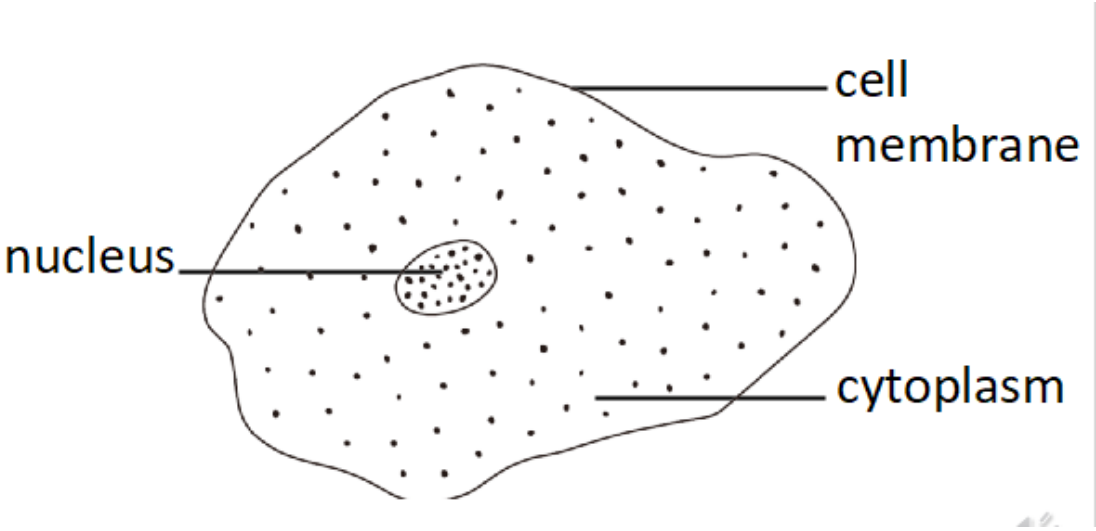
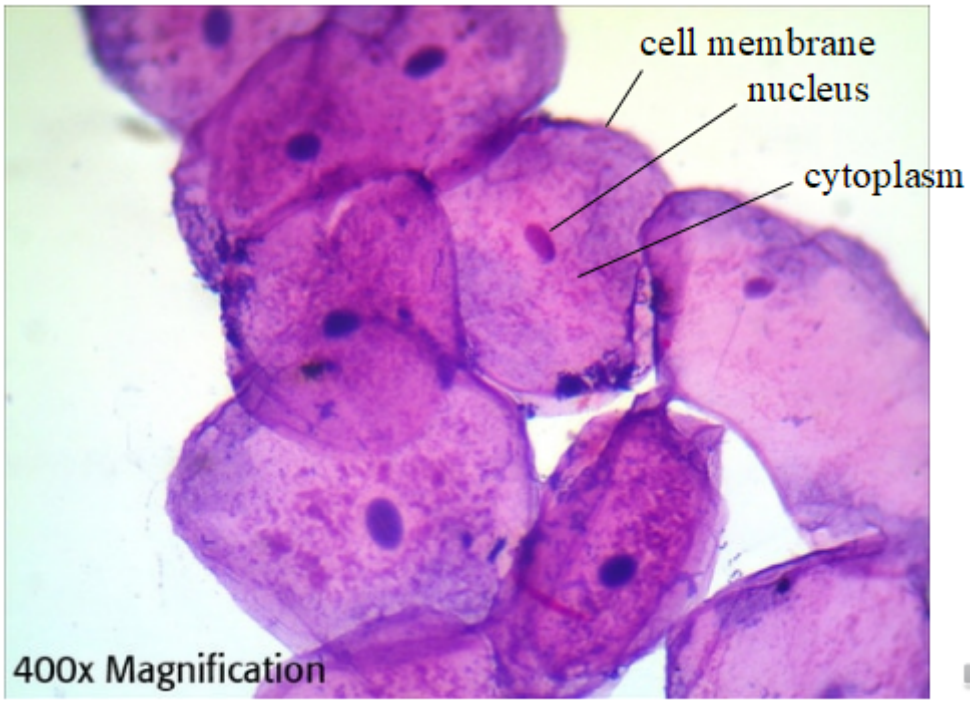
chapter 4

