

chapter 4 (附中文解釋)

- cells 細胞

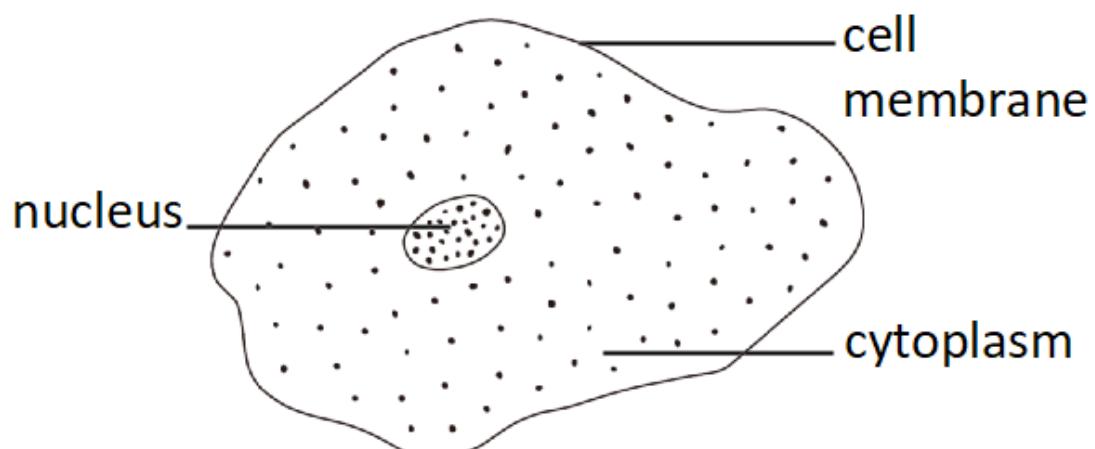
- basic unit of living things

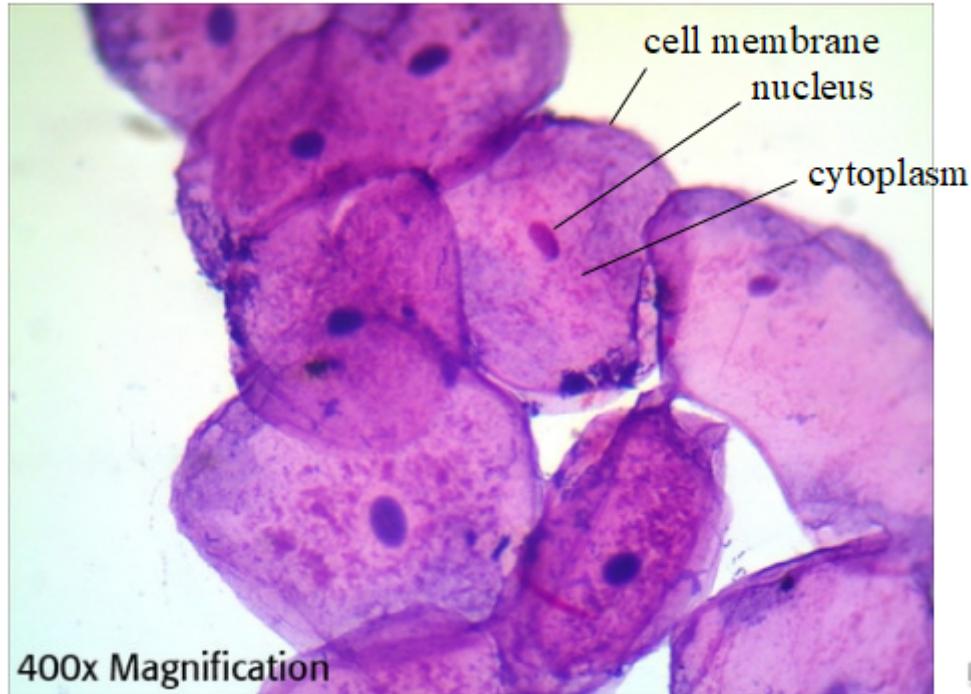
- all living things are made up of cells
 - made up of 1 cell only
 - called unicellular organisms 單細胞生物
 - made up of 2 or more cells
 - called multicellular organisms 多細胞生物

- basic structures of cells

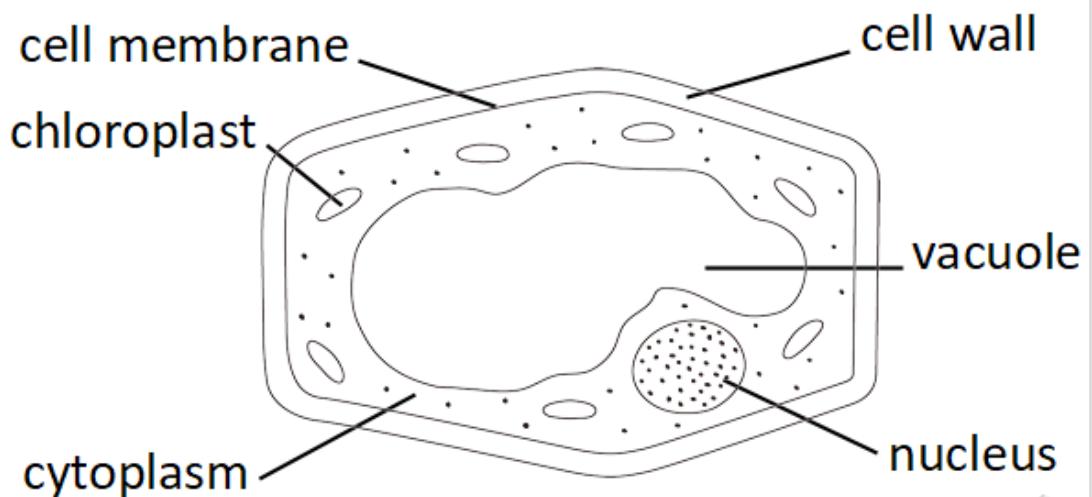
- animals cells

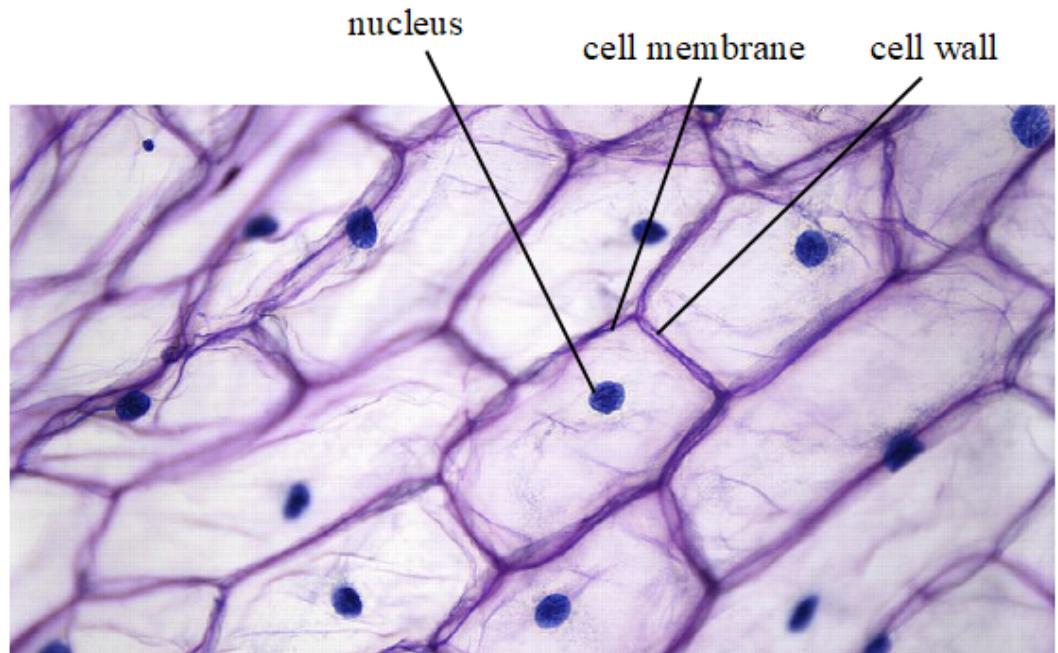
- cell membrane 細胞膜
 - Each animal cell is surrounded by a thin layer
 - cytoplasm 細胞質
 - Inside the membrane is a jelly-like substance
 - nucleus 細胞核
 - Surrounded by cytoplasm





