

43.2A: EXTERNAL AND INTERNAL FERTILIZATION

LEARNING OBJECTIVES

- Compare and contrast external and internal methods of fertilization

EXTERNAL FERTILIZATION

External fertilization usually occurs in aquatic environments where both eggs and sperm are released into the water. After the sperm reaches the egg, fertilization can then take place. Most external fertilization happens during the process of spawning where one or several females release their eggs and the male(s) release sperm in the same area, at the same time. The release of the reproductive material may be triggered by water temperature or the length of daylight. Nearly all fish spawn, as do crustaceans (such as crabs and shrimp), mollusks (such as oysters), squid, and echinoderms (such as sea urchins and sea cucumbers). Pairs of fish that are not broadcast spawners may exhibit courtship behavior. This allows the female to select a particular male. The trigger for egg and sperm release (spawning) causes the egg and sperm to be placed in a small area, enhancing the possibility of fertilization.



Figure 43.2A.1: Anemone fish protecting its spawn: An image of an Anemone fish protecting its spawn. The anemone fish utilizes a form of external fertilization.

External fertilization in an aquatic environment protects the eggs from drying out. Broadcast spawning can result in a greater mixture of the genes within a group, leading to higher genetic diversity and a greater chance of species survival in a hostile environment. For sessile aquatic organisms such as sponges, broadcast spawning is the only mechanism for fertilization and colonization of new environments. The presence of the fertilized eggs and developing young in the water provides opportunities for predation, resulting in a loss of offspring. Therefore, millions of eggs must be produced by individuals. The offspring produced through this method must mature rapidly. The survival rate of eggs produced through broadcast spawning is low.

INTERNAL FERTILIZATION

Internal fertilization occurs most often in land-based animals, although some aquatic animals also use this method. There are three

ways that offspring are produced following internal fertilization: oviparity, ovoviparity, and viviparity.

In oviparity, fertilized eggs are laid outside the female's body and develop there, receiving nourishment from the yolk that is a part of the egg. This occurs in most bony fish, many reptiles, some cartilaginous fish, most amphibians, two mammals, and all birds. Reptiles and insects produce leathery eggs, while birds and turtles produce eggs with high concentrations of calcium carbonate in the shell, making them hard. These animals are classified as oviparous.

In ovoviparity, fertilized eggs are retained in the female, but the embryo obtains its nourishment from the egg's yolk; the young are fully developed when they are hatched. This occurs in some bony fish (such as the guppy, *Lebistes reticulatus*), some sharks, some lizards, some snakes (such as the garter snake, *Thamnophis sirtalis*), some vipers, and some invertebrate animals (such as the Madagascar hissing cockroach, *Gromphadorhina portentosa*).

In viviparity, the young develop within the female, receiving nourishment from the mother's blood through a placenta. The offspring develops in the female and is born alive. This occurs in most mammals, some cartilaginous fish, and a few reptiles, making these animals viviparous.

Internal fertilization has the advantage of protecting the fertilized egg from dehydration on land. The embryo is isolated within the female, which limits predation on the young. Internal fertilization also enhances the fertilization of eggs by a specific male. Even though fewer offspring are produced through this method, their survival rate is higher than that for external fertilization.

KEY POINTS

- External fertilization is characterized by the release of both sperm and eggs into an external environment; sperm will fertilize the egg outside of the organism, as seen in spawning.
- Internal fertilization is characterized by sperm fertilizing the egg within the female; the three methods include: oviparity (egg laid outside female body), ovoviparity (egg held within female), and viviparity (development within female followed by live birth).
- Internal fertilization protects the fertilized egg or embryo from predation and harsh environments, which results in higher survival rates than can occur with external fertilization.
- Ovoviparity is characterized by an organism retaining a fertilized egg inside the body where development occurs and nourishment is received from the yolk.
- Viviparity is characterized by an organism which has its young develop within the female and nourishment is received directly from the mother via a placenta.

KEY TERMS

- oviparous:** egg-laying; depositing eggs that develop and hatch outside the body as a reproductive strategy
- viviparous:** being born alive, as are most mammals, some reptiles, and a few fish (as opposed to being laid as an egg)

- ovoviparity:** eggs are retained in the female, but the embryo obtains its nourishment from the egg's yolk

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