

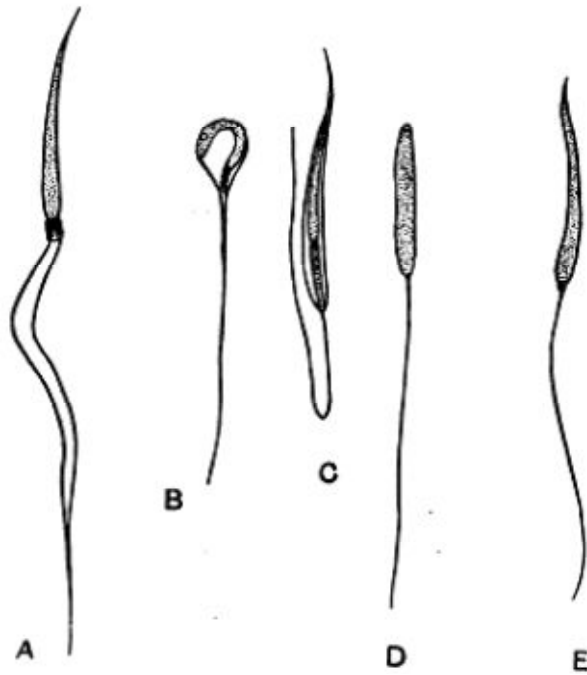
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### Fertilization in frog

In frog the sexes are separate, female being larger than male. Male has a nuptial pad at the base of the first finger of forelimb and also possesses a pair of vocal sacs. When frogs mate, the male grasps the female's trunk with his forelimbs. The technical name for this special kind of embrace is **amplexus**. Frogs and toads don't have penises. During amplexus the female discharges eggs, usually into water, while the male sheds sperms over the eggs.

### **Sperm**

The mature sperm measures on an average 0.03mm in length. It has an elongated solid head with an anterior bead-like acrosome. The short middle piece is invisible but the tail appears as a gray filamentous extension about four or more times the length of the sperm head.



### *Amphibian spermatozoa*

#### **Egg**

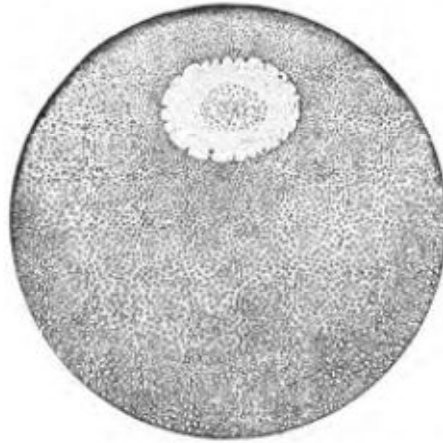
The egg for frog is about 2mm in diameter at the time of ovulation. It is surrounded by two accessory egg membranes in addition to the **plasma membrane**. Just outside the plasma membrane is a non living transparent membrane called **vitelline membrane** developed by the 2 ovum itself. Outer to vitelline membrane is the **jelly coat** or **albumen** secreted by the walls of the oviduct. As soon as the egg reaches the water, the jelly coat swells up by the imbibitions of water and it protects the egg from injury and against infection by bacteria and other microorganisms. Frog's egg exhibits a well developed polarity and radial symmetry. The cytoplasm has two regions, the cortex and endoplasm.

#### **1. Egg cortex**

A jelly like viscous layer of cytoplasm adherent to the plasma membrane is called ectoplasm or egg cortex. It possesses some membrane bound spherical bodies called **cortical granules** containing acid mucopolysaccharides. These remain arranged in a layer close to the plasma membrane. Dark-brown **pigment granules** are present in the egg cortex on the animal hemisphere. The presence of these granules imparts a dark brown colour to the entire animal hemisphere. The vegetal pole is whitish with little pigment granules. The cortical layer of egg is stable and is not shifted by streaming movement of cytoplasm or centrifugation force. It plays an important role in the development of egg. The egg cortex is responsible for establishing polarity, bilateral symmetry and general organization of the developing egg.