- 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.
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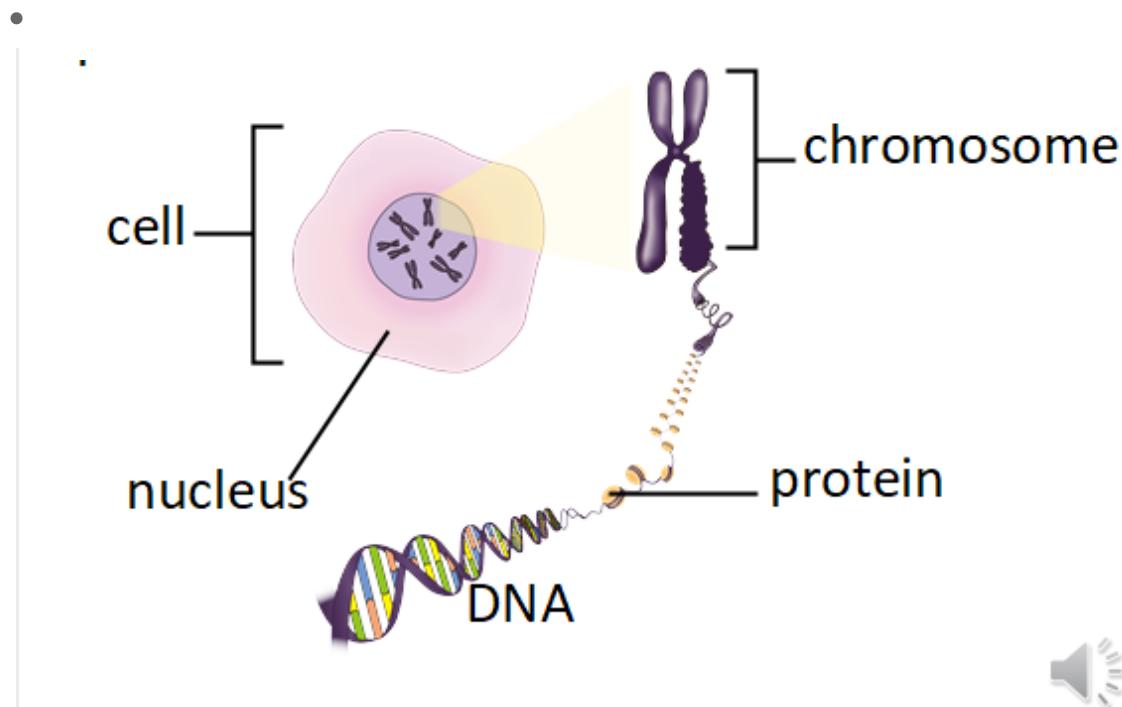


- Functions of the basic structures of cells
 - Cell membrane
 - Present in both animal cells and plant cells
 - Controls the movement of substances into and out of the cell
 - Nucleus
 - Present in both animal cells and plant cells
 - Contains genetic materials 基因 which control the activities of the 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

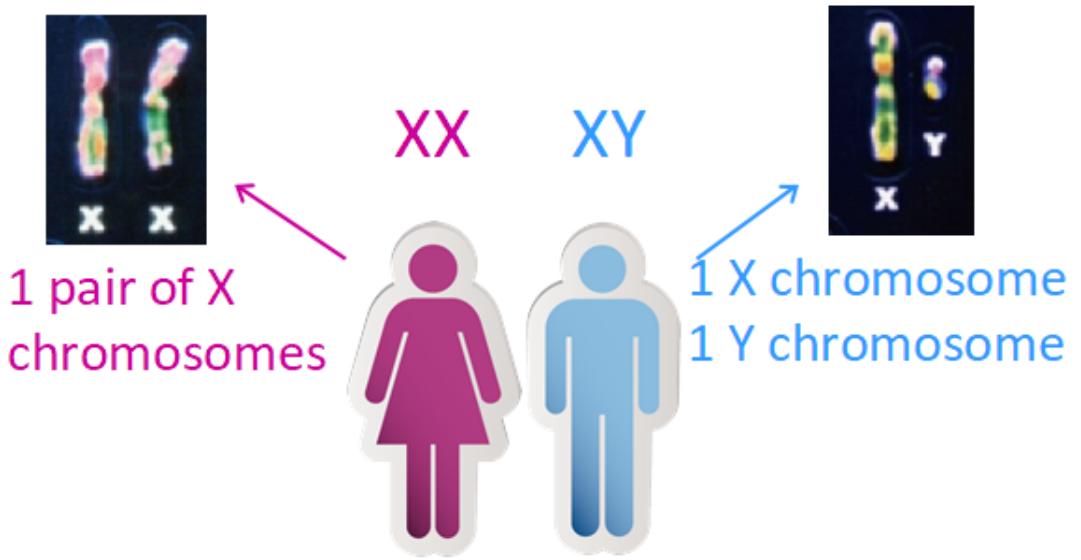
- electron microscopes
 - Can magnify the image of an object by up to several million times
- Genetic materials inside the nucleus of a cell
 - DNA (deoxyribonucleic acid)
 - the genetic materials inside the nucleus
 - contains all instructions needed for the cells to function, grow and reproduce
 - determines what features we receive from our parents

- Chromosomes and DNA

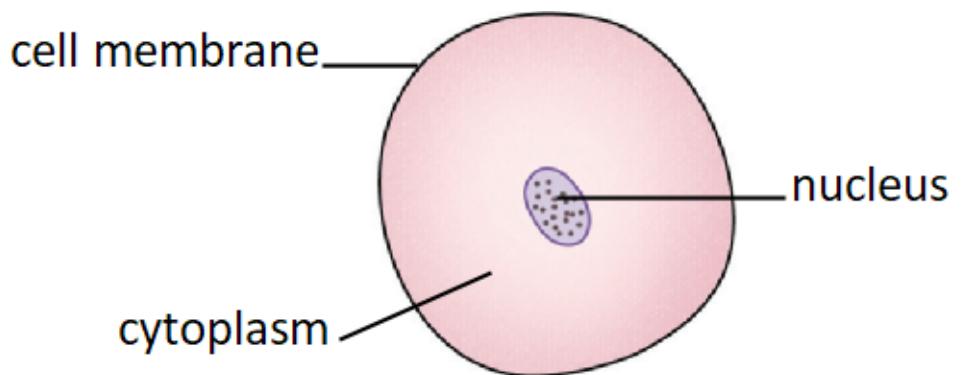
- DNA
 - The DNA coils up and wraps around the proteins
 - DNA coiled 卷 around proteins 蛋白質 in the nucleus of an animal cells
- Chromosomes 染色體
 - Inside the nucleus of a cell, there are thread-like structures
 - made up of DNA and protein in the nucleus of an animal cells
 - in the nucleus of an animal cells



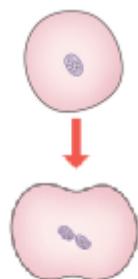
- Chromosomes in human body cells
 - Every cell in the human body contains 23 pairs of chromosomes or 46 chromosomes
 - There are 22 pairs of autosomes and one pair of sex chromosomes.
 -



- 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.
 -



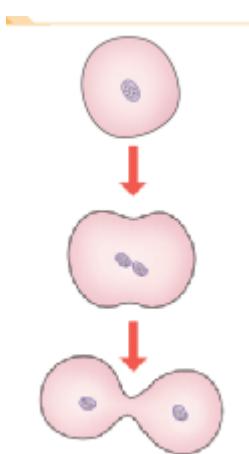
- step 2
 - The nucleus divides into two.
 -



- step 3

- The cytoplasm divides into two.

