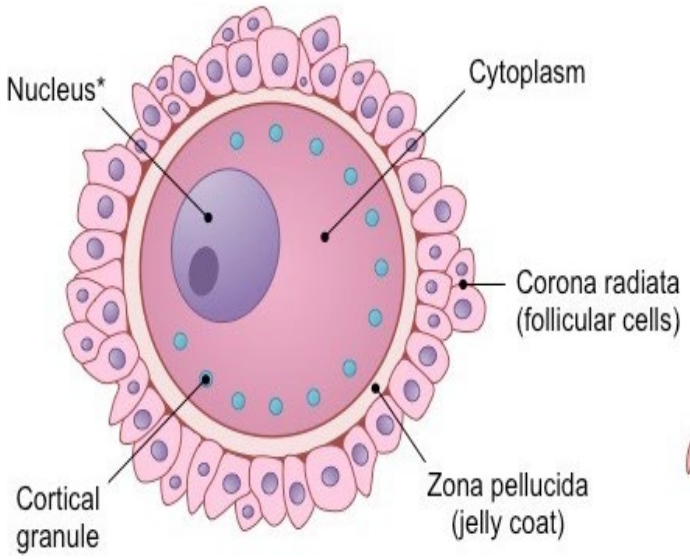
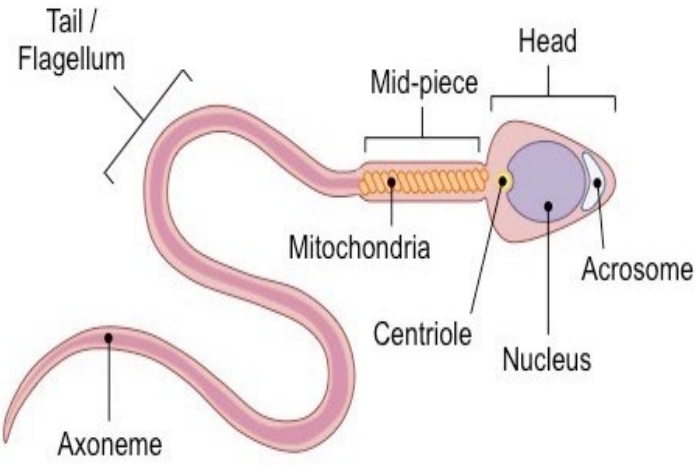
A. STRUCTURE OF EGG AND SPERM CELLS

Human Egg (Ovum)

