

Animal Development

All living organisms exhibit some form of growth and development.

Members of the animal kingdom have the most complex developmental cycles of any living organism.

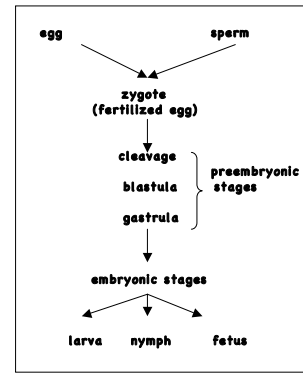
The sequence of discrete, recognizable stages that these organism pass through as they develop from the formation of a **zygote** (the fertilized egg) to the sexually mature adult are referred to as its **developmental cycle**.

Animal development can be subdivided into several sequential processes:

gametogenesis
fertilization
preembryonic development
embryonic development
post embryonic development

Embryonic development includes the processes of **growth, determination, differentiation** and **morphogenesis**.

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1. Gametes.

The gametes are produced by the process of meiosis which differs from mitosis in that only one of each chromosome ends up in the cells after division.

The male gamete, the sperm, is small and almost always flagellated.

The female gamete is usually large since it contains yolk, and spherical.

2. Fertilization.

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At fertilization only a single sperm penetrates and fertilizes the egg to produce a **zygote**. The egg and sperm each contribute a set of chromosomes so that the fertilized egg then has a pair of each chromosomes, one set from the male parent and the other set from the female parent. To prevent additional sperm from penetrating the egg a fertilization cone is produced to produce the original sperm into the egg quickly. Then a fertilization membrane expands around the egg and pushes away and "locks out" other sperm cells.

Slide: starfish unfertilized egg wm (Fig. 4.2a)

Slide: starfish fertilized egg wm (Fig. 4.2b)

-Be able to distinguish between unfertilized and fertilized eggs

3. Preembryonic Development. [Ex 4-1]

Almost immediately, the zygote begins to divide to produce a multicellular embryo.

a. Cleavage.

The first identifiable period of development occurs as the fertilized egg begins to divide.

These early divisions are called **cleavage divisions** and each cell produced is an identical genetic copy of the zygote and is called a **blastomere**. At this stage each blastomere has the potential to become a complete embryo.

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Slide: starfish early cleavage wm (Fig. 4.2)

-observe the slide of starfish eggs in early cleavage and be able to distinguish this stage from those that follow
-note 2, 4, 8 cell stages; each cell is called a **blastomere**

b. Morula:

Continued division leads to a solid ball of cells called the **morula**.

Slide: starfish late cleavage wm (Fig. 4.2G)

-identify the **morula** stage. How does its size compare with that of the fertilized egg?

c. Blastula:

Cell division continues until the embryo becomes a hollow ball of cells. If the embryo is spherical as in starfish it is called a **blastula**; The cavity inside the blastula is called the **blastocoel**.

Slide: starfish blastula wm (Fig. 4.2H)

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-Identify the **blastula** and distinguish it from other embryological stages

- hollow ball of cells
- blastocoel

d. Gastrula:

In the gastrula, a depression forms at one end of the embryo, cells move in to form a saclike pouch. The embryo is now essentially two layered. The cavity of this new pouch is called the **archenteron** (or **gastrocoel**) which is surrounded by the original, now much smaller **blastocoel**. The archenteron opens to the outside through the **blastopore**. The blastopore will eventually become either the **mouth** or the **anus** of the adult animal. By this time the individual cells of the embryo are beginning to **differentiate** into 3 embryonic tissue layers; the **ectoderm**, the **mesoderm** and the **endoderm**. The ectoderm will eventually become the skin and nervous system. The mesoderm will become the skeletal system, muscular system and circulatory system. And the endoderm will develop into the respiratory and digestive system. A cell removed at this stage can no longer develop into a complete embryo.

Slide: starfish gastrula wm (Fig. 4.3C,D)

-Identify the blastula and distinguish it from other embryological stages.

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-Note the **blastocoel**, **archenteron** (**gastrocoel**), and **blastopore**

4. Embryo

After the three embryonic tissue layers are formed in the gastrula the immature animal is referred to as an **embryo**. During embryonic development the organs and organ systems form. By the end of the embryonic stage all tissues and major organs have formed.

Slide: chick embryo 72 hours (HO)

Model: human embryo

-Note on the chick embryo and locate the brain, heart, limb buds, eye

The animal embryo may next develop into any of several forms such as **larvae**, **nymphs**, or **fetuses**. Further development varies considerably in different animal groups. Some examples are given below.

5a. Larvae.

In many animals, the embryo soon develops into a free living **larval form**. Larvae are an immature stage which move and feed independently and often have no resemblance at all to the adult of the species. While each phylum or class often has its own characteristic larvae, there are a few larval

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forms that are found in more than one phylum. Similar larvae imply similar ancestry; indicating that the taxa are relatively closely related. Many groups of animals have characteristic larval stages. A few examples are illustrated below:

i. Planula larva.

A simple multicellular, oval larva with no discernable organs, its surface is covered with cilia for movement common in jellyfish and some flatworms

Slide: *Aurelia* planula wm (HO)

ii. Nauplius larva.

A triangular larva with three pairs of jointed appendages, eyespots, and digestive organs.

Nauplii are larvae of crustaceans such as shrimp and crabs

Slide: nauplius, barnacle wm (HO)

iii. Glochidia larva.

Glochidia are larvae of freshwater clams that are parasitic on the gills of fish until they mature and fall to the sediment and begin life as freelifing clams. Note the large 'teeth' that they use to attach to their hosts.

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Slide: mussel glochidia wm (HO)

iv. Caterpillars, maggots, grubs and tadpoles (HO)

are examples of larvae that look and feed quite differently than the adults that they become (butterflies, flies, beetles and frogs, respectively)

Preserved: Caterpillars, maggots, grubs & tadpoles (HO)

5b. Nymphs:

Nymphs are immature stages of animals that at least somewhat resemble the adult of the species and that live and feed independently

Preserved: mayfly, dragonfly, stonefly nymphs

5c. Fetus:

In addition to embryonic development, vertebrates (higher animals) produce an immature stage that does resemble the adult but that is usually completely dependent on the mother (or enclosing egg) for nutrition and protection.

Preserved: misc vertebrate fetuses

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Illustrations: human fetal development
Models: Human fetus