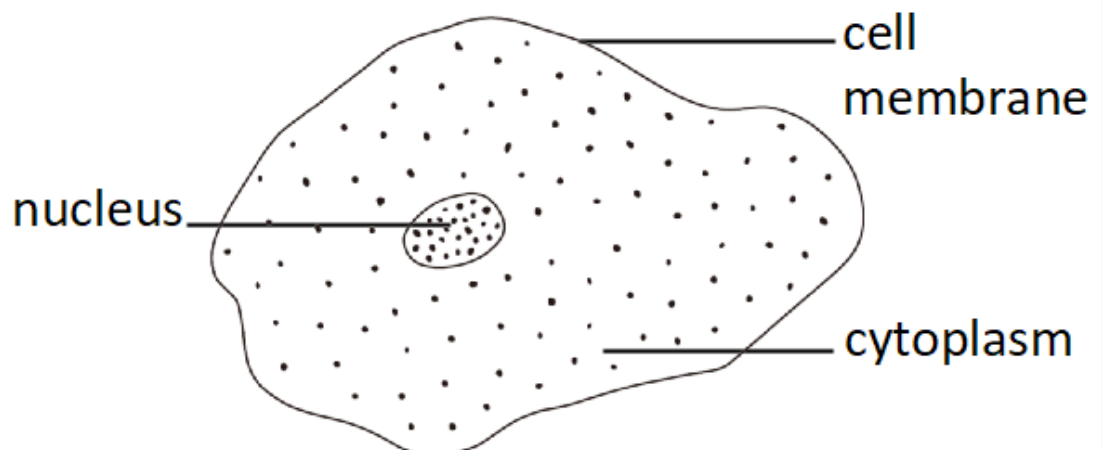
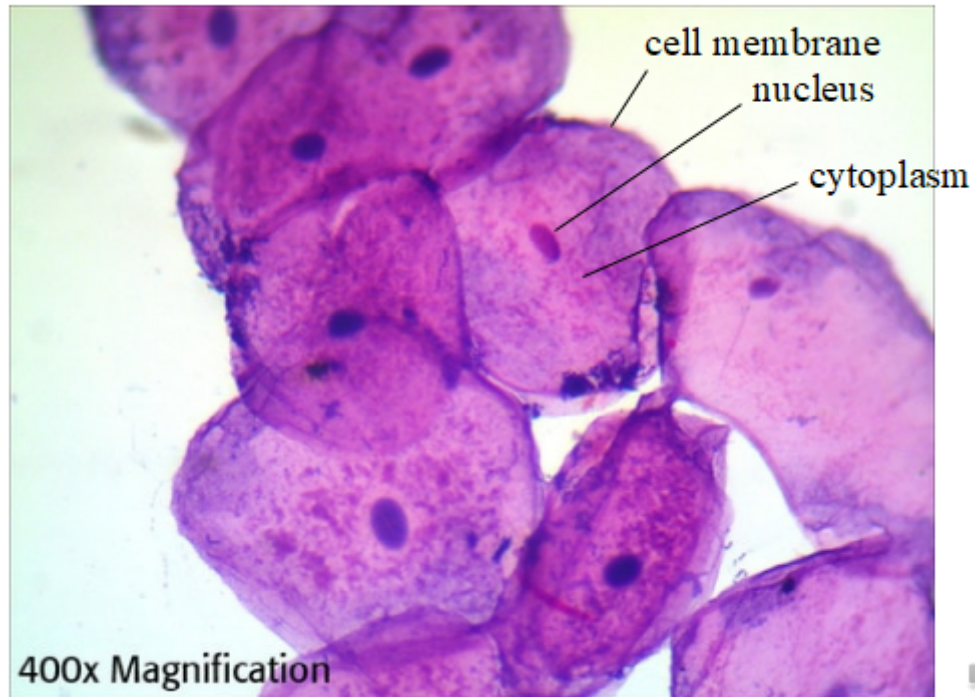


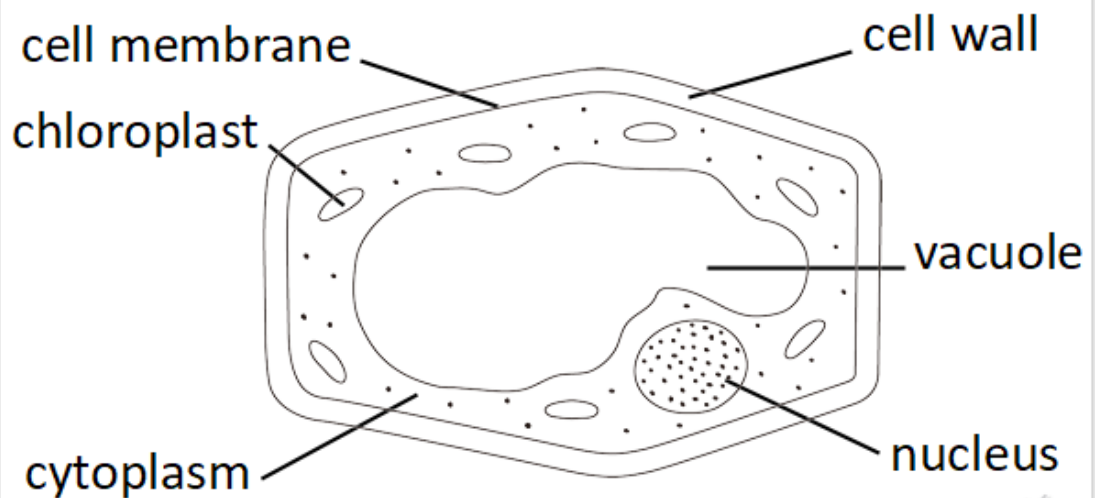
chapter 4 (附中文解釋)

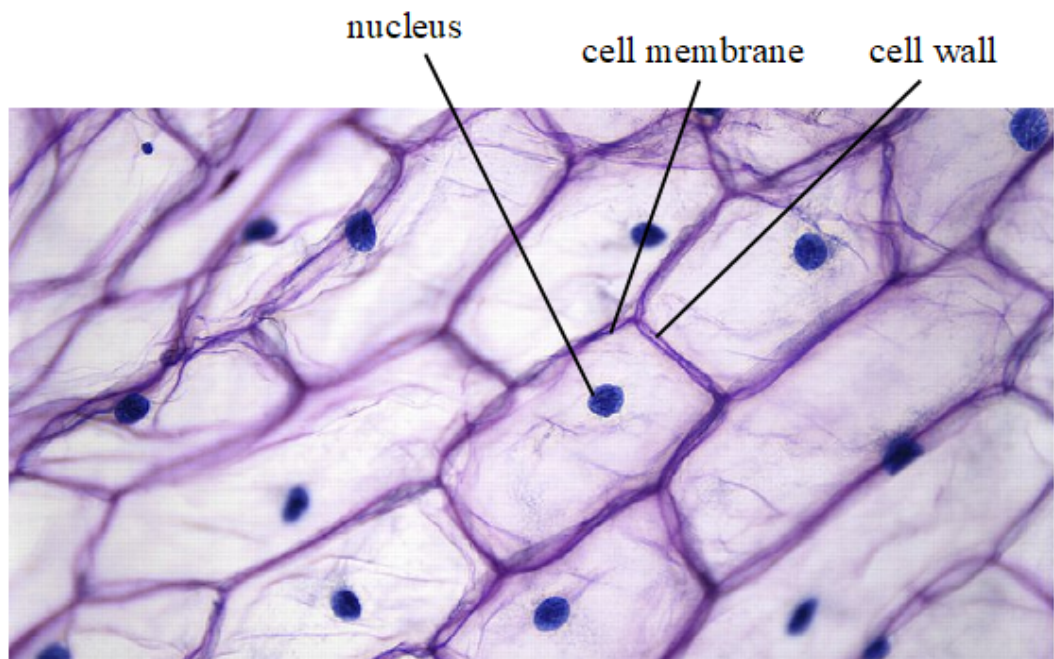
- cells 細胞
 - basic unit of living things
 - all living things are made up of cells
 - made up of **1 cell** only
 - called unicellular organisms 單細胞生物
 - made up of **2 or more cells**
 - called multicellular organisms 多細胞生物
 - basic structures of cells
 - animals cells
 - **cell membrane** 細胞膜
 - Each animal cell is surrounded by a thin layer
 - **cytoplasm** 細胞質
 - Inside the membrane is a jelly-like substance
 - **nucleus** 細胞核
 - Surrounded by cytoplasm