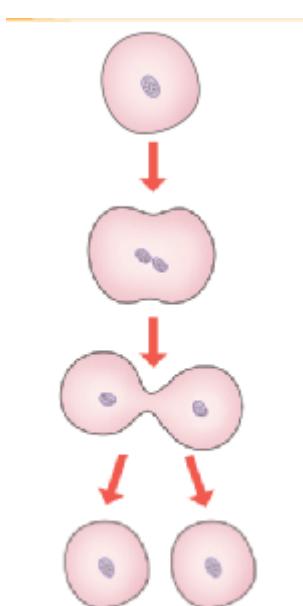
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- step 4

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

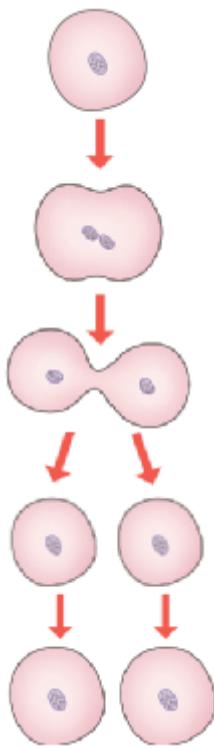
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- step 5

- The daughter cells absorb nutrients and grow bigger.

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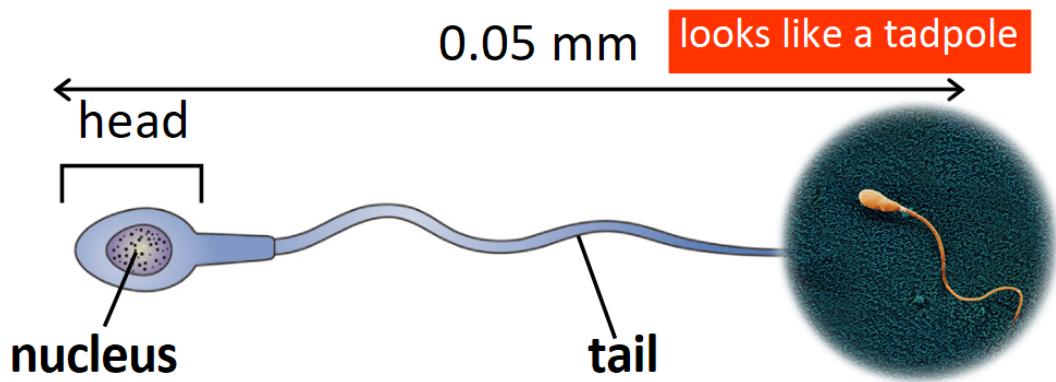
- When the daughter cells reach a certain size, they may divide again.
- As a result of repeated cell divisions and the increase in size of cells, living things grow bigger.

- 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
-

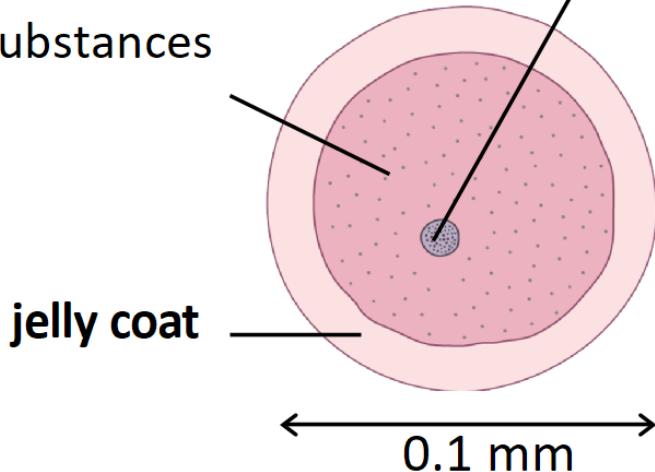


- Ovum / Ova / Egg 卵子

- 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

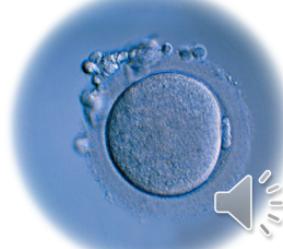
- contains food substances



nucleus

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

spherical shape



- 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) 睾丸

- enclosed in the scrotum 陰囊

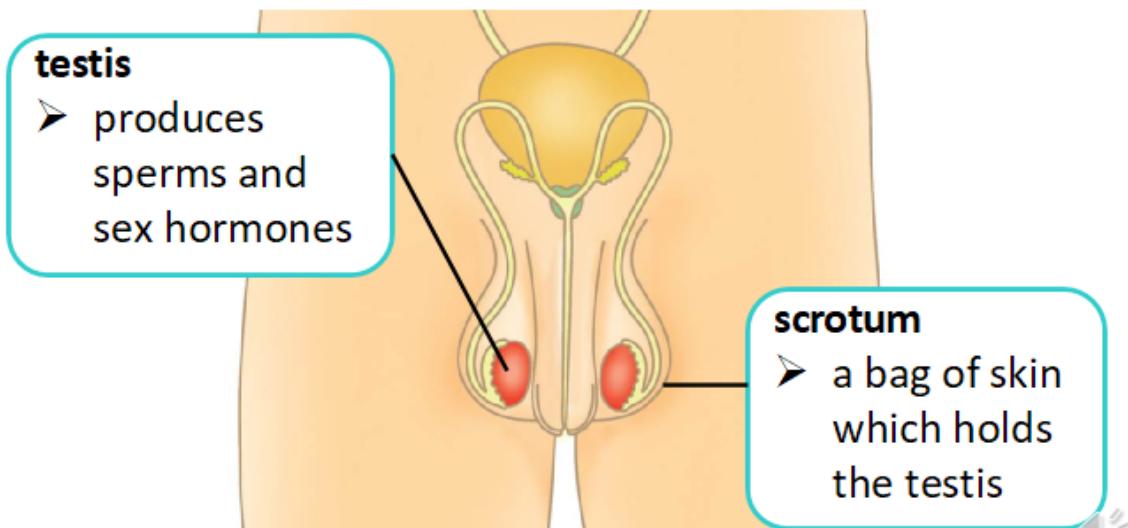
- testis 睾丸

- 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

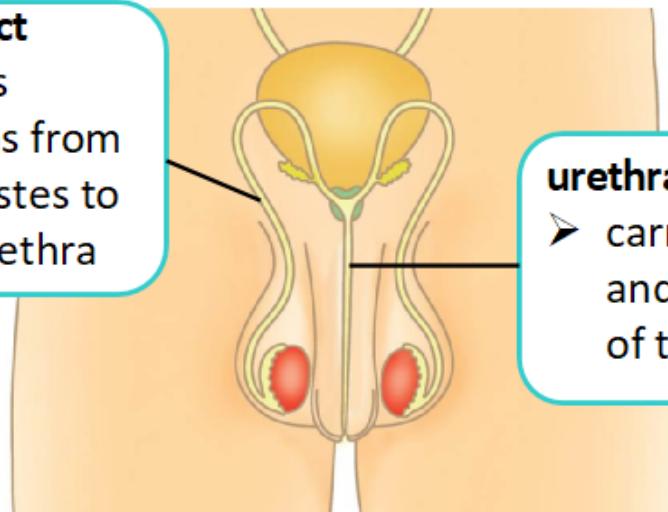
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sperm duct

