

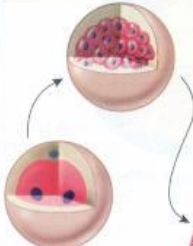
Lesson 3: Prenatal Development and Forms of Sexual Reproduction

Key Concepts

- Development of the human zygote occurs in stages
- Sexual reproduction takes many different forms.

Prenatal Development

- Human prenatal (**before birth**) development begins as soon as the egg is **fertilized**
- Within 30 hours of this event, the **zygote** divides by **mitosis** for the first time.
- Cell division continues at such a fast rate that there is no time for the early cells to increase in size between divisions.

Age (weeks)					
1	2	3	4	5	6
← zygote to formation of embryonic disc →		embryo			
 Zygote cleaves; blastocyst implants		 2-3 mm	 4 mm	 8 mm	 13 mm
Two-layered embryo forms; amniotic cavity and yolk sac open		Gastrulation occurs; notochord and beginning of neural tube form	Neural tube closes; heart beats; arm buds, tail, and gill grooves form	Incipient eye parts—retina (as optic cup) and lens (as lens pits)—form; leg buds form; brain enlarges	Webbed fingers and external ear form; pigment appears in retina; tail and gill grooves disappearing
Age (weeks)					
7	8	9	10	11	12
embryo		fetus			
 18 mm	 30 mm	 50 mm	 61 mm	 73 mm	 87 mm
Webbed toes form; bones begin to harden; back straightens; eyelids form	Upper limbs bend at elbows; genitalia begin to differentiate; fingers are distinct	Toes separate; eyelids develop; major parts of brain are present	Chin grows; nostrils separate; face appears human; genitals appear male or female	Well-defined neck appears; genitalia are complete; sucking reflex appears	
Age (months)					
4	5	6	7	8	9
fetus					
 140 mm	 190 mm	 230 mm	 270 mm	 300 mm	 350 mm
Blood cells form; all major organs form; head and body hair appear; movements are felt by mother		Fetus may be viable if born; eyelids open; lungs and lung circulation develop; may suck thumb; fat deposited under skin		Fetus usually viable if born; fat deposits increase; body hair is lost; head hair is well developed; most senses are well developed; fetus turns head down in uterus	

Embryonic Development

- Early development of an organism is called **embryonic development**
- In humans it is the first **two months** after fertilization
- At the end of the first week it is called a **morula**, and at the end of two weeks a **blastula**