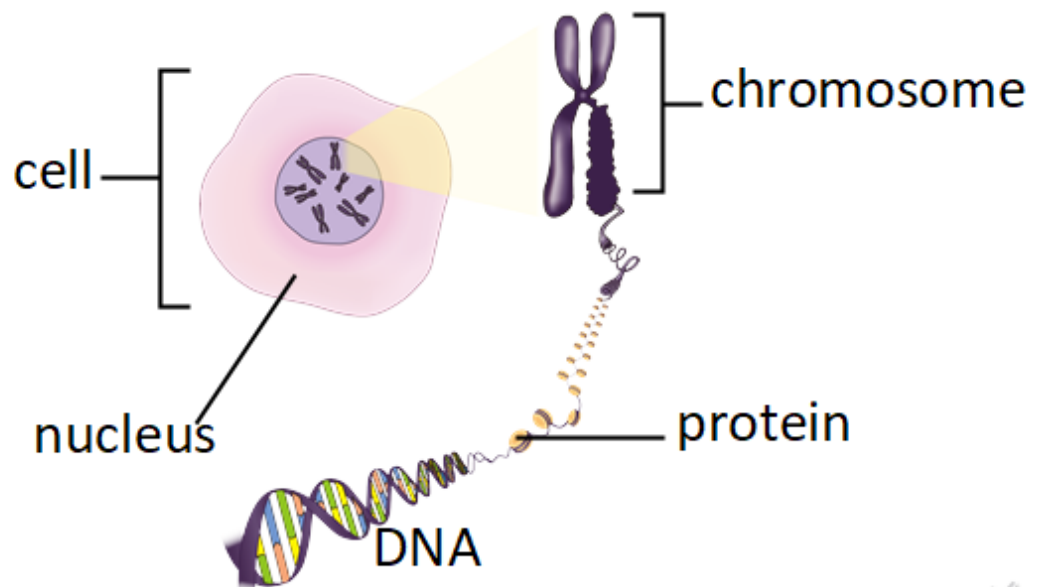
- plant cells
 - also consists of a cell membrane, a nucleus and cytoplasm
 - **cell wall 細胞壁**
 - plant cell has a rigid cell wall outside the cell membrane.
 - **vacuole 液泡**
 - There is usually a large vacuole in the cytoplasm.
 - **chloroplasts 葉綠素**
 - Some cells in green plants also contain chloroplasts.



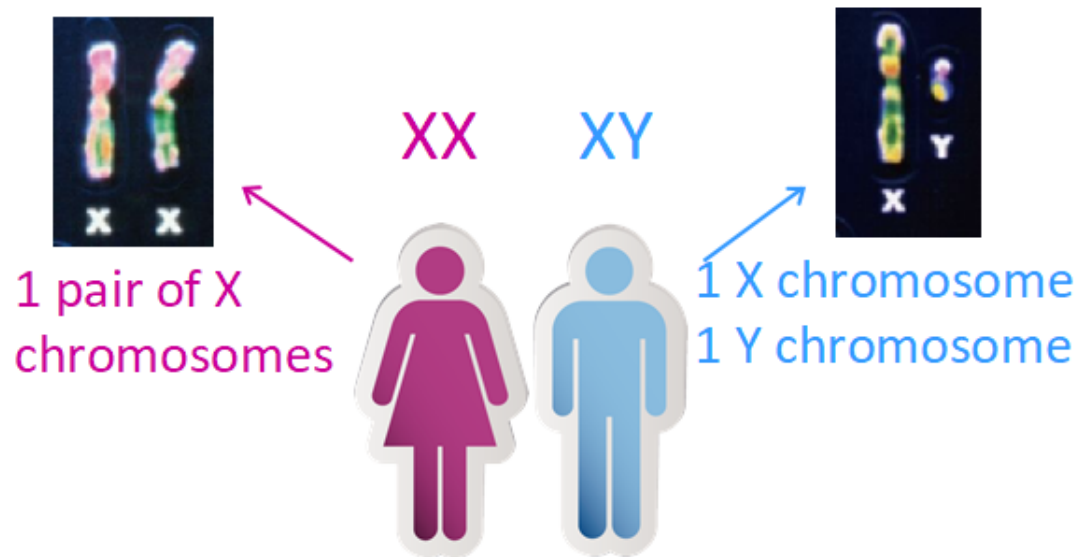


- Functions of the basic structures of cells
 - Cell membrane
 - Present in both animal cells and plant cells
 - Controls the **movement** of substances into and out of the cell
 - Nucleus
 - Present in both animal cells and plant cells
 - Contains **genetic materials 基因** which control the **activities** of the cell
 - Cell wall
 - Present only in plant cells
 - **Protects, supports** and **gives shape** to a plant cell
 - Cytoplasm
 - Present in both animal cells and plant cells
 - The medium where **chemical reactions** take place
 - Vacuole
 - Present only in plant cells
 - Contains mainly **water** and stores **dissolved minerals 溶解矿物**
 - Chloroplast
 - Present only in plant cells
 - Site where **photosynthesis 光合作用** takes place in order to make food
- Observing cells with a microscope
 - The microscope
 - light microscopes
 - Can magnify **放大** the image of an object by up to a few hundred times

- electron microscopes
 - Can magnify the image of an object by up to several million times
- Genetic materials inside the nucleus of a cell
 - DNA (deoxyribonucleic acid)
 - the genetic materials inside the nucleus
 - contains all instructions needed for the cells to function, grow and reproduce
 - determines what features we receive from our parents
 - Chromosomes and DNA
 - DNA
 - The DNA coils up and wraps around the proteins
 - DNA coiled 卷 around proteins 蛋白質 in the nucleus of an animal cells
 - Chromosomes 染色體
 - Inside the nucleus of a cell, there are thread-like structures
 - made up of DNA and protein in the nucleus of an animal cells
 - in the nucleus of an animal cells



- Chromosomes in human body cells
 - Every cell in the human body contains 23 pairs of chromosomes or 46 chromosomes
 - There are 22 pairs of autosomes and one pair of sex chromosomes.



- Cell division and growth

- cell division 細胞分裂

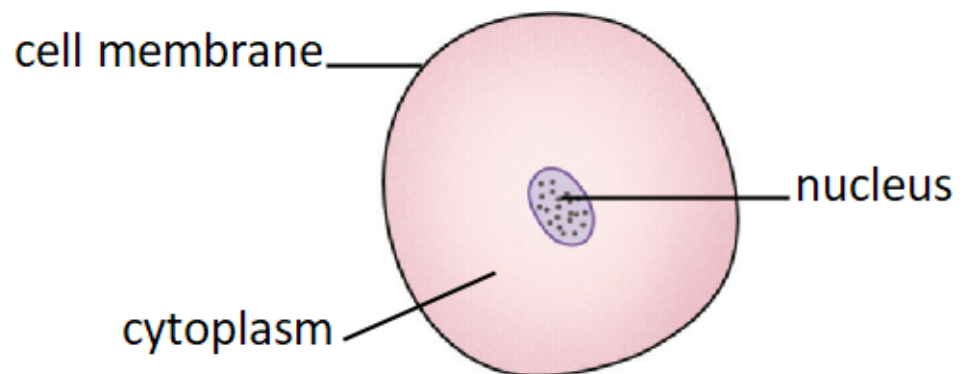
-

- When living things grow, the number of cells in their bodies increases by cell division.