- carries sperms from the testes to the urethra

urethra

- carries semen and urine out of the body

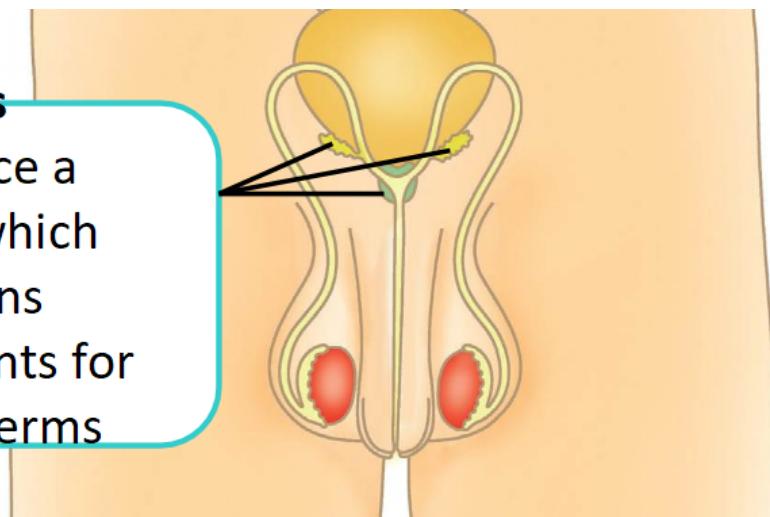


- sex glands 性腺體

- 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
-

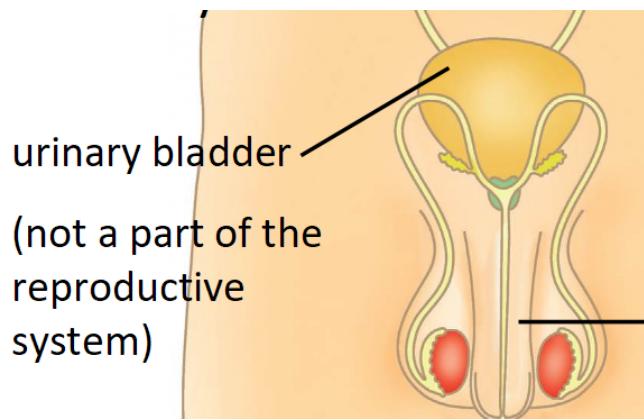
sex glands

- produce a fluid which contains nutrients for the sperms

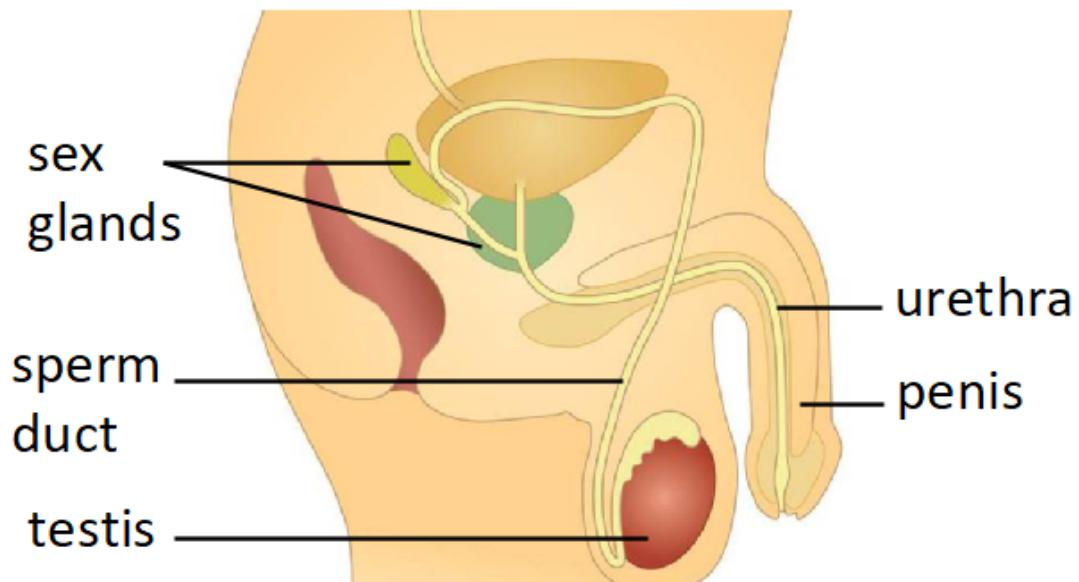


- penis 陰莖

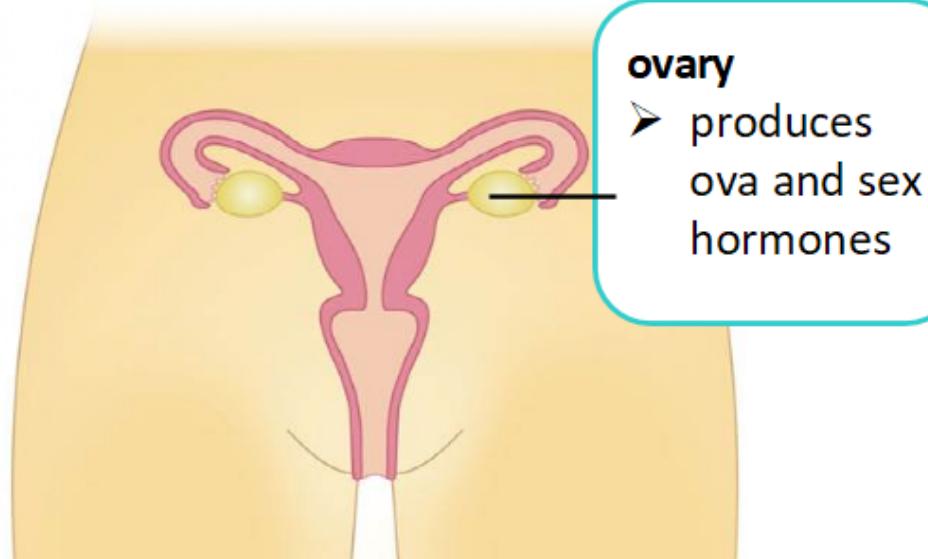
- The semen flows through the urethra to the tip of the penis & passed out of the body
- ejects semen to the female reproductive system during sexual intercourse
-



