Sexual Reproduction in Nature

Sexual reproduction

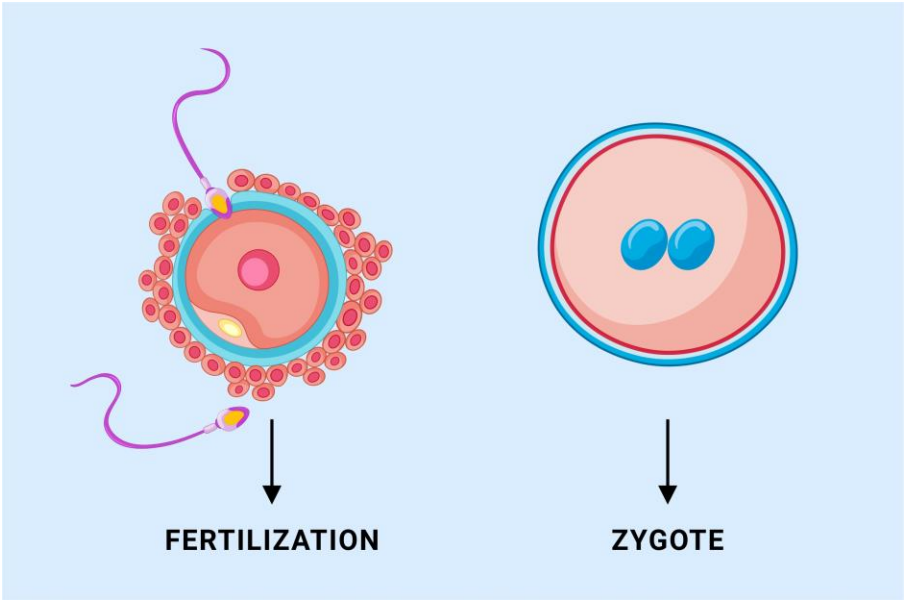
- **Sexual reproduction** is the process of bringing the two types of gametes together for the fertilization process to lead to a new organism.
  - Recall Meiosis is the process of create gametes (sperm and egg cells) in many organisms
- There are three steps to sexual reproduction

Step 1: Mating

- The process by which gametes arrive at the same place at the same time. The mating process is different for different organisms.
- Examples
  - Seasonal conditions and timing (sheep mate in the fall/winter for offspring to be born in the spring, which is better for the offspring)
  - Geological and environmental conditions (Mountain goats mate on mountains for safety)
  - Mating calls and rituals, such as Peacock dances and Orca whale cries
  - Some mates chosen due to desirable traits, such as strength