- step 1

- Before cell division, the genetic materials in the nucleus of the parent cell make an identical 一樣的 copy of themselves.

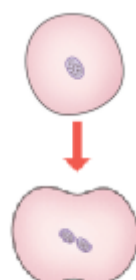
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- step 2

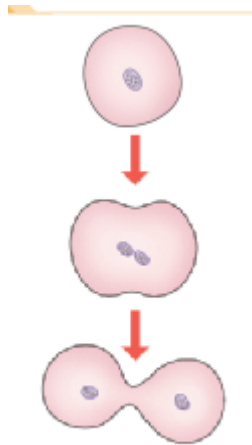
- The nucleus divides into two.

-



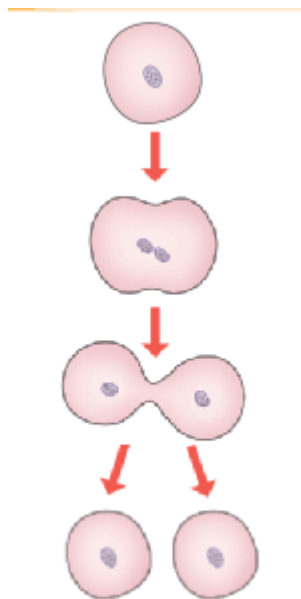
- step 3
 - The cytoplasm divides into two.

-



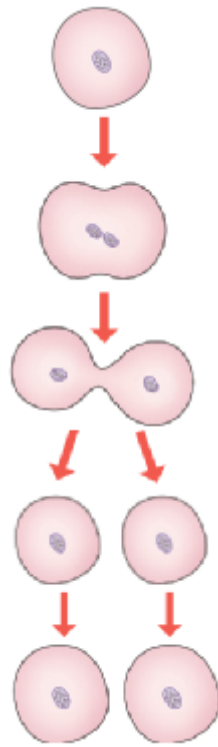
- step 4
 - Two new cells called daughter cells are formed, each containing a nucleus.

-



- step 5
 - The daughter cells absorb nutrients and grow bigger.

-



- When the daughter cells reach a certain size, they may divide again.
- As a result of repeated cell divisions and the increase in size of cells, living things grow bigger.

- How are cells organized in living things?

- The right tools for the job

- multicellular organisms

- many different types of cells

- cells are specialized 專門 for carrying out a particular job

- human body

- hundreds of different types of specialized cells

- come from stem cells

- stem cells

- cell differentiation 細胞分化

- can differentiate 分化 into different types of cells

- specialized to perform a particular function

- example

- animal cells

- nerve cells

- for carrying messages

- long and have many branches

- enables them to carry messages throughout the body

- muscle cells
 - for movement
- red blood cells
 - for carrying oxygen around the body
- Skin cells
 - flat and close together
 - makes them a good protective layer 保護層 for the body
- Fat cells
 - store so much fat that the nucleus is pushed to the cell membrane
 - large store of fat helps the body keep warm
- plants cells
 - Transporting cells
 - long and tube-shaped
 - transport water, nutrients and minerals throughout the plant
 - Leaf cells
 - contain many chloroplasts for the plant to carry out photosynthesis
 - Root hair cells
 - increase the surface area of the root in contact with the soil
 - more water and minerals can be absorbed
- The shape and size
 - related to its function

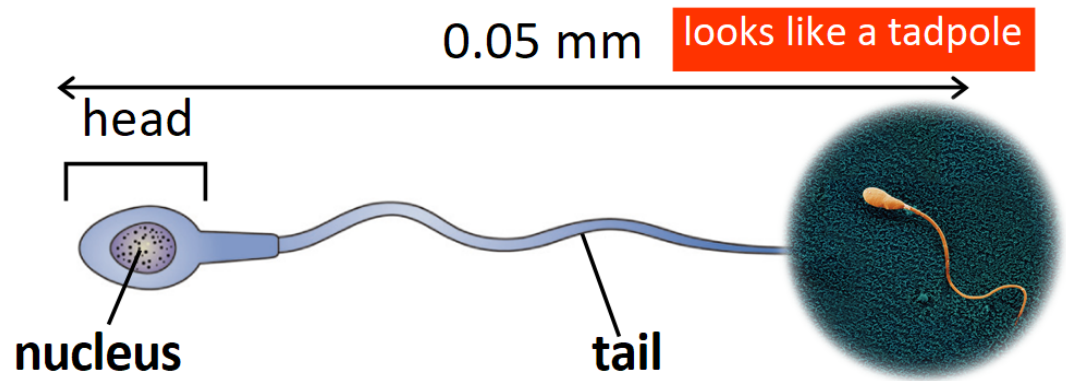
• Human reproduction

- - one of the vital functions of all living things
 - Living things produce offspring 後代 to ensure the continuity of species.
- human sex cells
 - - Humans reproduce by sexual reproduction
 - a male sex cell called sperm
 - a female sex cell called ovum (plural: ova) or egg.

- Sperms 精子

- has head & tail
- look like a tadpole 蝌蚪
- nucleus
 - carries the genetic materials of the male parent (father)
- tail
 - beats to allow the sperm to swim

-



- Ovum / Ova / Egg 卵子

- a spherical shape 球體
- much larger than a sperm
- surrounded by a jelly coat
- nucleus
 - carries the genetic materials of the female parent (mother)
- cytoplasm
 - contains food substances

- cannot move

-

cytoplasm

- contains food substances

nucleus

- carries the genetic materials of the female parent (mother)