Side view of the male reproductive system



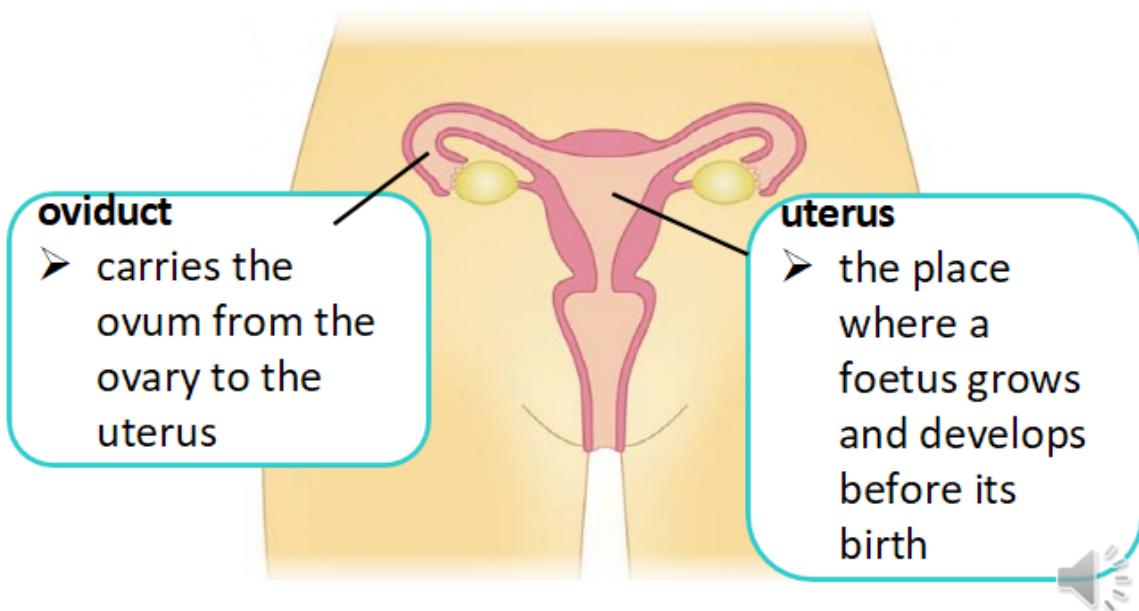
- Female reproductive system
 - ovaries (ovary) 卵巢
 - produces ova and sex hormones
 - Usually only one ovum is released into the oviduct each month
 - called ovulation 排卵
 - The ovum is then moved through the oviduct to the uterus
 -



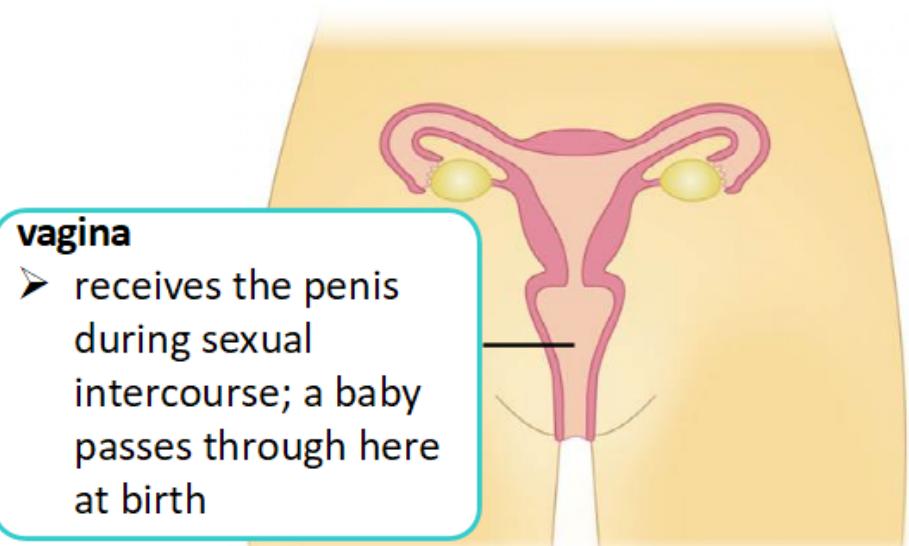
ovary

- produces ova and sex hormones

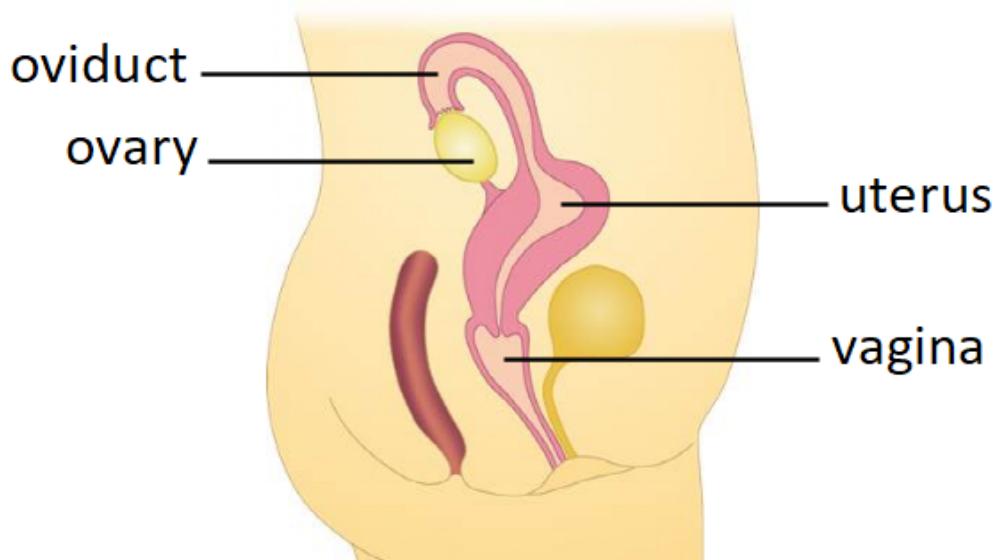
- oviduct 輸卵管
 - carries the ovum from the ovary to the uterus
- uterus 子宮
 - the place where a foetus grows and develops before its birth
-



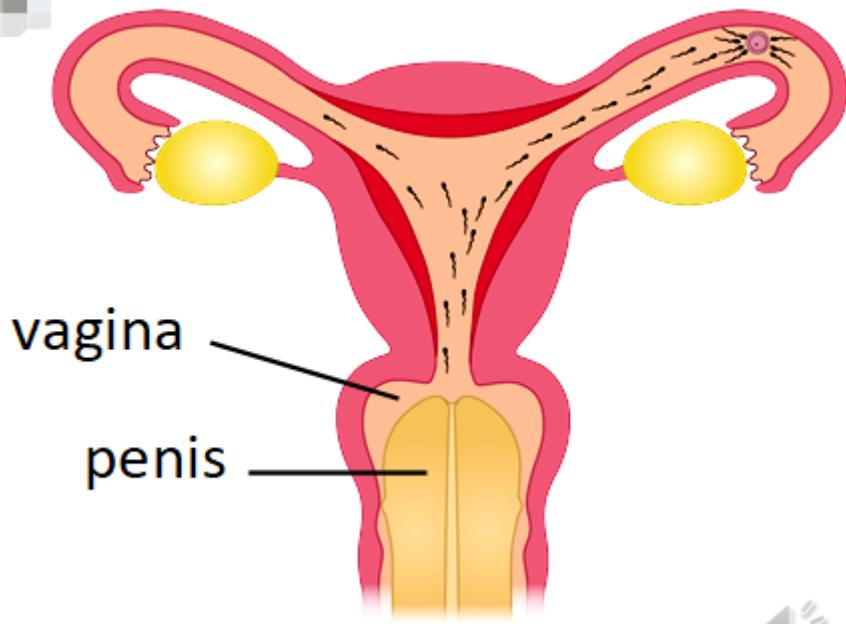
- vagina 阴道
 - The uterus opens to the vagina.
 - receives the penis during sexual intercourse; a baby passes through here at birth
 -