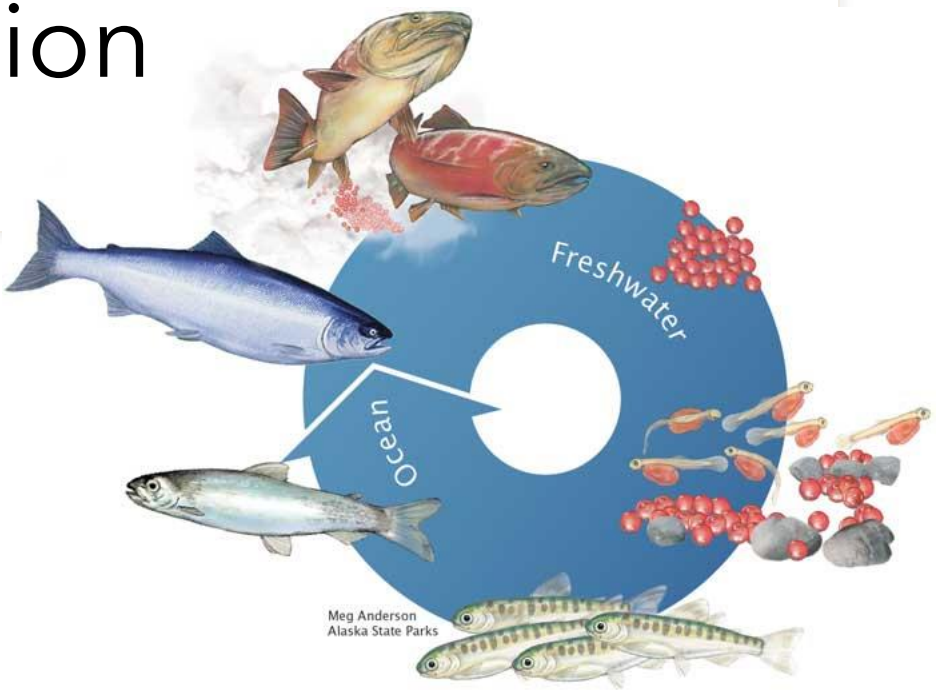
Step 2: Fertilization

- The union of a sperm cell with an egg cell.
- Once a sperm cell enters the egg cell, the egg cell emits an electrical charge preventing it from being fertilized by other sperm cells.
- Once the egg is fertilized, mitosis-based cell division will only begin if:
  - Enough nutrients are present (interphase)
  - The temperature is correct (needed for certain proteins to work correctly)
  - Sufficient moisture is present to prevent drying out
  - The embryo is protected from predators or environmental factors like UV radiation