jelly coat

spherical shape

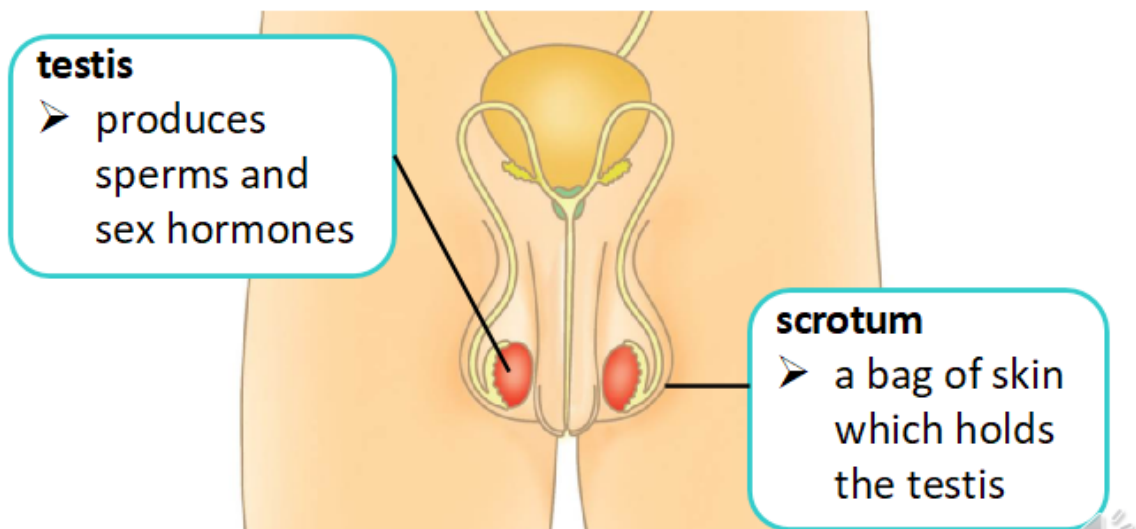
0.1 mm



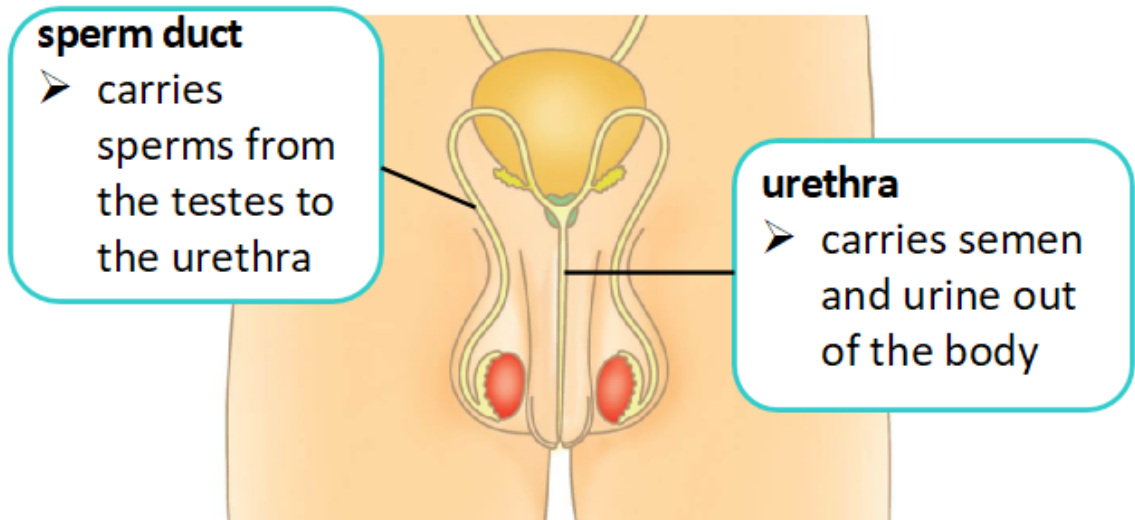
- Chromosomes in human sex cells
 - sex chromosomes
 - sex chromosomes in female body cells → XX
 - sex chromosomes in male body cells → XY
 - Sperms
 - formed from father's sperm-producing cells
 - During their formation, each pair of autosomes and the pair of sex chromosomes separate.
 - Ova
 - formed from mother's ovum-producing cells.
 - During their formation, each pair of autosomes and the pair of sex chromosomes separate.
- a sperm and an ovum each carries 23 chromosomes.
-

	Male		Female	
	Body cell	Sex cell (sperm)	Body cell	Sex cell (ovum)
No. of chromosomes	46 (in 23 pairs)	23	46 (in 23 pairs)	23
No. of autosomes	44	22	44	22
Sex chromosomes	XY	half in number: X half in number: Y	XX	X

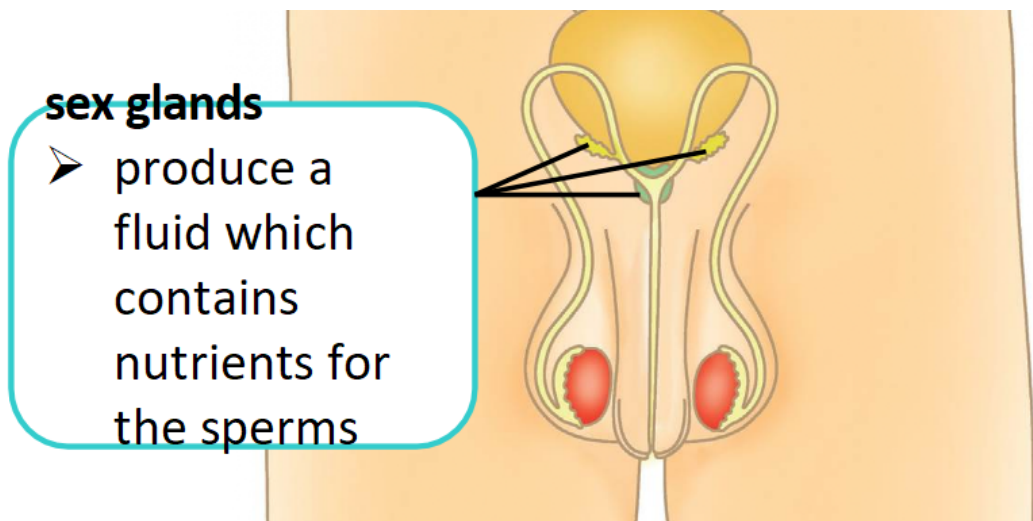
- Human reproductive systems
 - Male reproductive system
 - sperms
 - produced in the **testes** (singular: testis) 睪丸
 - enclosed in the **scrotum** 陰囊
 - testis 睪丸
 - produces **sperms** and **sex hormones**
 - scrotum 陰囊
 - a bag of skin which **holds the testis**



- sperm ducts 輸精管
 - **connect the testes** to the **urethra**
 - **carries sperms** from the testes to the urethra
- urethra 尿道
 - **carries semen** and **urine** out of the body

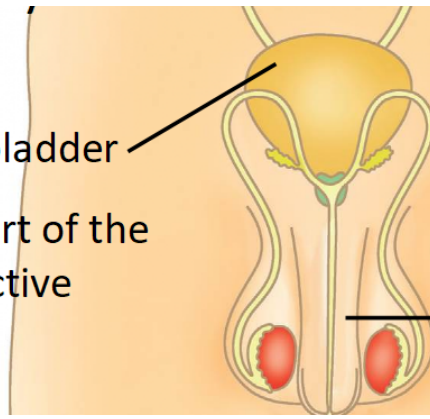


- sex glands 性腺體
 - When the sperms travel up the sperm ducts, they are mixed with a fluid from the sex glands
 - produce a fluid which contains nutrients for the sperms
 - keep the sperms alive
 - The sperms and the fluid together form the semen 精液
 -



- penis 陰莖
 - The semen flows through the urethra to the tip of the penis & passed out of the body
 - ejects semen to the female reproductive system during sexual intercourse
 -

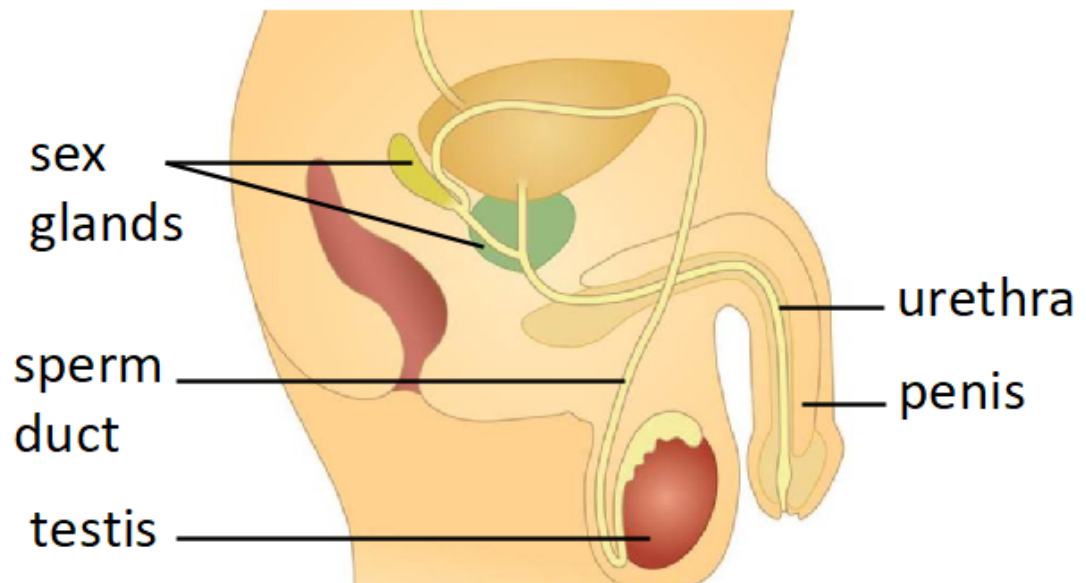
urinary bladder
(not a part of the
reproductive
system)



