

KEY NOTES ON EXTERNAL FERTILIZATION

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What is External Fertilization?

- Fertilization that occurs outside the body of an organism is known as external fertilization. It usually requires a water body for successful fertilization.
- The sperms and eggs are released in an external environment. External fertilization usually occurs during spawning when the female releases the egg and the male releases the sperm in the same environment.
- External fertilization in an aquatic environment protects the desiccation of eggs. Broadcast spawning leads to higher genetic diversity due to larger mixing of genes within a group. The chances of survival of the species also increase.
- For organisms like sponges, broadcast spawning is the only process for fertilization. Millions of eggs are produced by individuals because many are lost by predation.

Features of External Fertilization

- The success rate of fertilization is very low.
- Unlike internal fertilization, a large number of gametes need to be produced by the male and female to ensure reproductive success.
- A water body is required to initiate external fertilization. The sperms would die on land.
- It is a reproductive disadvantage for most of the animals because most of the gametes die without being fertilized.
- External fertilization is, however, a simple reproductive strategy which does not require the involvement of any hormones or mating rituals.

Advantages of External Fertilization

- It results in increased genetic variations.
- It produces a larger number of offsprings.
- The gametes released can drift and therefore it is easy to find mates.

Disadvantages of External Fertilization

- A large number of gametes are left unfertilized and wasted.
- Predators and other environmental hazards reduce the chances of fertilization.
- The sperm might not necessarily come in contact with the eggs.
The gametes or the zygote dessicate.

Examples of External Fertilization

The examples of external fertilization are given below:

- **Sea Urchins**

They use chemotaxis to attract the sperms towards the eggs. Their spawning is synchronized to prevent the eggs and sperms from diluting or drifting away.

- **Frogs**

The female releases the eggs into the water. The male also releases the sperms in the water to fertilize them. The larval life of the frogs is in water whereas the adult life is on land.

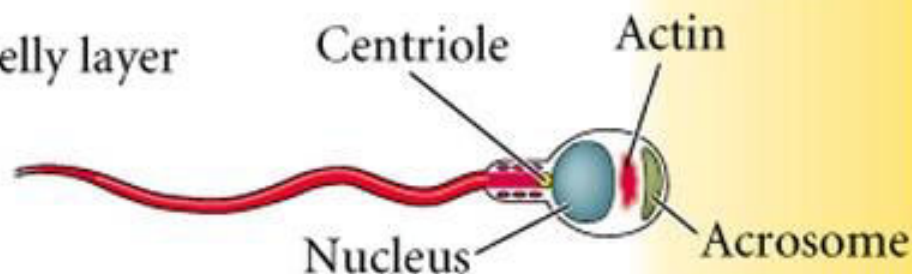
Chemo attraction in SEA URCHIN fertilization

Activation of sperm swimming movements requires stimulation of the propulsion machinery of the sperm. Sperm are activated in a series of steps. First, contact with diffusible molecules contained in **egg jelly** initiates **chemotaxis**. Chemotaxis is the process by which a migrating (or swimming) cell moves toward a higher concentration of a diffusible or substrate-bound guidance molecule. Second, physical contact with egg jelly occurs. This causes the **acrosome reaction**, which is triggered a rise in internal **calcium concentration** inside the sperm head.

The small peptide **RESACT** acts as a chemoattractant for sea urchin sperm. When receptors on the surface of the sperm bind RESACT, a signal transduction cascade involving cyclic GMP (cGMP) is set in motion, triggering faster sperm swimming. In this movie, inactive RESACT is added to a field of sperm. A flash of light causes photolytic activation of the RESACT, resulting in rapid movement of the sperm toward the source of the RESACT. See if you can see where the RESACT was added!