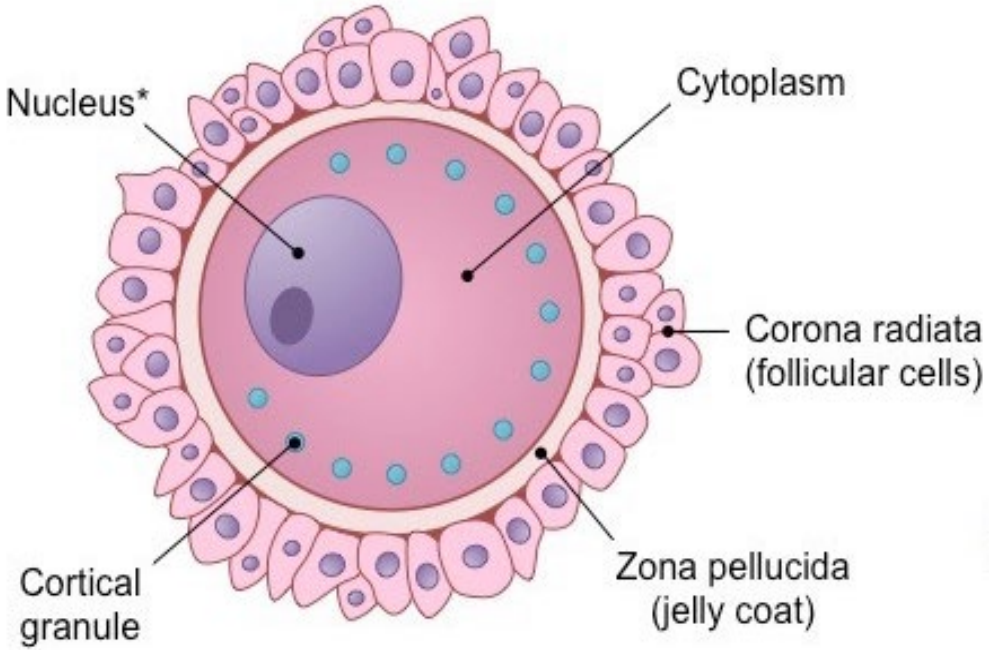


Human Sperm (Spermatozoa)



Haploid nucleus of 23 chromosomes	**Haploid nucleus of 23 chromosomes**
Large cytoplasm stores fat and protein for embryo growth	Acrosome enzymes that digest the zona pellucida (jelly coat) around the egg
Zona pellucida protects the egg cell and restricts entry of sperm	Helical mitochondria produce ATP by aerobic respiration for swimming
Cortical granules harden the zona pellucida (jelly coat) to prevent multiple fertilisation	Tail provides the propulsion for swimming
	Microtubules in a 9+2 setup make the tail beat from side to side
	Protein fibres strengthen the wall

B. BARRIERS ON AN EGG CELL



Sperm cells must get through **three** different layers:

- **Follicle cells** (corona radiata)
- **Jelly coat** (zona pellucida)
- **Cell membrane**

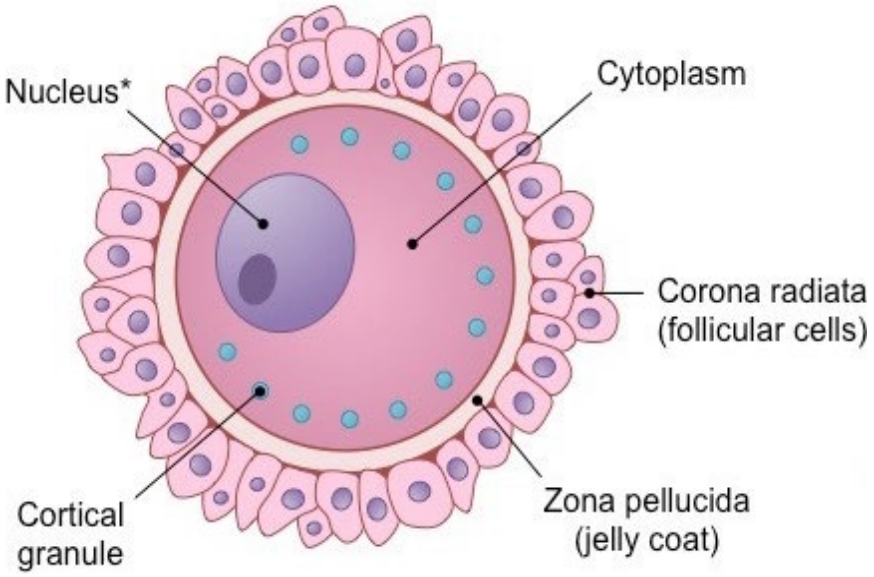
C. POLYSPERMY

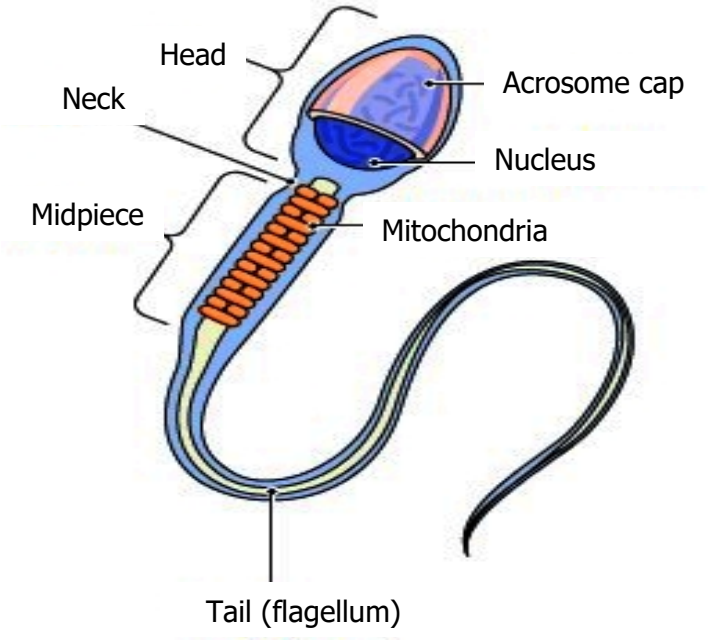
Fusion of two or more sperm with an egg to produce (e.g) a triploid zygote