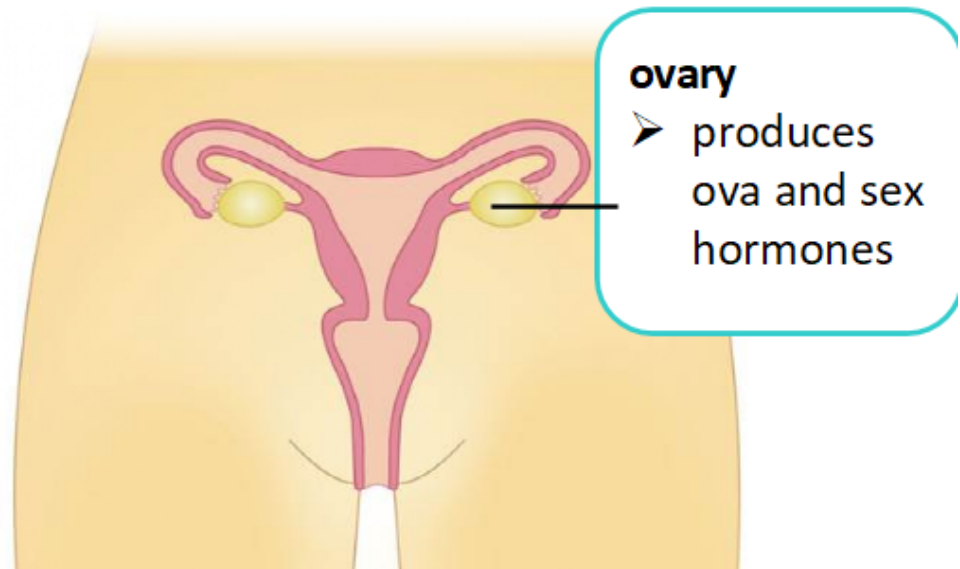
penis

- ejects semen to the female reproductive system during sexual intercourse

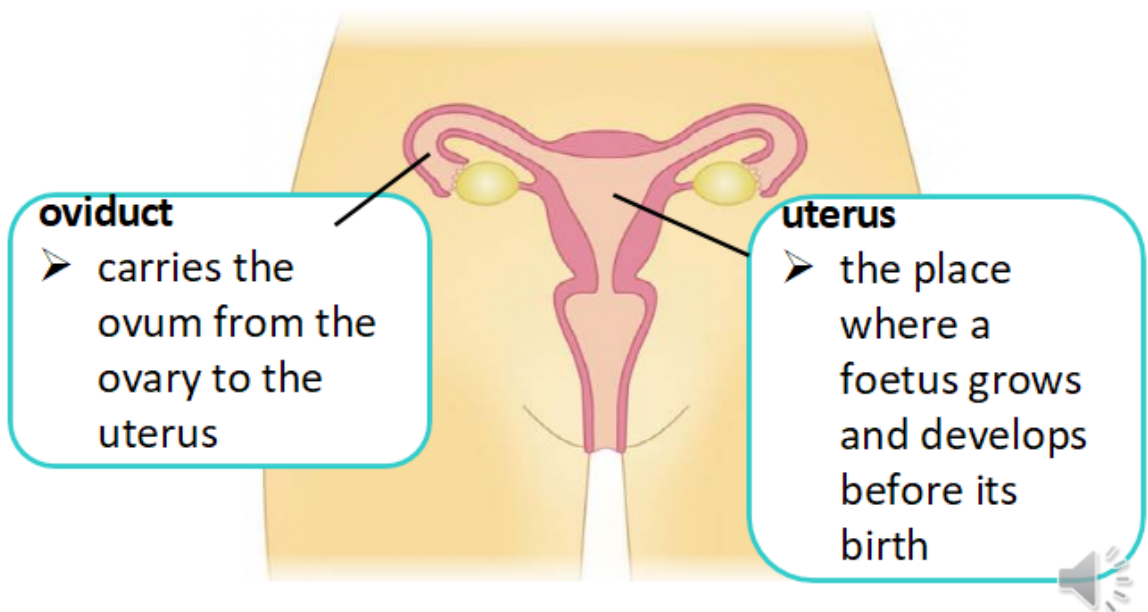
Side view of the male reproductive system



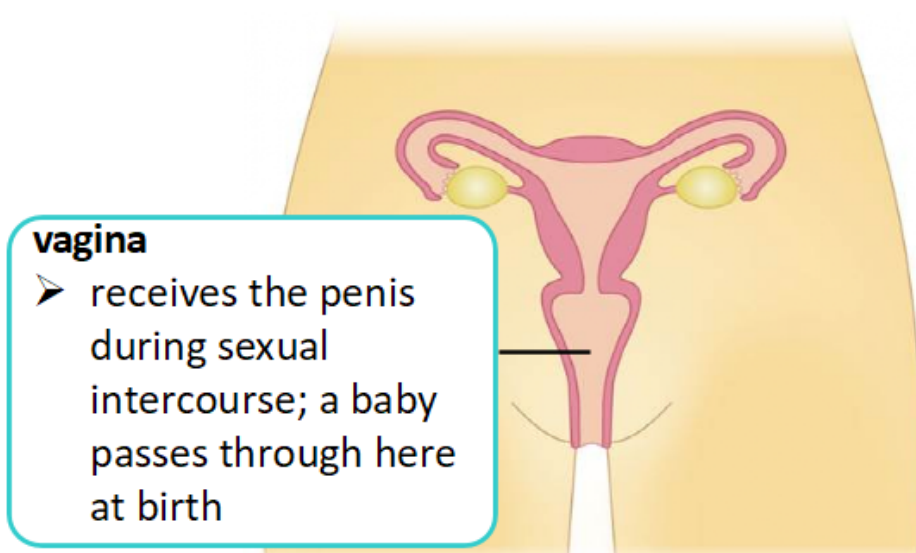
- Female reproductive system
 - ovaries (ovary) 卵巢
 - produces ova and sex hormones
 - Usually only one ovum is released into the oviduct each month
 - called ovulation 排卵
 - The ovum is then moved through the oviduct to the uterus



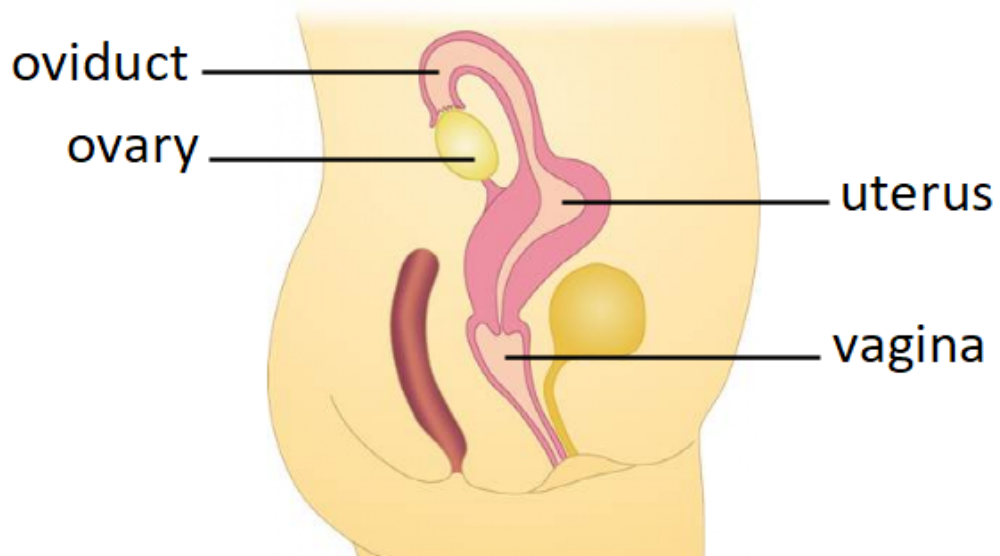
- oviduct 輸卵管
 - carries the **ovum** from the **ovary** to the **uterus**
- uterus 子宮
 - the place where a **foetus grows** and **develops** before its birth