Side view of the female reproductive system

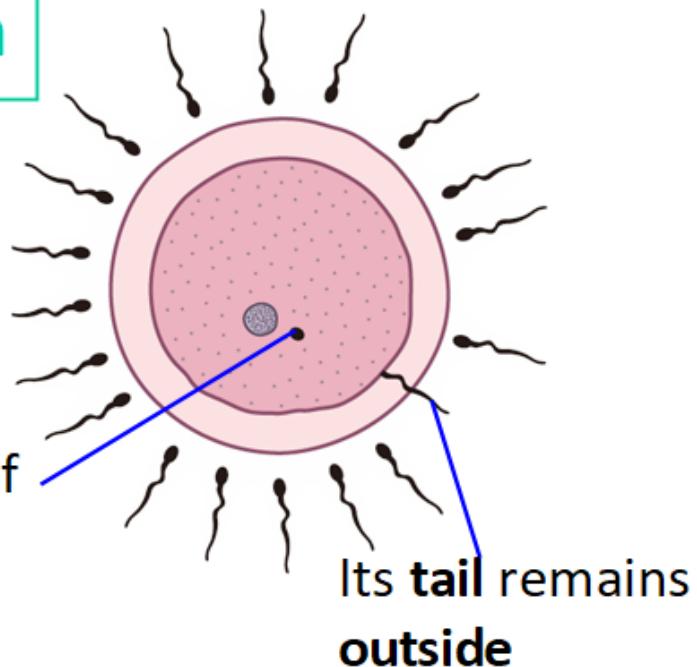


- Process of human reproduction
 - Fertilization 受精
 - A new life begins when a sperm fuses with an ovum.
 - sexual intercourse 性交
 - During sexual intercourse, the husband inserts his erect penis into the vagina of his wife.
 - Semen containing millions of sperms is ejected into the vagina.
 - Sperms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



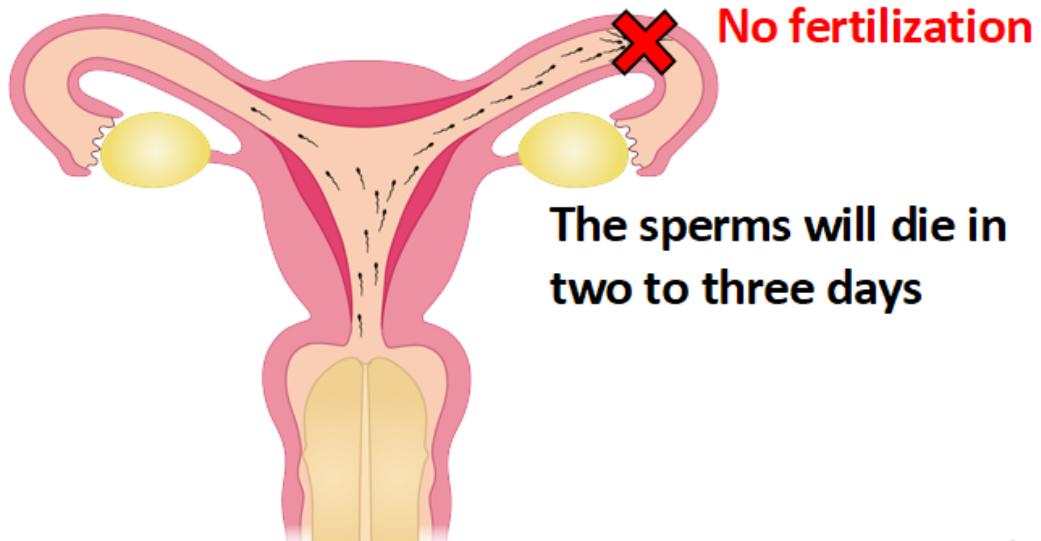
- If an ovum is present in the oviduct
 - one of the **sperms** may fuse with the **ovum**
 - form a **zygote** 受精卵 (also called a fertilized ovum)
-

Fertilization

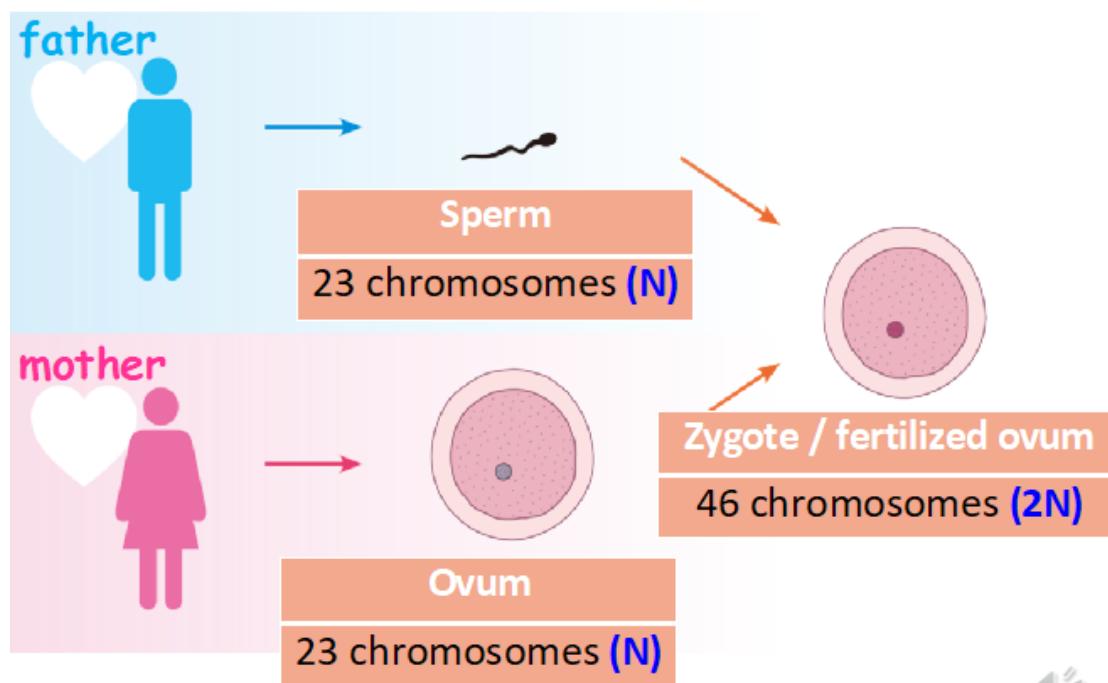


- The nucleus of the sperm fuses with the nucleus of the ovum to form a zygote.
- no ovum in the oviducts
 - sperms will die in two to three days
-

If there is no ovum in the oviducts...