These cells usually die.

- Polyspermy is **prevented** during **fertilisation**.

D. FERTILISATION





1. Sperm are **attracted** to a **chemical signal**, so they swim **up** the **oviduct** towards the **egg**.

2. **One sperm** breaks through the **layer** of **follicle cells** and **binds** to the **jelly coat** (zona pellucida).

3. This triggers the **acrosome reaction**.

   - The **acrosome** cap **separates** from the sperm, releasing **digestive enzymes**.

   - These allow the sperm to **go through** the **jelly coat** (zona pellucida) and reach the **cell membrane**.

4. The **cell membranes** of **sperm** and **egg fuse**. Sperm **nucleus** enters the egg and **fuses** with its **nucleus**.

5. This **fusion** triggers the **cortical reaction**. **Cortical granules** move to the **cell membrane** of the **egg** and **fuse** with it.

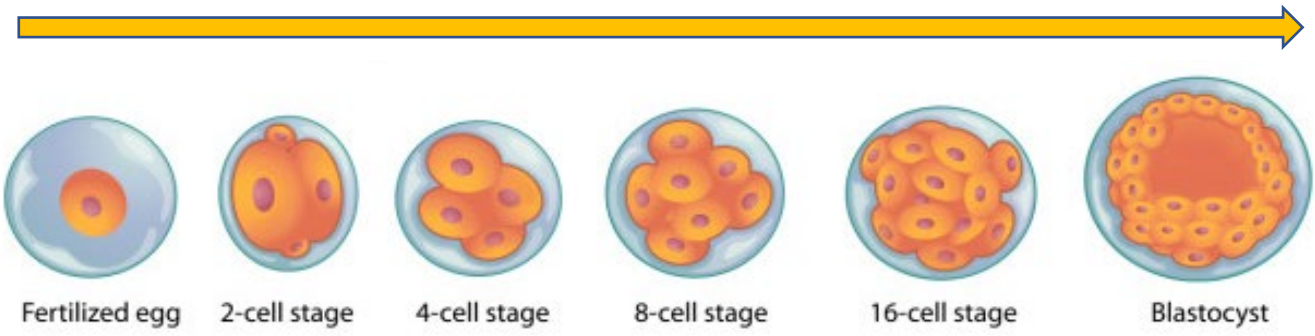
   - they **release** their **contents** (**enzymes**) by **exocytosis**

   - these **enzymes cross-link glycoproteins** in the **jelly coat** (zona pellucida), making it **hard**. This prevents further sperm from entering (= **prevents polyspermy**)

6. **Mitosis** occurs to produce a **2-cell embryo**.