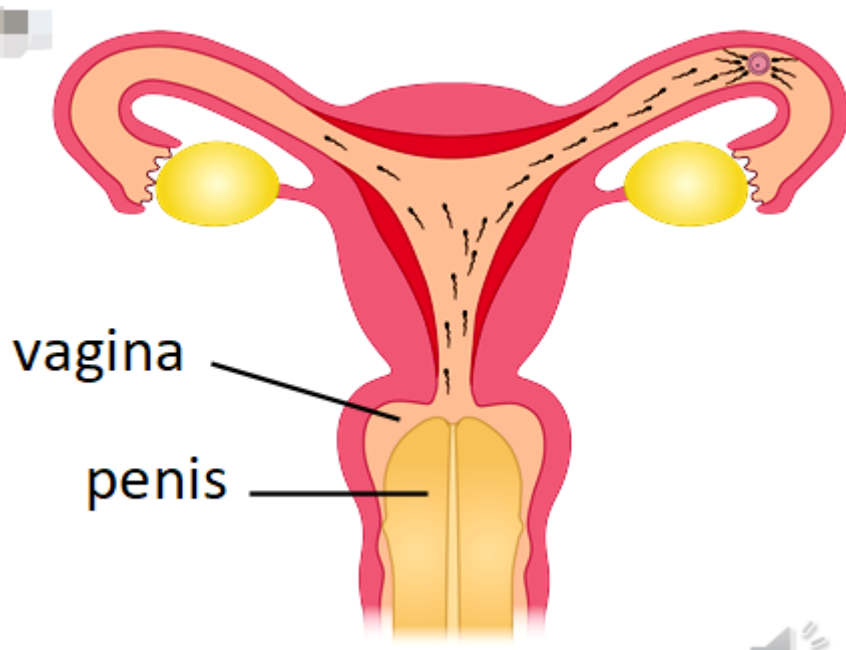
- vagina 陰道
 - The **uterus** opens to the **vagina**.
 - receives the penis during sexual intercourse; a **baby passes through** here at birth



Side view of the female reproductive system

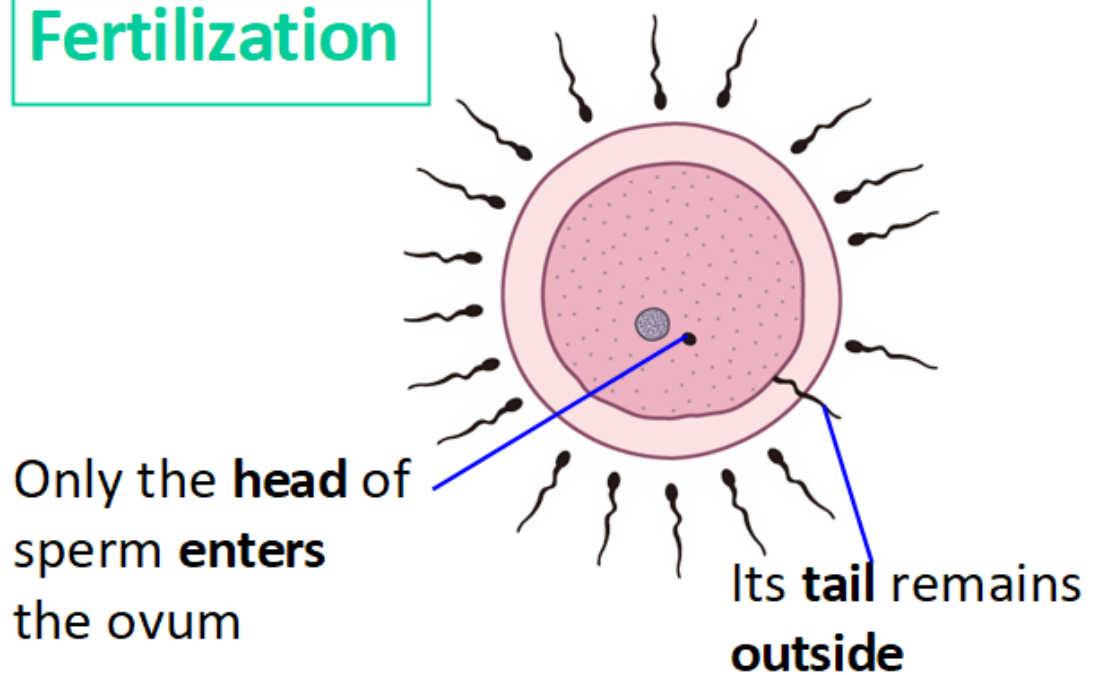


- Process of human reproduction
 - Fertilization 受精
 - A new life begins when a sperm fuses with an ovum.
 - sexual intercourse 性交
 - During sexual intercourse, the husband inserts his erect penis into the vagina of his wife.
 - Semen containing millions of sperms is ejected into the vagina.
 - Sperms swim up the uterus, and then enter the oviducts.



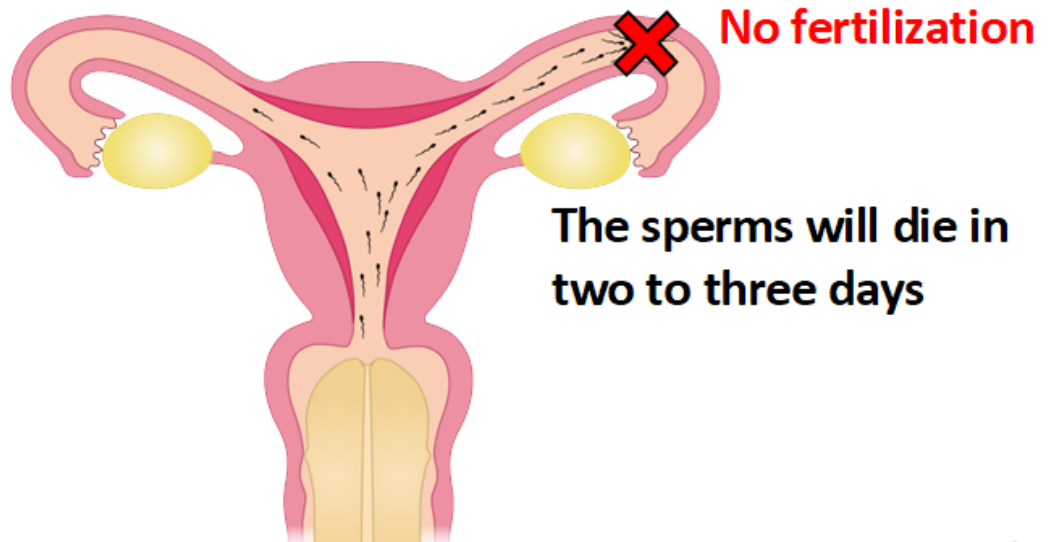
- If an ovum is present in the oviduct
 - one of the **sperms** may fuse with the **ovum**
 - form a **zygote** 受精卵 (also called a fertilized ovum)