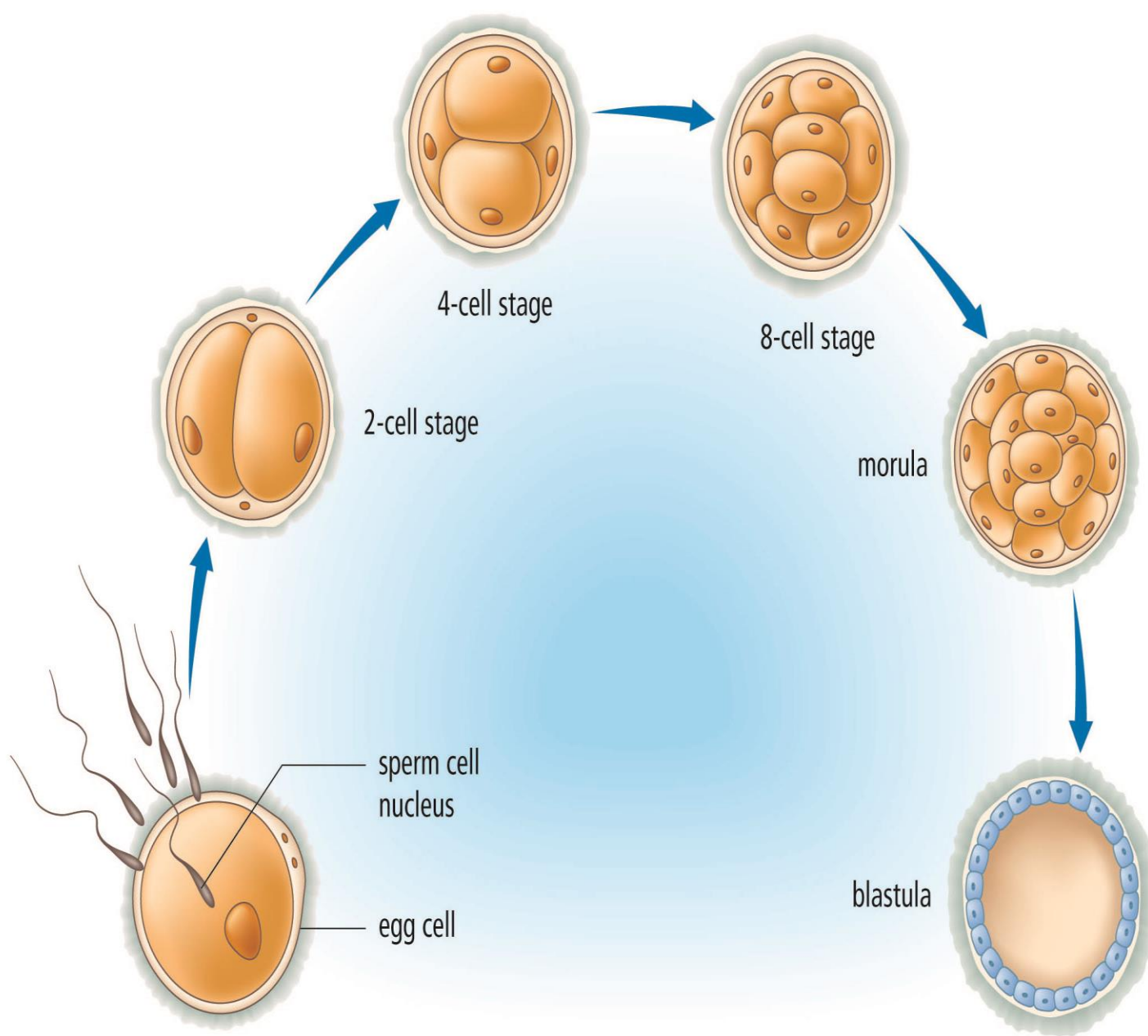
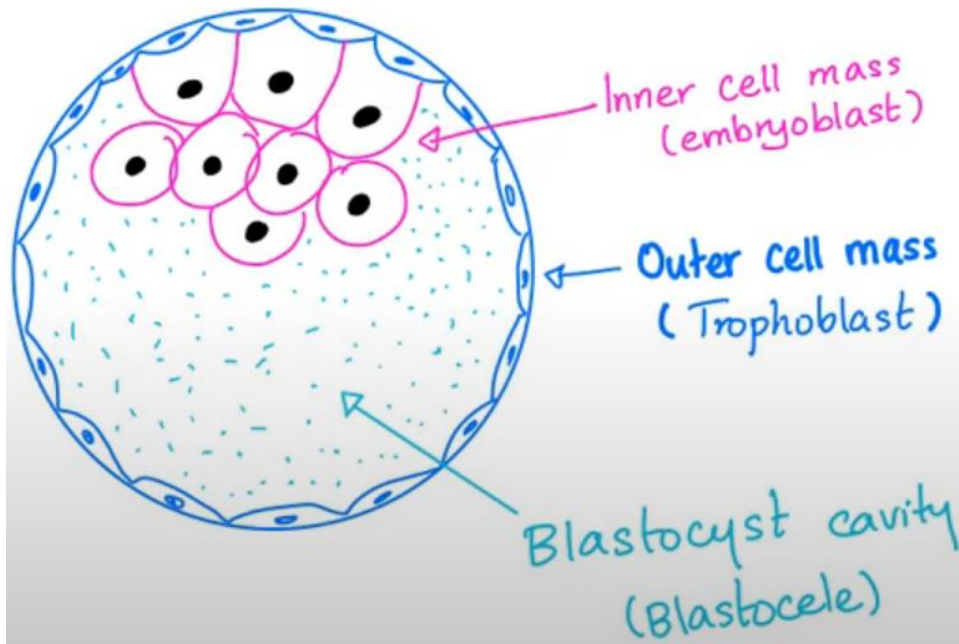


Figure 6.33 Mitosis and cell division are the basis of embryonic development.

The inner cell mass of the blastula becomes the **organism** (i.e., the baby).

The outer cell mass forms the **placenta** (the placenta implants to the uterus of the mother and delivers oxygen and other nutrients to baby)



Blastocyst cavity makes room for in-folding of the blastula that forms the gastrointestinal tract.