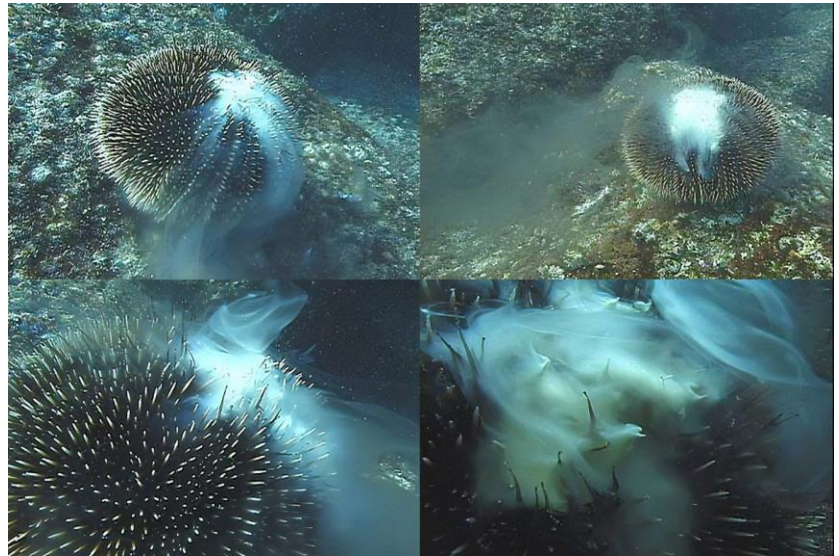


The two nuclei will eventually fuse

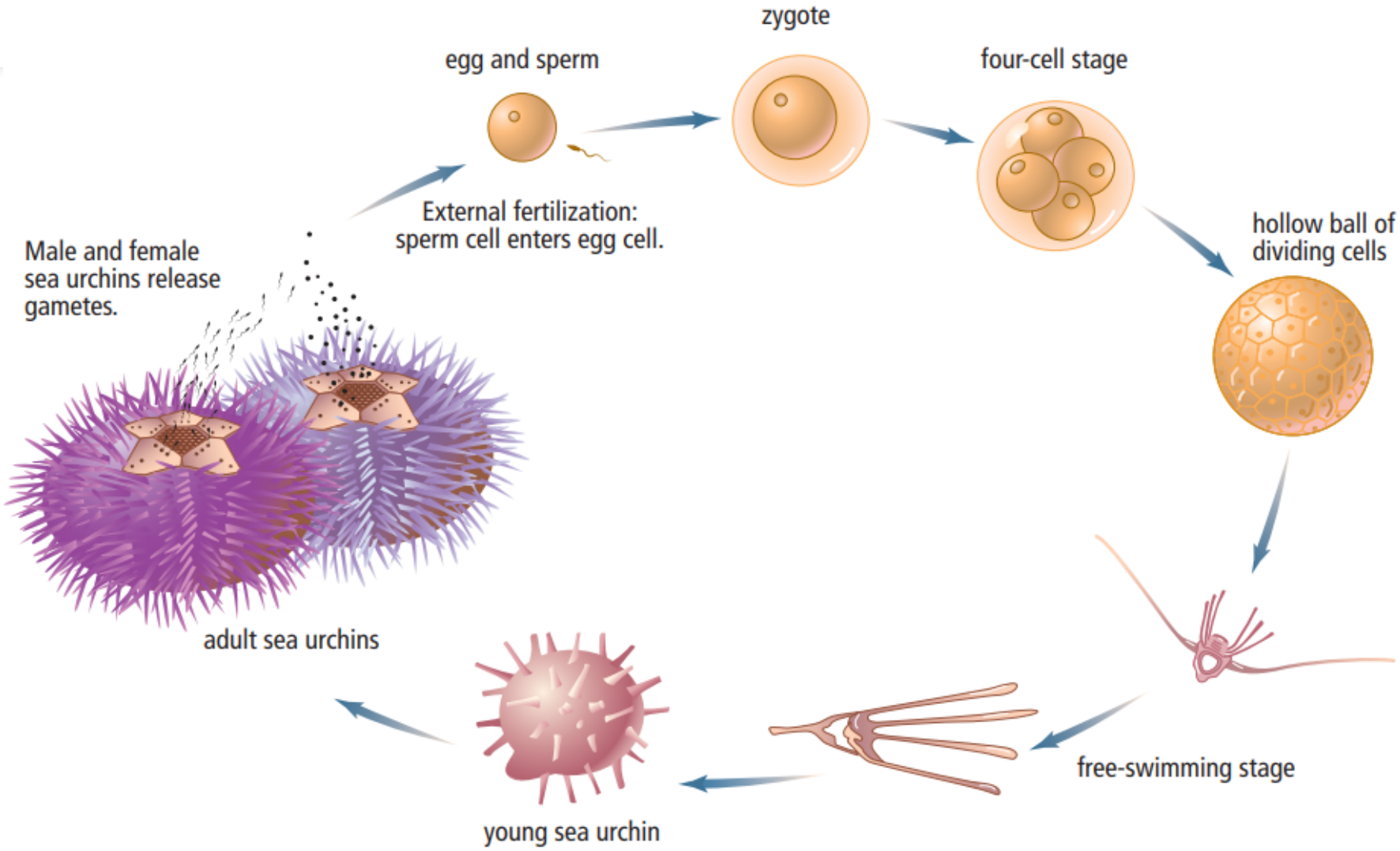
Two Types: External Fertilization



- A sperm and an egg cell meet outside of the bodies of the parents.
- This is common in sea life, where female fish will lay eggs for a male fish to add sperm cells to.
  - Example: Salmon
- Some species will spray millions of sperm cells at times of the year where they may encounter released eggs cells
  - Example: Sea Urchin

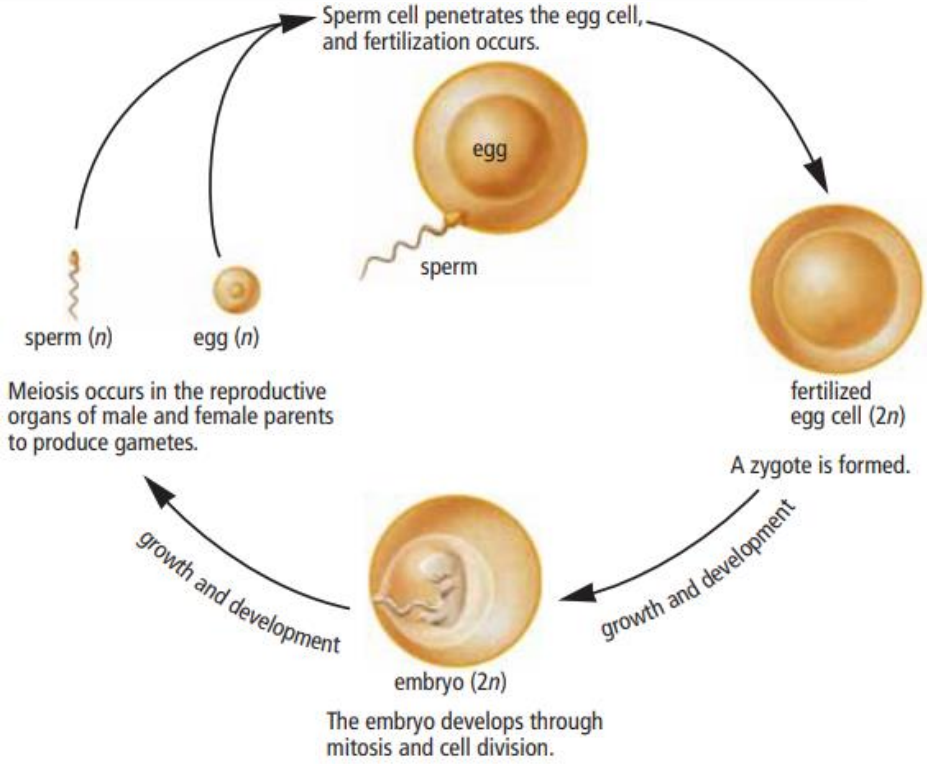


Sea Urchin Life Cycle



Two Types: Internal Fertilization

- A sperm and an egg cell meet inside the body of a female.
- This occurs when a male member of a species deposits sperm cells in a female of the species.
- After fertilization, the female will provide nutrients and safety for early growth. This will continue until birth, **<u>OR</u>** until eggs are deposited outside the body.