Fertilization

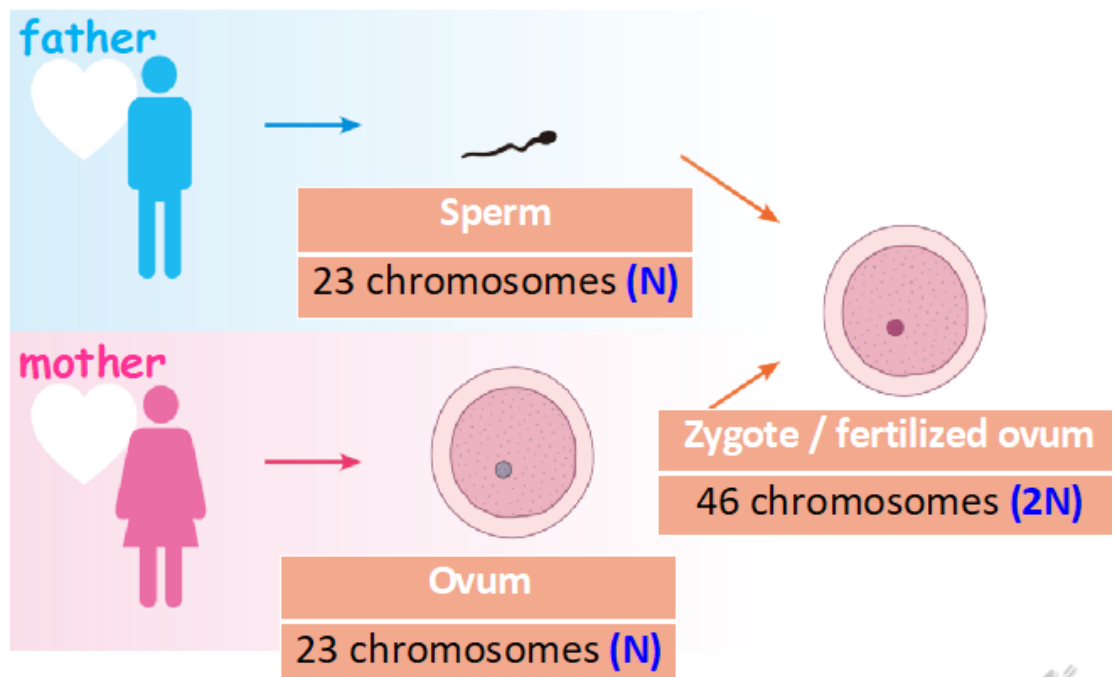


- The nucleus of the sperm fuses with the nucleus of the ovum to form a zygote.
- no ovum in the oviducts
 - sperms will die in two to three days

If there is no ovum in the oviducts...



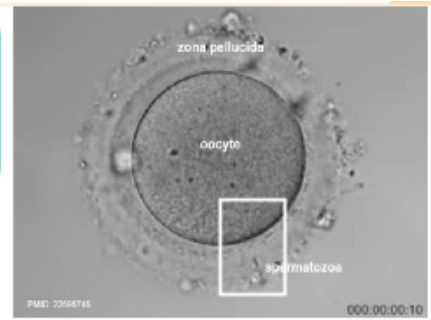
- chromosomes
 - The sperm and the ovum each carries 23 chromosomes (one set of chromosomes).
 - use 'N' to denote one set of chromosomes



- The zygote formed from fertilization carries 46 chromosomes (two sets of chromosomes).
- Implantation 植入
 - 1. After fertilization, a zygote is formed.
 - 2. The zygote divides and develops into an embryo 胚胎

2 The zygote divides and develops into an **embryo**.

1 After fertilization, a zygote is formed.



- 3. The embryo **implants** into the **uterine lining** 子宮内膜 (The woman is now pregnant 懷孕)

- embryo is **moved through** the **oviduct** to the **uterus**

-

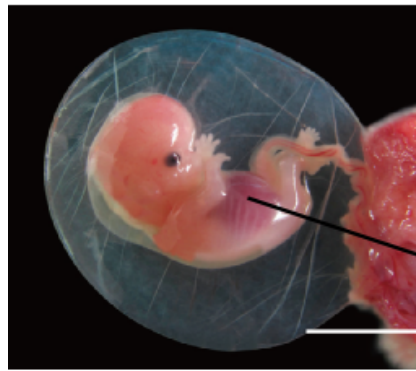
The woman is now pregnant.

embryo is moved
through the oviduct
to the uterus

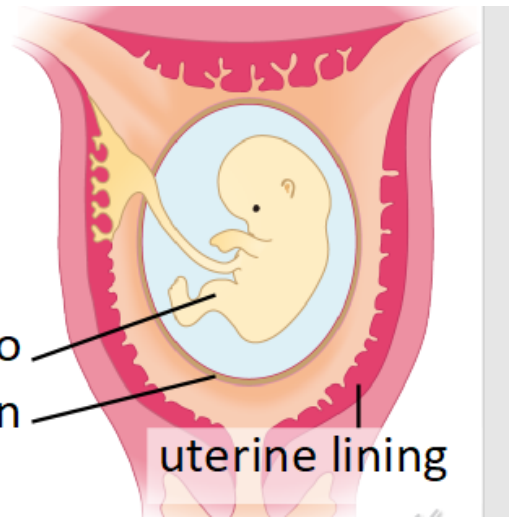
3 The embryo **implants**
into the **uterine lining**.

uterine lining

- Development of the embryo
 - After implantation, the embryo begins to **develop** in the uterus of its mother
 - develops inside a bag called the **amnion** 羊膜

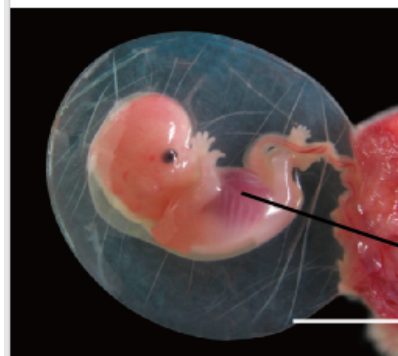


embryo
amnion

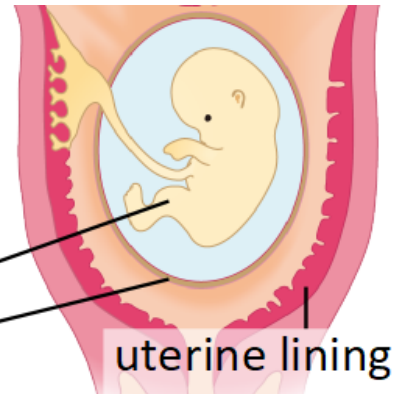


uterine lining

- The amnion is filled with a watery liquid
 - a cushion to protect the embryo against shock
 -

