I. Introduction to Zoology  
A. What is an Animal?

Animal life began in Precambrian seas with the evolution of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_forms that lived by eating other organisms. Early animals populated seas, fresh water, and eventually the land.

B. Three things we focus on:

* + 1. Nutrition
    2. Life history define animals.

C. Structure, nutrition, and life history define animals.

1. Animals are multicellular, heterotrophic, and eukaryotes. In contrast to autotrophic nutrition of plants and algae, animals must take into their bodies preformed organic chemicals. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Animals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that provide strong support in the bodies of plants and fungi. The multicellular bodies of animals are held together by structural proteins, the most abundant being collagen.

3. Also unique among animals are two types of tissues responsible for impulse conductions and movement: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Most animals reproduce sexually, with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ usually dominating the cycle. \*\*\*See diagram on next slide

Sketch: Cleavage Blastula Gastrulation Gastrula

D. Did the animal kingdom evolve from a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ protist?

* Most scientist agree that the animal kingdom in monophyletic; animal lineages can be traced back to a common ancestor.
* Likely a flagellated protist over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years ago.
* Related to a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which arose about a billion years ago.
* Going From A single cell to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Organism

II. Chapter 8   
A. Early Concepts: Preformation versus \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a. Mystery of development in the 17th and 18th centuries

1. Naturalist-philosophers claimed that young animals were \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and that development was simply a matter of unfolding what was already there.

2. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ histologist thought he saw a preformed human infant in sperm in a microscope he made.

3. 1759 Embryologist \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Studied the development of a chick
* No preformed individual, only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material that became arranged into layers.
* This process was called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-a fertilized egg contains the building materials for development.
* Unknown forces control these actions???

B. Hierarchy of Development Decisions

* Course of Differentiation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ location and induction
* Cell types that make up the body do not just “unfold”, but arise from conditions created in preceding stages.

**Copy Diagram**

C. Fertilization (1n) egg + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* The initial event in development in sexual reproduction is fertilization, the union of male and female gametes to form a zygote.
* Recombinant of parental and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Parthenogenesis-development without fertilization (Example some fish and salamanders)

D. Cleavage and Early Development

* During cleavage the embryo divides repeatedly to convert the large cytoplasmic mass into a large cluster of small maneuverable cells called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

E. Cleavage and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* No growth during this period, only subdivisions of mass, which continues until somatic cell size is attained. Think of it as origami!!!!
* So, what are somatic cells?
* At the end of cleavage 100s to 1000s of cells

DRAW Slide- Cleavage and Early Development

F. What can we learn from Development?

* Developmental Biology is a growing field!!
* How can a zygote, a single layer cell, produce a multitude of body parts in an organism and how gene expressions proceeds.
* Search for commonalities among organisms.

II. An overview of Development Following Cleavage

A. Blastulation

* Cleavage subdivides the mass of zygote until a cluster of cells called a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**is formed (looks like a hollow mass of cells).
* In most animals, the cells are arranged around a central fluid-filled cavity called a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
* Formation of a blastula stage, with its one layer of germ cells, occurs in **all** multicellular animlas.

B. Gastrulation and Formation of Two Germ Layers

a. Gastrulation converts the spherical blastula into a more complex configuration and forms a second germ layer.

* + One side of the blastula bends inward in a process called invagination, forming a new internal cavity. Picture pushing in a beach ball-the inward region forms a pouch.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the gut cavity called an archenteron or gastrocoel.
  + The opening to the gut, where the inward bending began, is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

b. The gastrula stage has two layers:

a. An outer layer of cells surrounding the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, called ectoderm

b. An inner layer of cells is called endoderm

* + - * The gut opens only at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it is called a blind or incomplete gut. Animals with a blind gut must consume food completely digested, or the remains of the food egested through the mouth. Ex sea anemones and flatworms.
      * Most animals have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a second opening, the anus.

c. Formation of the Mesoderm, a Third layer

i. Multicellular animals (not sponges) proceed blastula to gastrula

* + - Two germ layers called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Three germ layers called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      * The third layer is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

See Class Handout

C. Formation of the Coelom

* Coelomates are animals with a true coelom, a fluid filled body cavity completely lined by tissues derived from mesoderm.
* The inner and outer layers of tissue that surround the cavity connect dorsally and ventrally to form mesenteries that suspend the internal organs.

**D. Protostome vs Deuterostome in Coelomates**

* Mollusks, annelids, arthropods and some other phyla are collectively called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Echinoderms and chordates are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4 Fundamental differences between the two groups:

\*\*\*\*\* See Class Handout or next slide

E. Mechanisms of Development

* First Nuclear Equivalence
  + What does this diagram tell us?
* Second Cytoplasmic specification
  + What does this diagram tell?
* Third Embryonic induction
  + What does this diagram tell?