Two Types: Internal Fertilization

- In humans, a female will usually only release one egg cell from the ovaries that will be fertilized by one of the many sperm cells that a male deposits (created in the testes). The eggs will remain with the female until birth.
- In other species, the number of eggs released may differ, like snakes which will instead lay between 3-100 eggs. This is still lower than asexual reproduction.

Two Types: Comparison

Internal Fertilization:

- **Higher chance of offspring survival from protection and parental care**
- **High energy cost**
- **Lower amounts of zygotes produced**

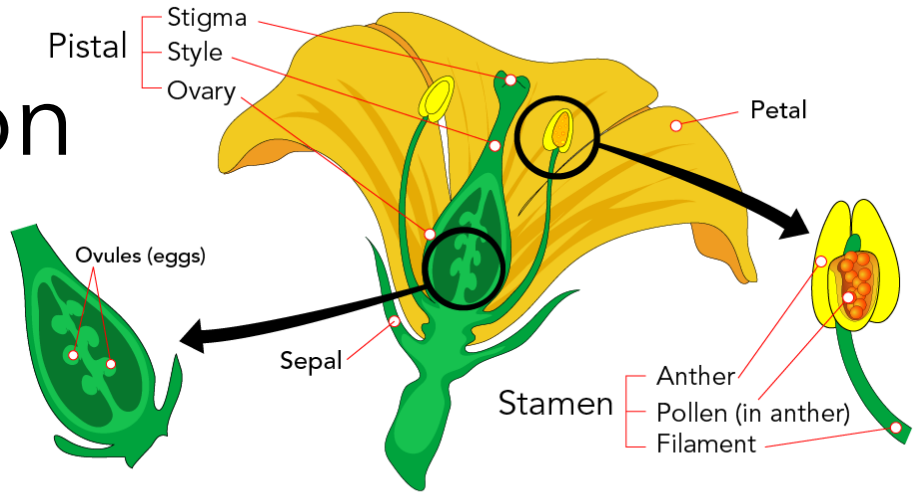
External Fertilization:

- **Lower chance of offspring survival from lower protection and parental care**
- **Lower energy cost**
- **Higher amounts of offspring**
- **Offspring spread out and compete less amongst themselves and their parents for food**