E. EMBRYO DEVELOPMENT

REPEATED MITOSIS
DURING THIS TIME, IT TRAVELS DOWN THE OVIDUCT TO THE UTERUS



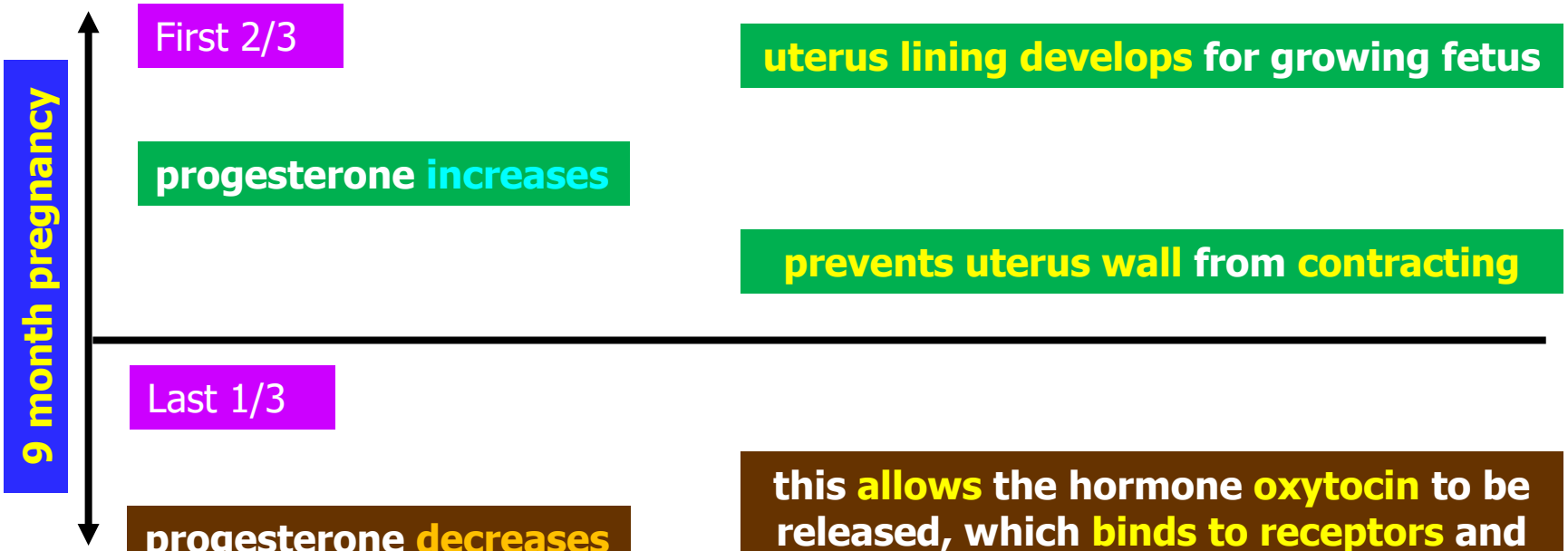
The **blastocyst**:

- is a hollow **ball of cells**;
- **implants** into the **uterus lining** when 7 days old;
- then **secretes HCG** hormone;
- **HCG stimulates ovaries** to **release progesterone** for the first 3 months;
- **HCG maintains/prevents degeneration** of the **corpus luteum** so it **continues** to **produce progesterone**
- **progesterone** makes sure the **uterus lining continues to thicken**;
- by week 12, the **ovary stops secreting progesterone** and the **placenta takes over** this role: it **secretes progesterone (and oestrogen) until childbirth**.