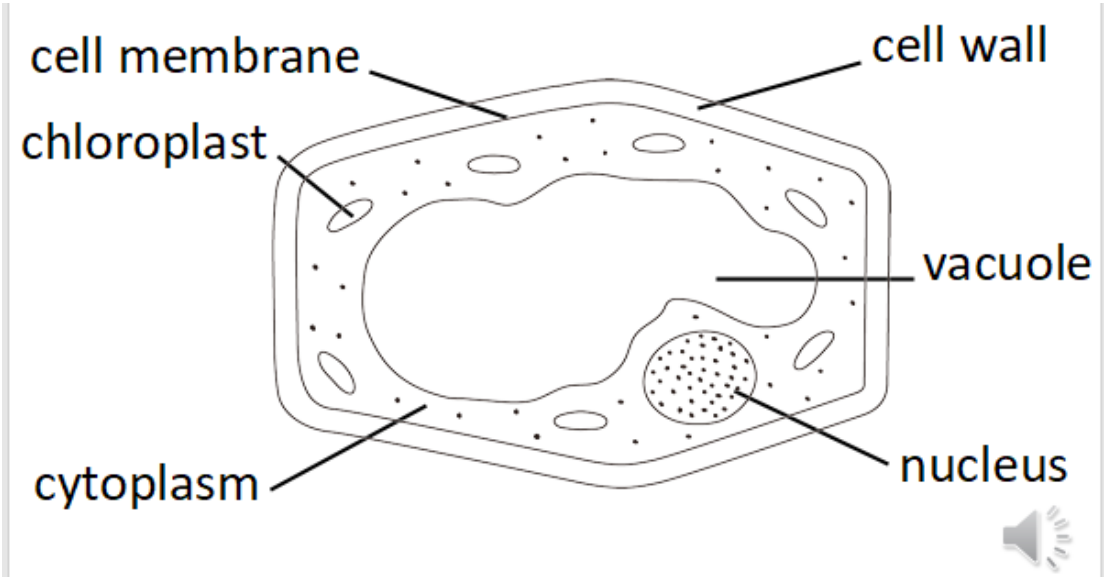
- cells
  - basic unit of living things
    - all living things are made up of cells.
      - made up of 1 cell only
        - called unicellular organisms
      - made up of 2 or more cells
        - called multicellular organisms
  - basic structures of cells
    - animals cells
      - cell membrane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