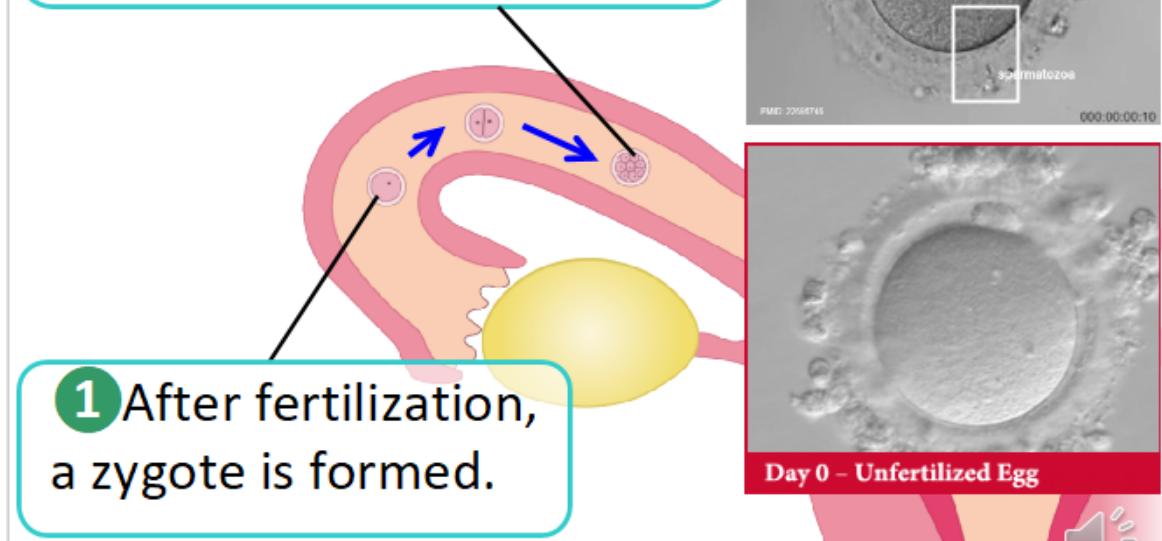


- chromosomes
 - The sperm and the ovum each carries 23 chromosomes (one set of chromosomes).
 - use 'N' to denote one set of chromosomes



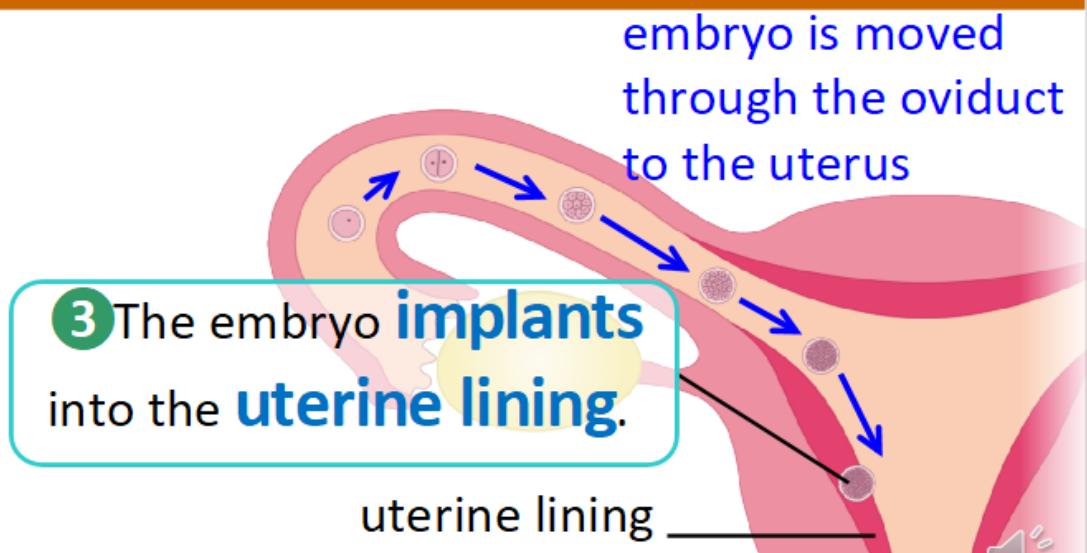
- The zygote formed from fertilization carries 46 chromosomes (two sets of chromosomes).
- Implantation 植入
 - 1. After fertilization, a zygote is formed.
 - 2. The zygote divides and develops into an embryo 胚胎

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

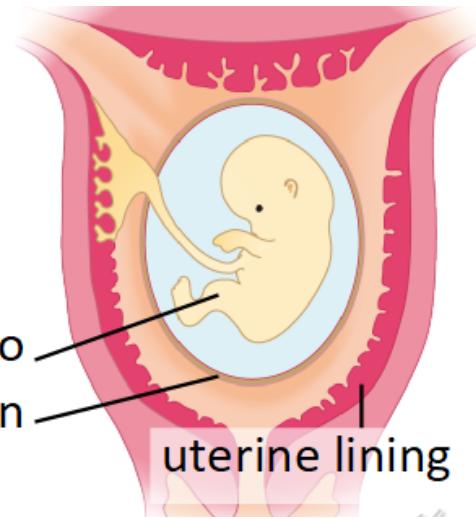
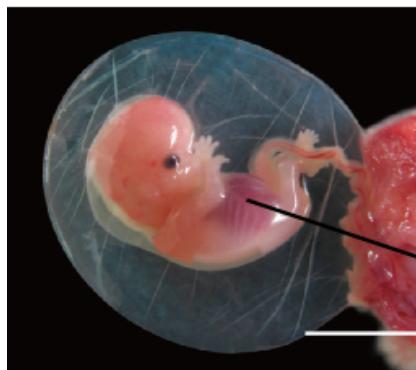


- 3. The embryo **implants** into the **uterine lining** 子宮内膜 (The woman is now pregnant 懷孕)
 - embryo is moved through the **oviduct** to the **uterus**
 -

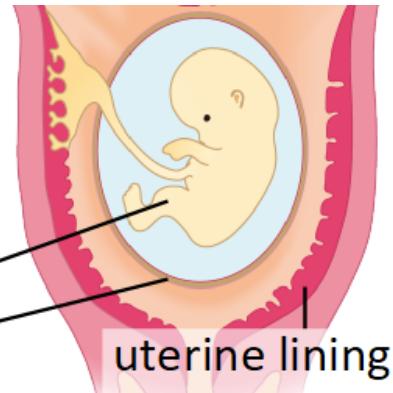
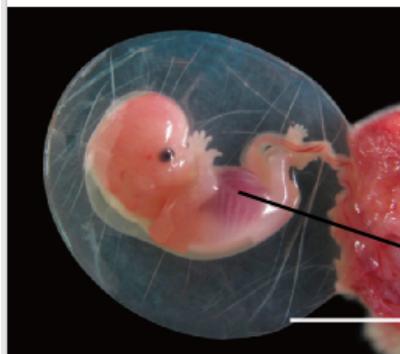
The woman is now pregnant.