Embryonic Development

- The cells are embryonic **stem cells**. Stem cells are undifferentiated which means they can form any kind of specialized cell.
- In the next stage it organizes into **three layers**, called a gastrula

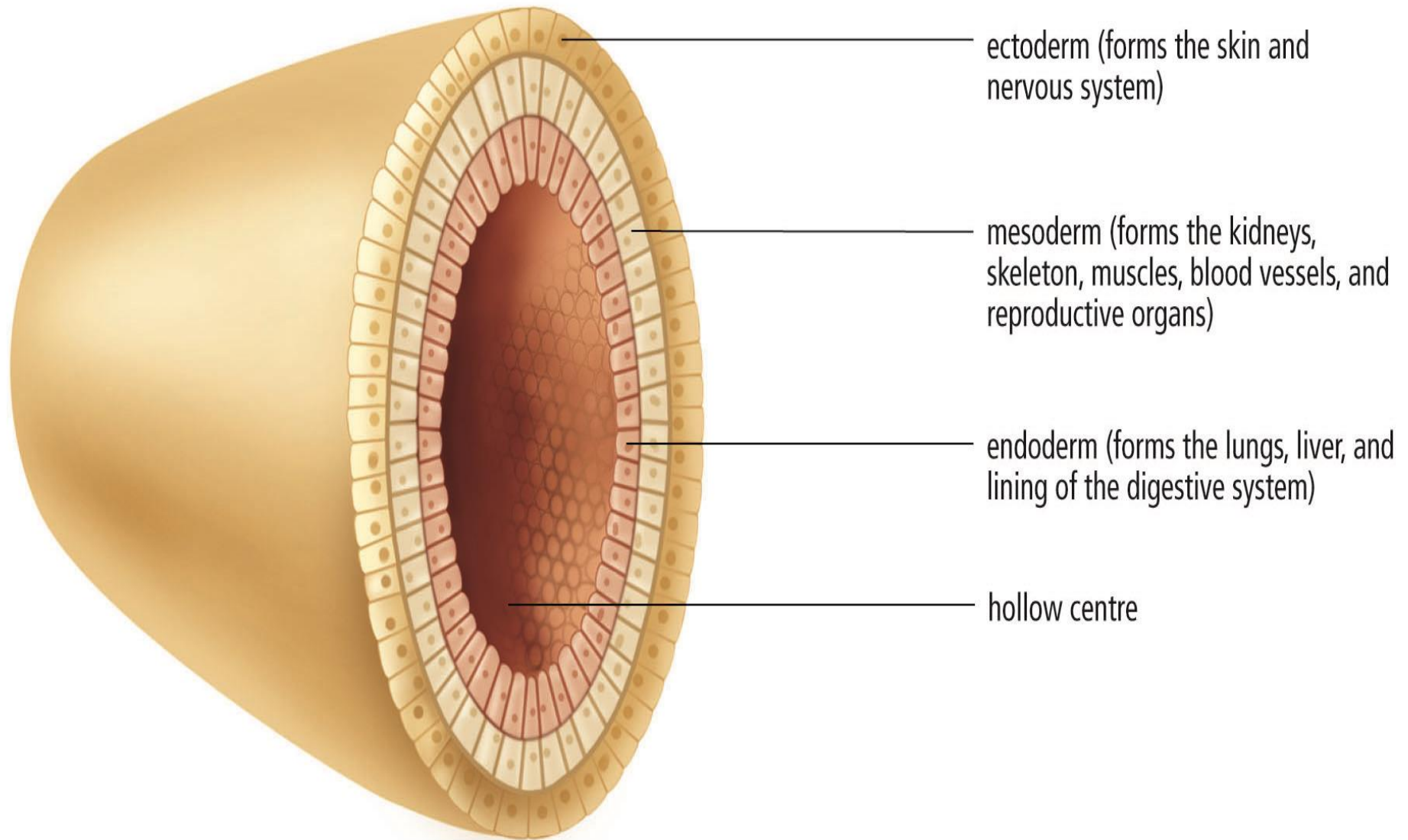


Figure 6.34 In the gastrula, cells are organized in three layers. Cells in these layers will eventually form organs.

Gastrula formation from Zygote

- <https://www.youtube.com/watch?v=jsFn-SC2Q8>

Fetal Development

- First trimester: developing organ systems, now called a **fetus**
- Second trimester: **rapid growth** between 12 and 16 weeks.
- Third trimester: significant growth in the **brain**

Fetus Development Month by Month

- <https://www.youtube.com/watch?v=cX59tv5iqr4>

External Fertilization

- Sperm and egg unite **outside of the bodies** of the parents
- Common in animals that live in the **water**
- If a sperm cell comes in contact with an egg cell of the same species, fertilization **may occur**