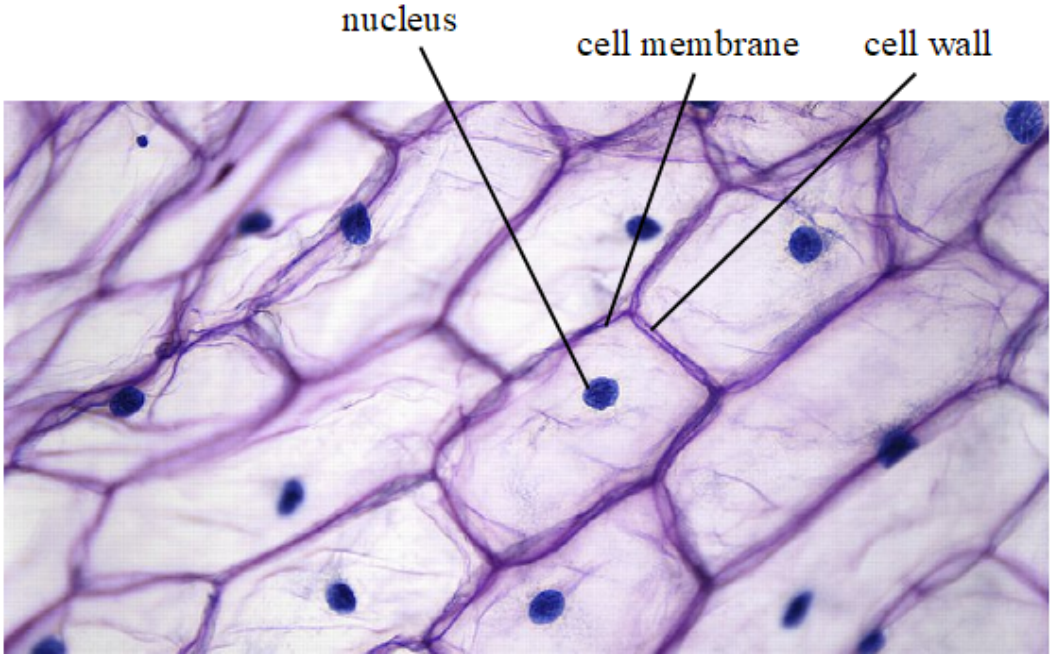
      -



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



  -

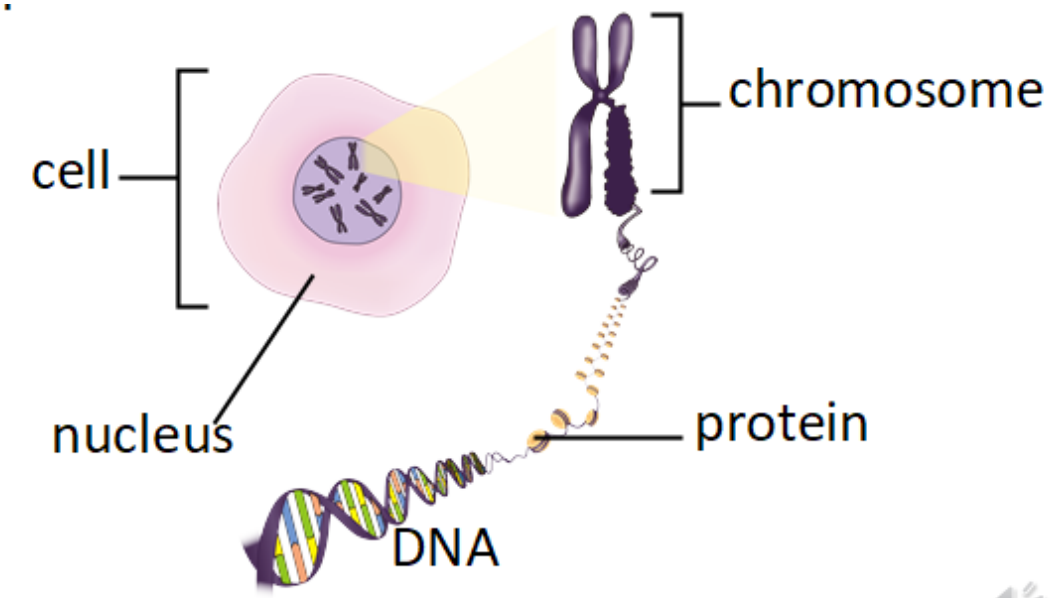


- Functions of the basic structures of cells
  - Cell membrane
    - Present in both animal cells and plant cells
    - Controls the movement of substances into and out of the cell
  - Nucleus
    - Present in both animal cells and plant cells
    - Contains genetic materials which control the activities 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
  - Chloroplast
    - Present only in plant cells
    - Site where photosynthesis takes place in order to make food