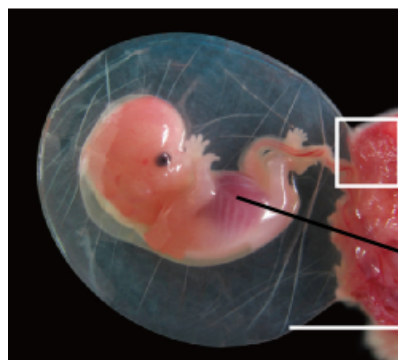


embryo
amnion



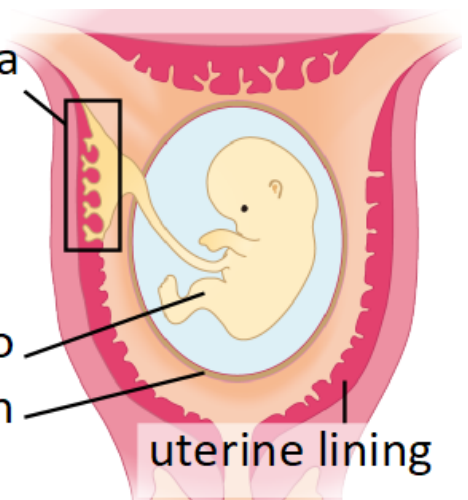
uterine lining

- At the site where the embryo is implanted
 - a placenta 胎盤 begins to form
 -



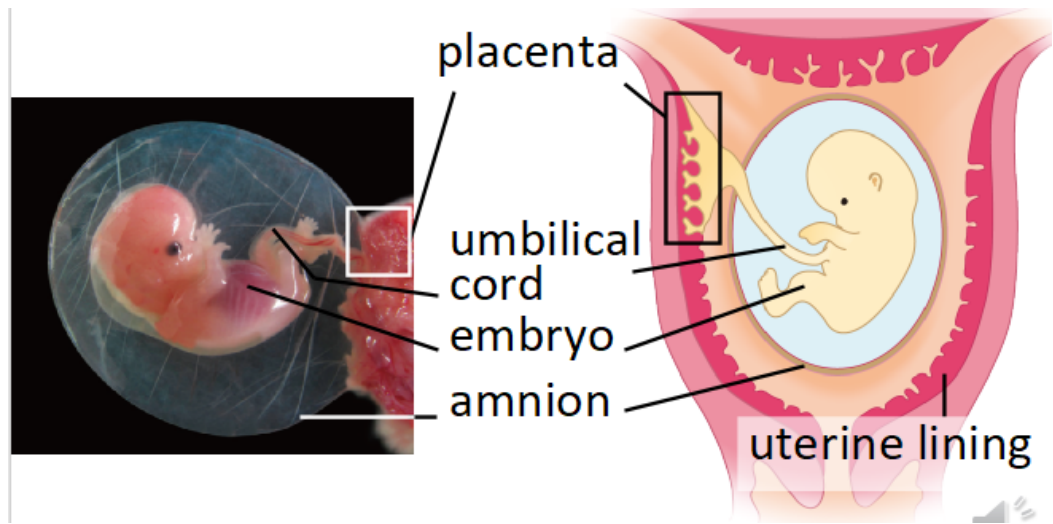
placenta

embryo
amnion



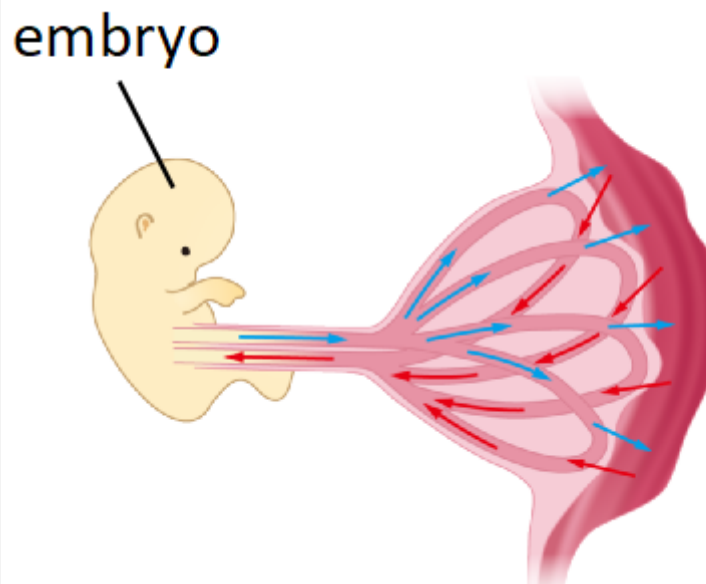
uterine lining

- The placenta is attached to the embryo by an umbilical cord
 -



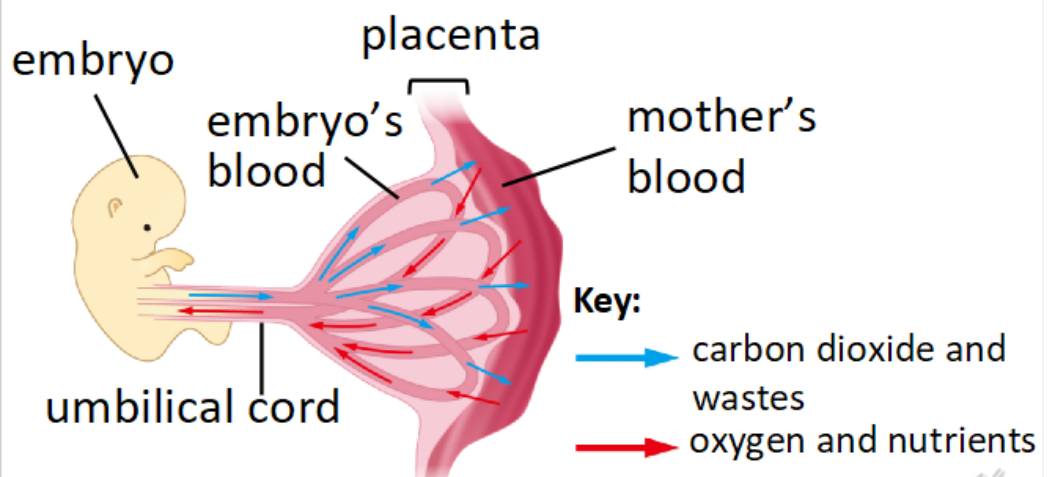
- The embryo gets oxygen and nutrients from its mother & gets rid of carbon dioxide and other wastes

•



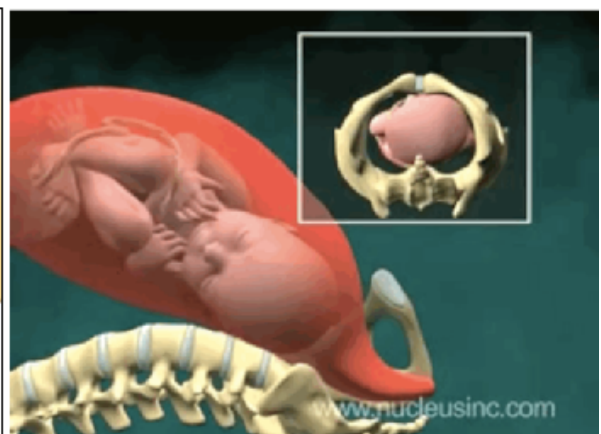
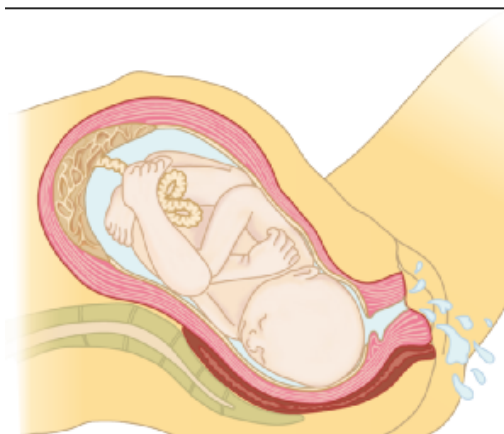
- placenta allows this exchange of materials

•



- About 8 weeks after fertilization

- The embryo develops into a **foetus** with all the major organs formed.
- About 38 weeks after fertilization
 - The foetus is ready to be **born**.
- From embryo to foetus before birth
 - Embryo: 1 week [~ 0.1 cm]
 - embryo is about to implant into the uterine lining
 - Embryo: 5 weeks [~ 0.4 cm; ~ 1 g]
 - heart beats
 - backbone formed
 - Foetus: 8 weeks [~ 3 cm; ~ 3 g]
 - all major organs formed
 - arms and legs begin to form
 - Foetus: 12 weeks [~ 10 cm; ~ 48 g]
 - head, neck, arms and legs continue
 - to develop and are more clearly seen
 - Foetus: 20 weeks [~ 20 cm; ~ 380 g]
 - arms and legs grow well
 - may begin to suck thumb
 - Foetus: 38 weeks [~ 36 cm; ~ 3 kg]
 - ready to be born
- Birth of a baby
 - When the foetus is about to be born
 - normally changes its position and lies with its **head downwards**.
 -



- Labour (the birth giving process) begins with a sign of pain in the abdomen
 - 1. Muscles of the uterus contract **strongly**.

- 2. Amnion breaks.
- 3. Watery liquid flows out to lubricate the vagina.
- 4. Opening of the uterus becomes wider.
- 5. Baby is pushed out with the head coming out first.
- After birth,
 - the baby cries for the first time
 - takes its first breath.
 - The doctor then clamps 夾住 and cuts the umbilical cord.
 - remains will dry up and fall off. The scar left behind is the navel.
 - The placenta is expelled 排出 after the baby is born