(A) SEA URCHIN

(1)- Sperm contacts jelly layer



(2)- Acrosomal reaction



(3)- Digestion of jelly layer



(4)- Binding to vitelline envelope



(5)- Fusion of acrosomal process membrane and egg membrane

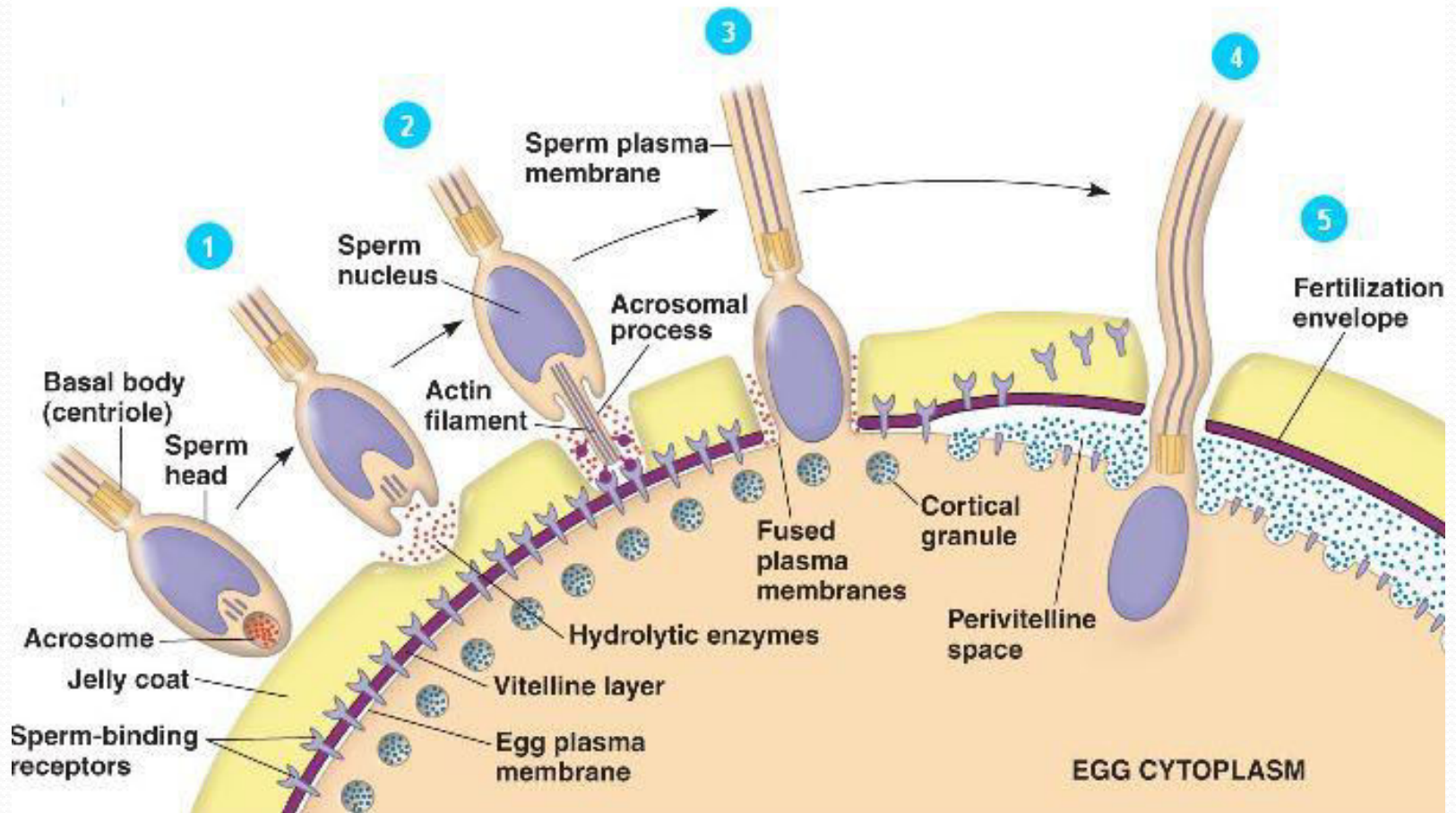


← Jelly layer →

Vitelline envelope

Egg plasma membrane

Fertilization in sea urchin.





THANK YOU