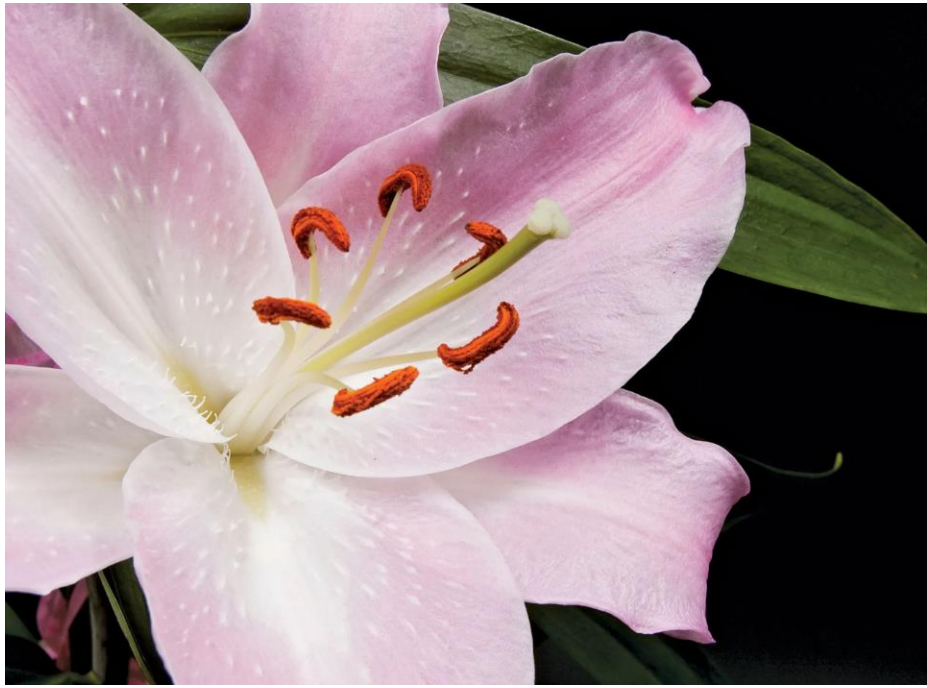
Plant Fertilization: Pollination

- The transfer of male gametes in structures called **pollen** (protective cases) from the male reproductive part of a plant to the female reproductive part of a plant.
- In order for sperm cells to be moved to the female reproductive organs, pollinators are required.
  - Pollinators can be living things such as bees, which have pollen stuck to them when collecting nectar, or non-living things like wind or water
  - Living pollinators are typically attracted by food, smells, or design/colours.

Plant Fertilization: Pollination



- Flowers contain both male and female reproductive structure.
- The pollen is released from a long structure called an **anther** (of a **stamen**) and will travel by various means to a long, central structure called a **stigma**. Not all plant species with flowers have a stigma.
- At the bottom of this stigma are the plant's egg cell producing ovaries.
- Note that it is possible for a flower to self-pollinate (where its egg cell is pollinated by its own sperm cell). However, the inbreeding of plants will result in lower genetic diversity, so less differences over time.

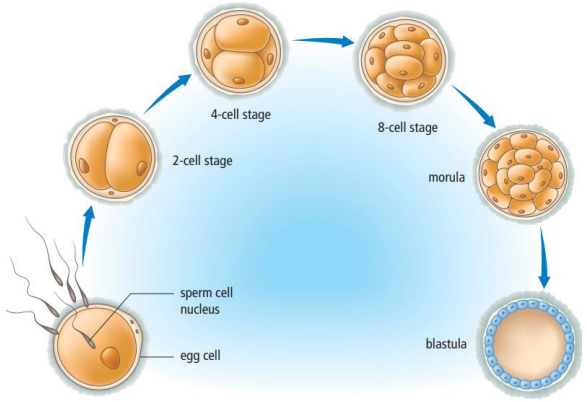


Plant Fertilization: Seeds

- After the sperm cell travels down a pollen tube and fertilizes the egg cell, a zygote will begin to grow into an embryo while inside a **seed**.
- The seed is a structure that contains nutrients and has a tough shell on the outside for protection.
- Once a seed is created, it will not progress past a certain point until it is planted in a suitable place.
- Seeds can travel by using
  - Wind
  - Animals (can be eaten and survive digestion)
  - Having a shape that is easily is pushed around

Step 3: Embryonic Development

- This is when a zygote develops into an **embryo**, which is an early form that resembles the basic shape of the new organism.
- There is a section in the book on this, but this part is **NOT TESTABLE KNOWLEDGE**
- After a human embryo develops, it will take 3 distinct 3-month periods to prepare for birth. Each period of 3 months is called a **trimester**. This means that once an embryo develops, it will take **about** 9 months to develop into a baby that is ready to be born. Embryonic development differs between species.



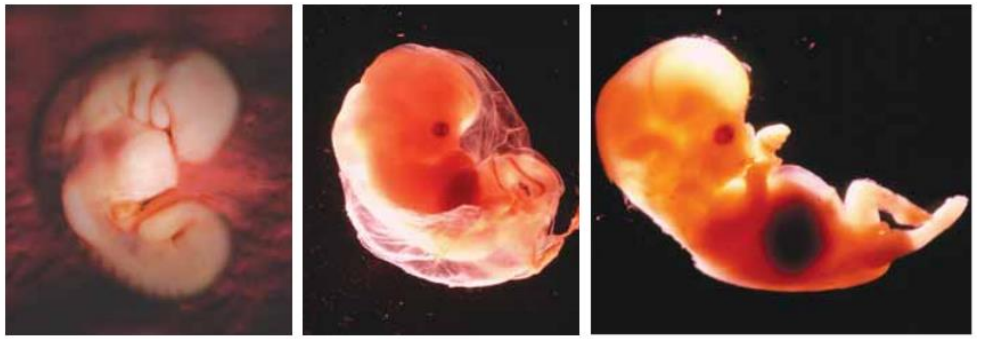


Figure 6.35A The embryo at 4 weeks

Figure 6.35B The fetus at 8 weeks

Figure 6.35C The fetus at 12 weeks