AT DIFFERENT STAGES, EMBRYO CELLS DIFFERENTIATE AND BECOME SPECIALISED

THIS IS DONE BY SWITCHING ON (EXPRESSING) SPECIFIC GENES SO THAT DIFFERENT ORGANS DEVELOP

F. HORMONAL CONTROL OF PREGNANCY



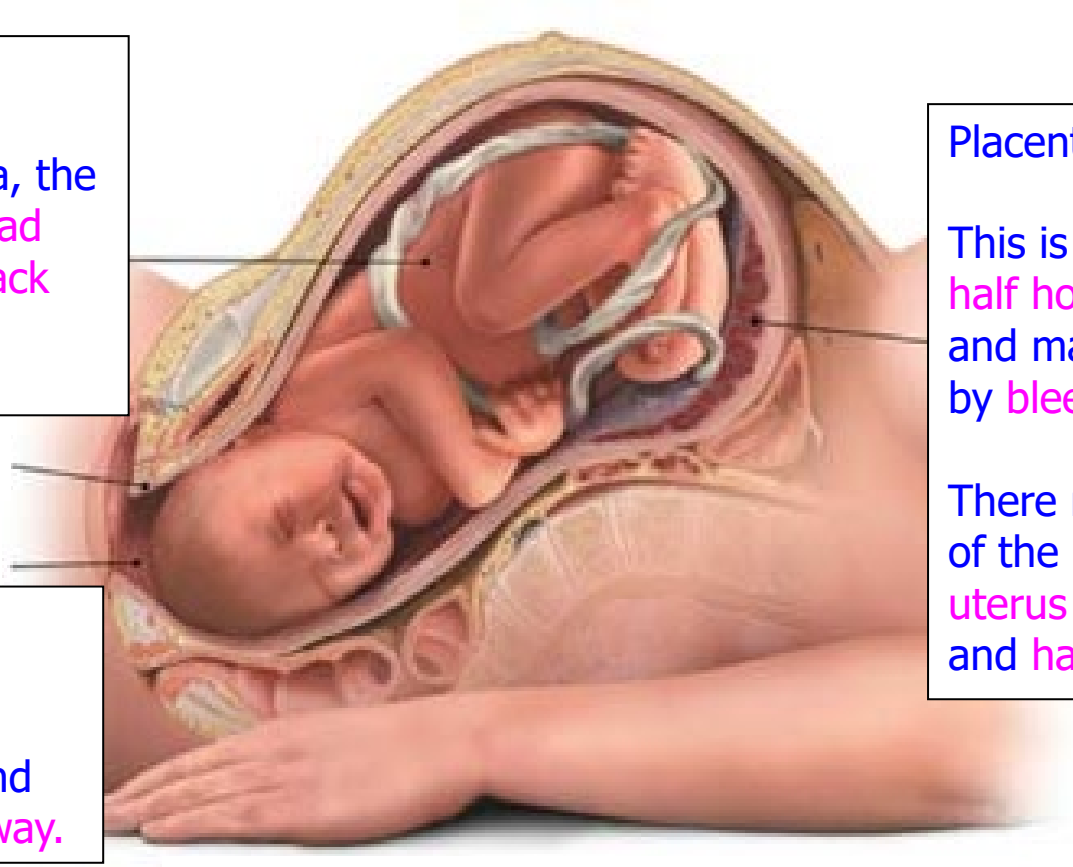
Uterus contractions cause more oxytocin to be released, so contractions become stronger and stronger = positive feedback

Uterus contractions cause cervix to dilate; amniotic sac bursts, releasing fluid; baby born after several hours of contractions

G. CHILDBIRTH

Fetus

To pass into the vagina, the fetus must bend its head forward and turn its back towards its mother's stomach.



Placenta

This is pushed out in the half hour following the birth and may be accompanied by bleeding.

There must be no residue of the placenta left in the uterus to avoid infection and haemorrhage.

Vagina

At the moment of being pushed out, the vagina and cervix form a single pathway.

Pushing Out (Expulsion)

The baby is pushed out when the cervix is dilated enough to allow it to pass through.

