cells*

- The morphogenetic process called **gastrulation** rearranges the cells of a blastula into a three-layered (**triploblastic**) embryo, called a **gastrula**, that has a primitive gut (**archenteron**).

early gastrula



late gastrula



Photos courtesy of K. Wynne

### The Blastopore

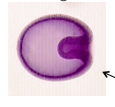
*The Dent in the hollow ball of cells*

- The **blastopore** is the first opening in the embryo – the point of invagination during gastrulation.
- The blastopore will eventually become either the **mouth** or the **anus**.

←

One end of the gut-tube or the other.

**Mouth 1<sup>st</sup>:**  
**Protostome**



→


**Anus 1<sup>st</sup>:**  
**Deuterostome**

Blastopore Archenteron  
Photos courtesy of K. Wynne

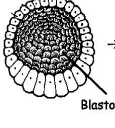
### Gastrulation

- The three tissue layers produced by gastrulation are called embryonic **germ layers**.
- The **ectoderm** forms the outer layer of the gastrula.
  - Outer surfaces, neural tissue
- The **endoderm** lines the embryonic digestive tract.
- The **mesoderm** partly fills the space between the endoderm and ectoderm.
  - Muscles, reproductive system

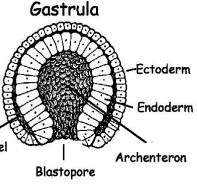
Zygote



Blastula



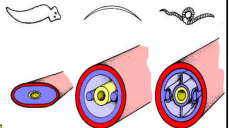
Gastrula



Ectoderm  
Endoderm  
Blastocoel  
Archenteron  
Blastopore

### Coelom Formation

- The **coelom** is a body cavity found in many triplo(3)blastic(Layers) organisms that is completely surrounded by mesoderm.
- Not all protostomes have a true coelom.
  - Pseudocoelomates** have a body cavity between mesoderm and endoderm.
  - Acoelomates** have no body cavity at all other than the gut.

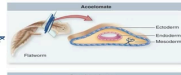


### Body cavities

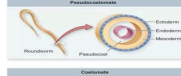
Coelom => a fluid filled cavity surrounded by mesoderm

- Acoelomate -
- Pseudocoelomate
- Coelomate


Acoelomate



Pseudocoelomate



Coelomate



Flatworm	Roundworm	Segmented worm
<b>Acoelomate</b>	<b>Pseudocoelomate</b>	<b>Coelomate</b>
No body cavity	Partial body cavity	-FULL BODY CAVITY: -Need to be 3 germ layers +Allows more room to devolve complexity