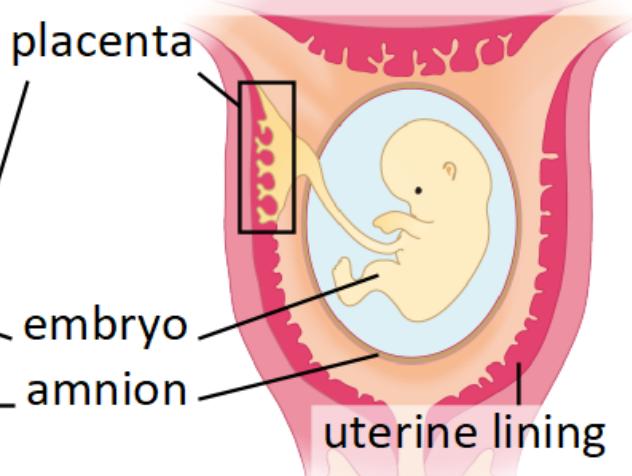
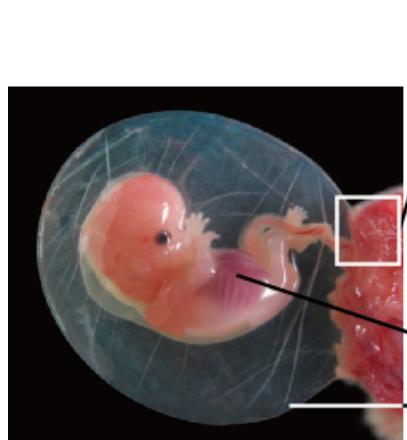
- Development of the embryo
 - After implantation, the embryo begins to **develop** in the uterus of its mother
 - develops inside a bag called the **amnion** 羊膜
 -



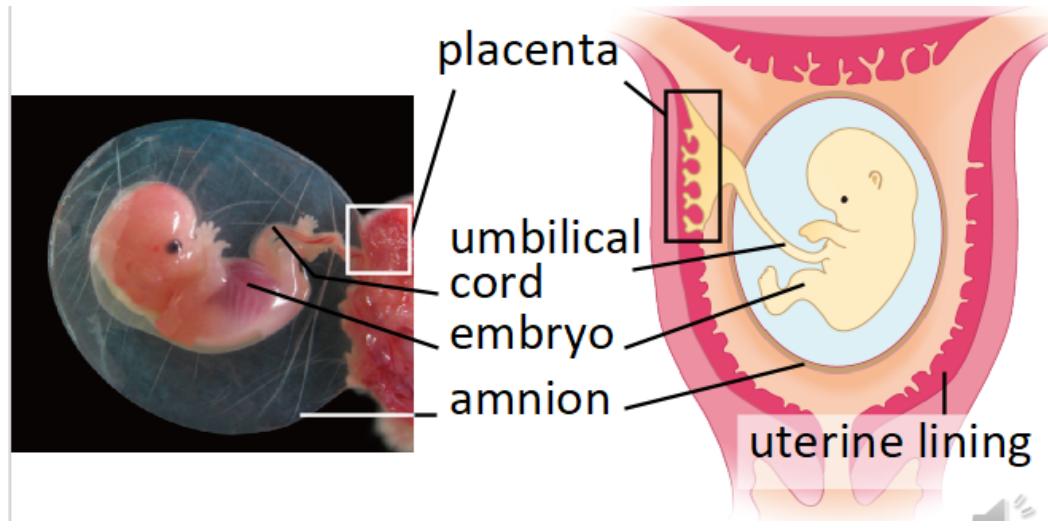
- The amnion is filled with a watery liquid
 - a cushion to protect the embryo against shock
 -



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

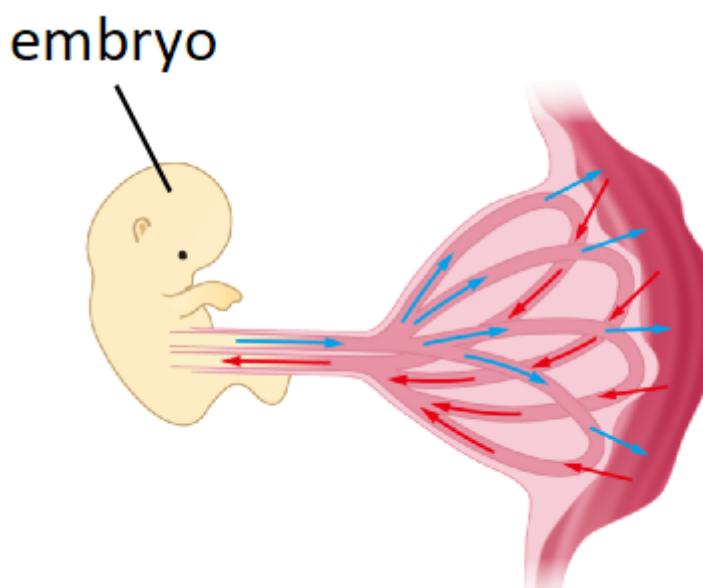


- The placenta is attached to the embryo by an umbilical cord
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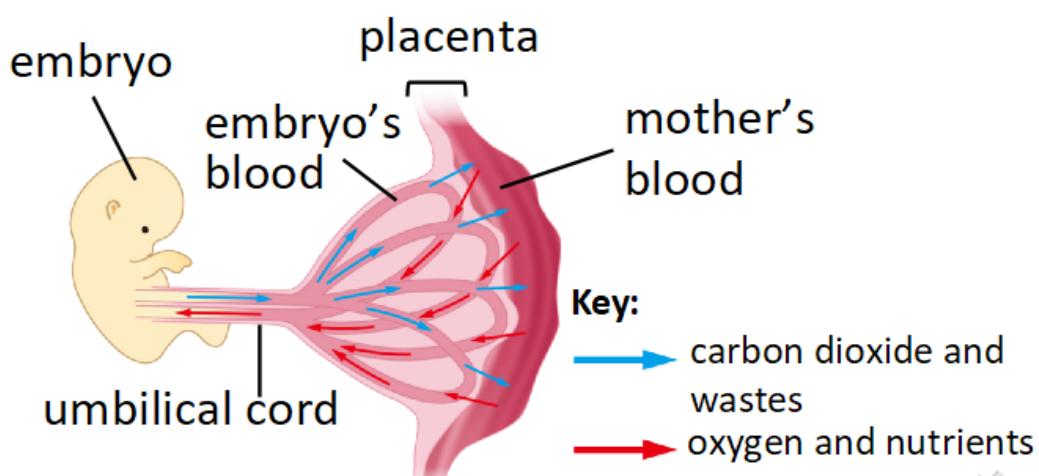
- The embryo gets **oxygen** and **nutrients** from its mother & gets rid of carbon dioxide and other wastes

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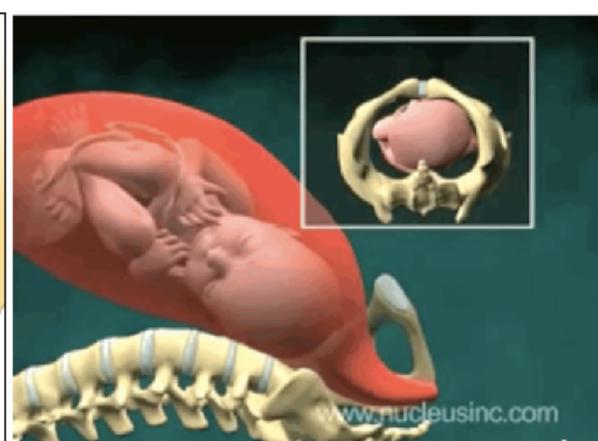
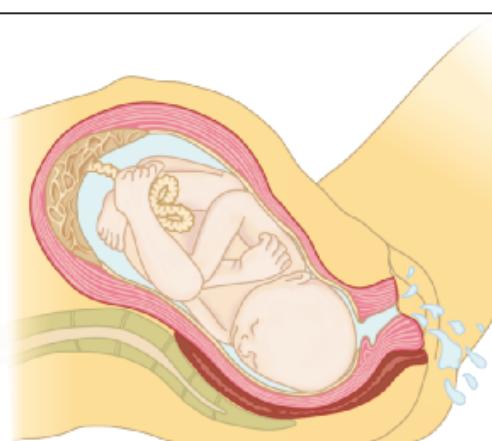
- placenta allows this **exchange of materials**

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- 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