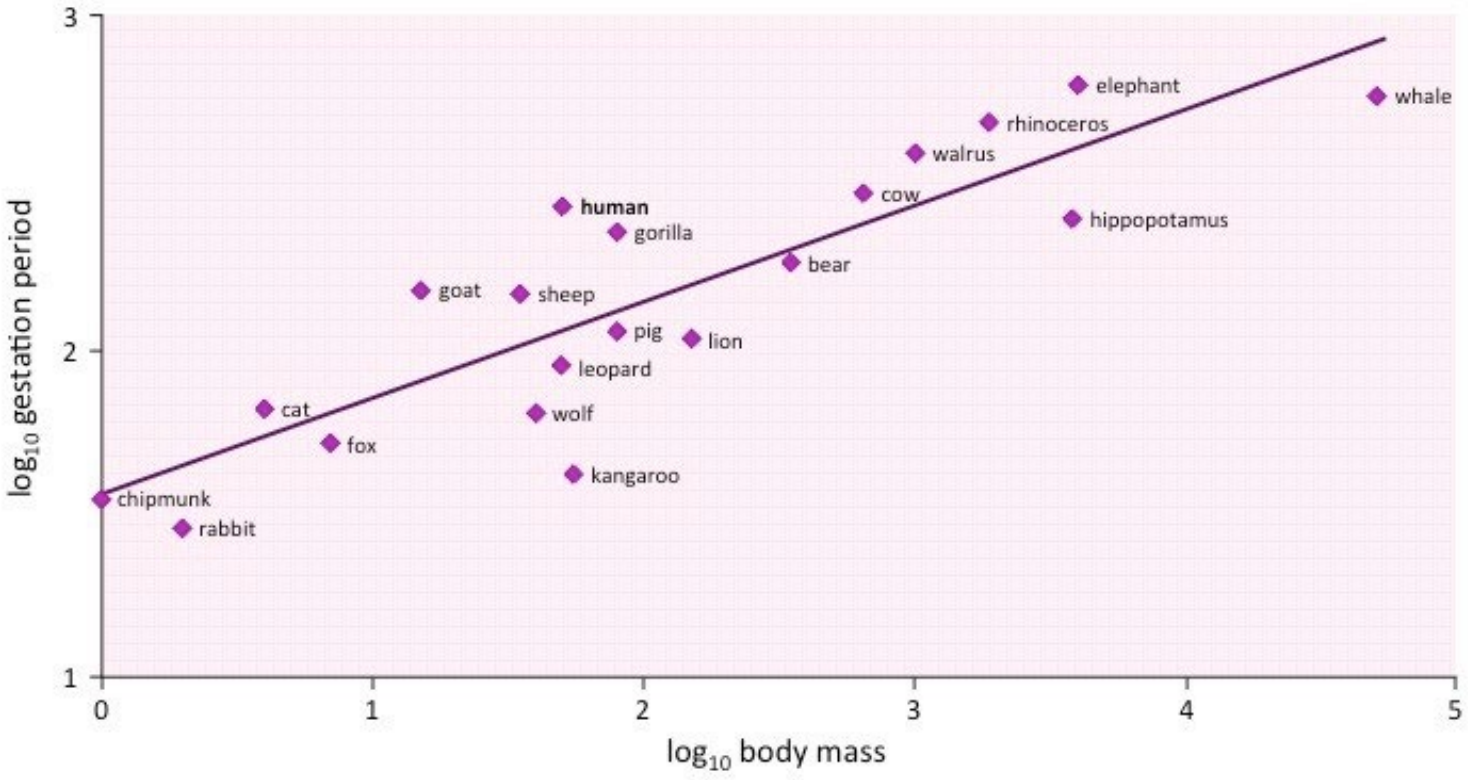
This pushing out is helped by the uterus wall contracting and voluntary abdominal contractions of the mother.

H. INTERNAL v EXTERNAL FERTILISATION

Internal Fertilization	External Fertilization
The male passes his sperm into the female's body (copulation)	Males put their sperm over the eggs
Fertilisation happens inside the female's body	Fertilisation happens outside the female's body
e.g. mammals (humans), reptiles (pythons) and birds (albatrosses)	e.g. fish (salmon) and amphibians (frogs)
Less susceptible to environmental influences, such as predators and pH changes	More susceptible to environmental influences, such as predators and pH changes
Species can use internal fertilisation to prevent exposure and the drying up of gametes or embryos Offers more protection to the gametes and embryos, but at a potential survival cost to the mother	Species that reproduce this way usually release large amounts of gametes to compensate for losses

I. GESTATION PERIODS

- The **gestation period** is the **amount of time** that a female is **pregnant** before **giving birth**.



- Generally, the **larger the animal, the longer the gestation period** (= a **positive correlation**)
- But there are **some species with the same gestation period** that are **very different in size/mass**
- **Offspring** from animals with **longer gestation periods** tend to be **more advanced** in their **development**.
- This makes sense as **more developed infants** will typically require a **longer gestation period**.