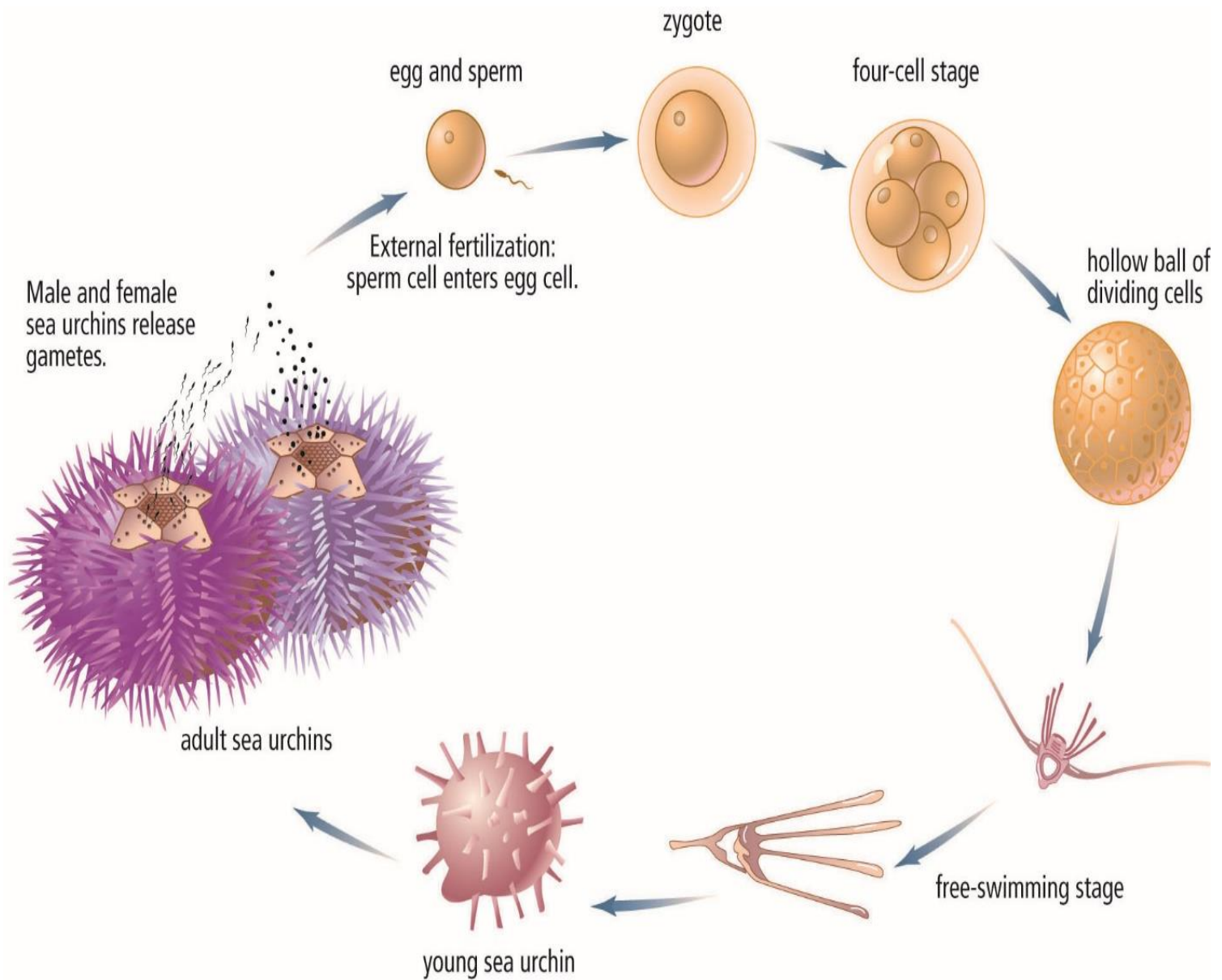


Figure 6.19 The life cycle of the sea urchin. Many water-dwelling animals that rely on external fertilization have a similar life cycle.