## **2. Endoplasm**

The inner ooplasm with its nucleus is called endoplasm which is colloidal in nature. This portion contains cell organelles like mitochondria and ribosomes, and also organic and inorganic substances. Endoplasm contains a cup shaped mass of white yolk platelets called **vitelline cupola**. The **germinal vesicle** or **nucleus** is located near the animal pole. The yolk granules are little and small sized in the animal pole while they are heavily deposited in the vegetal pole. Frog's egg is said to be **mesolecithal** and **moderately telolecithal** since it contains a moderate amount of yolk which is distributed unevenly in the cytoplasm, the vegetal pole having the highest concentration.



*Amphibian egg*

### **Fertilization**

Fertilization is the fusion of sperm with egg resulting in the formation of zygote. It is characterized by the following events.

1. Fertilization is external.
2. It is monospermy, i.e. only one sperm fuses with the egg.
3. The fertilized egg rotates in such away that the animal hemisphere goes above.
4. The jelly coat swells and increases in thickness.
5. The second meiotic division is completed resulting in the release of the second polar body'
6. The sperm enters the egg in the animal hemisphere at an angle of 400 from the centre of animal pole.
7. Immediately after the entry of the sperm into the egg, the vitelline membrane becomes elevated. This membrane is now called **fertilization membrane**. The space between this membrane and the surface of the egg is called **perivitelline space** filled with a fluid called

**perivitelline fluid.** In this fluid, the fertilized egg can rotate freely. The rotation of the egg is inevitable for the normal process of development. Immediately after fertilization, the black pigmented animal pole placed above and the yolk-laden vegetal pole below.

8. Before the release of egg into the water' the jelly coat remains thin. As the egg is released into the water, the jelly coat absorbs water and begins to swell until the thickness of the jelly becomes twice the diameter of the egg.

9. The second maturation division is completed immediately after fertilization. As a result, the fertilized egg releases the second polar body.

10. The egg pronucleus and sperm pronucleus fuse together to form the zygotic nucleus. This process is called amphimixis.

11. On one side just below the equator, a crescent like area appears; it will be grey in colour. This area is called **grey crescent**. It appears opposite to the point of sperm entry. The region of the grey crescent will become the posterior side and the opposite region will become the anterior side of the future embryo. This leads to the formation of a definite bilateral symmetry in the fertilized egg. .The unfertilized egg is radially symmetrical.

12. The sperm penetrates the egg perpendicular to the cortex. After penetration, the sperm moves in the cortex perpendicularly, along the radius of the egg. This path of the sperm is marked by pigment granules. This path of the sperm in the egg cortex is called **penetration path**. After crossing the cortex, the sperm changes its

direction and moves towards the egg nucleus. This changed path is also marked by pigment granules and is called **copulation path**.

### **Grey Crescent (Gray Crescent)**

1. Grey crescent is a crescent-like and grey colored area developing on the surface of amphibian egg opposite to the point of sperm entry.
2. It is a surface feature developing as a result of cytoplasmic movements stimulated by the sperm entry in the egg.
3. It appears just above the margin where the yellow-white vegetal pole material merges with the darkly pigmented animal pole material.
4. It appears on the surface of the egg opposite to the point of sperm entry.
5. Grey crescent marks the future dorsal side of the embryo.
6. The first cleavage bisects the grey crescent into two equal halves and this plane represents the future median plane of the embryo.
7. The formation of grey crescent, thus fixes up the final symmetry of the egg and the future embryo
8. In the gastrula, the grey crescent materials are located on the dorsal lip of the blastopore.
9. The grey crescent materials function as the organizer because, when it is- removed from the embryo, the embryo fails to develop further. At the same time when a normal embryo is grafted with another grey crescent, two embryos develop.
10. In the late gastrula, grey crescent materials are incorporated in to the chordamesoderm.