Barrel sponge external reproduction

- <https://www.youtube.com/watch?v=SIPpOJin5Wc>

External Fertilization

- Advantages
 - Very **little energy** required to find a **mate**
 - **Large numbers** of offspring produced at one time
 - Offspring usually **widely spread out** (little competition)

External Fertilization

- Disadvantages
 - Many gametes **will not survive** outside of parent's bodies or meet to result in fertilization
 - Since parents do not care for offspring, **few survive to adulthood**

Internal Fertilization

- Sperm cells are **deposited within** the females body where they meet an egg cell
- Once a single sperm cell has merged with an egg cell, **no more** are able to enter
- The embryo **develops** and is nourished **inside** the mother's body for a period of time
- After offspring are born, most mammals **continue to protect** their young for months or years

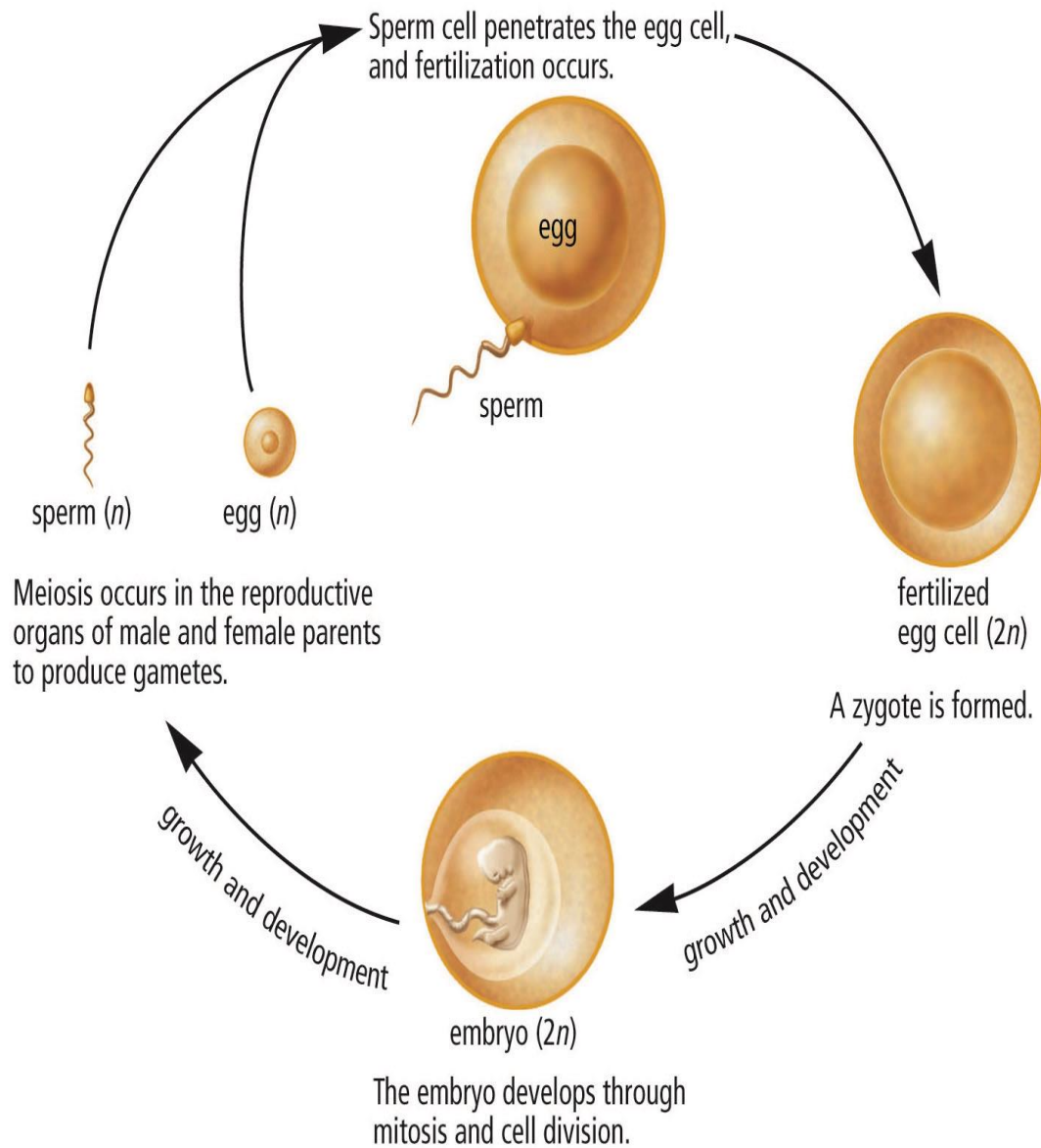


Figure 6.23 The life cycle of animals

Internal Fertilization

Advantages

- **More offspring survive** as a result of embryo protection and parental care

Disadvantages

- Requires **more energy** to find a mate
- Results in the production of **fewer zygotes**

Mating Rituals (sexual reproduction)

- <https://www.youtube.com/watch?v=W7QZnwKqopo>