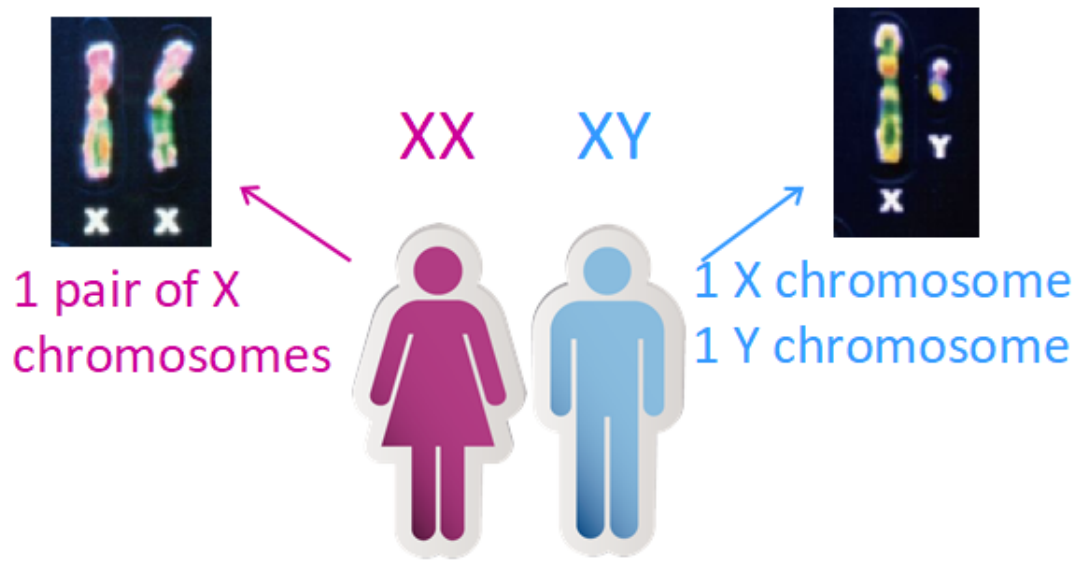
- Observing cells with a microscope
  - The microscope
    - light microscopes
      - Can magnify the image of an object by up to a few hundred times

- electron microscopes
    - Can magnify the image of an object by up to several million times

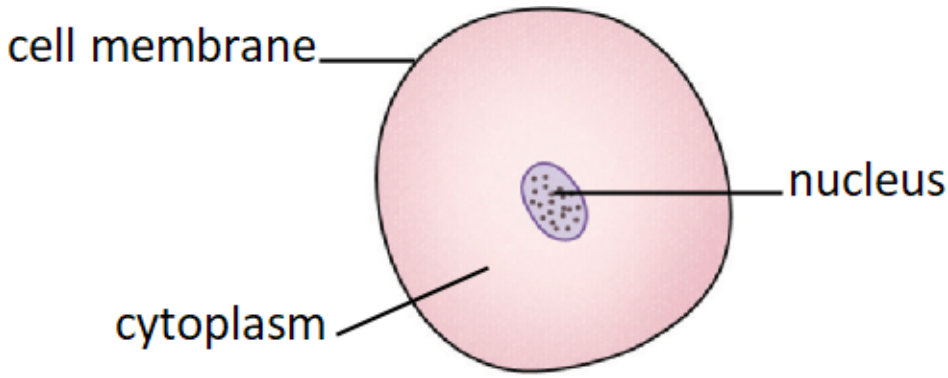
- Genetic materials inside the nucleus of a cell
    -
        - DNA (deoxyribonucleic acid)
            -
                - the genetic materials inside the nucleus
            - contains all instructions needed for the cells to function, grow and reproduce
                - determines what features we receive from our parents
    - Chromosomes and DNA
        - DNA
            - The DNA coils up and wraps around the proteins
                - DNA coiled around proteins in the nucleus of an animal cells
        - Chromosomes
            - 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
        -



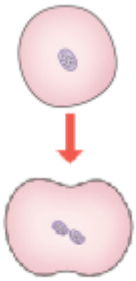
    - Chromosomes in human body cells
        - Every cell in the human body contains 23 pairs of chromosomes or 46 chromosomes
        - There are 22 pairs of autosomes and one pair of sex chromosomes.
        -

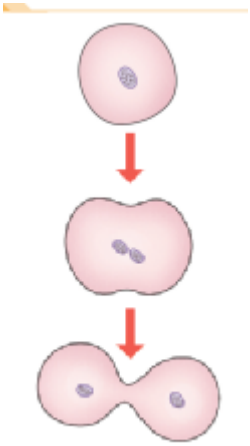
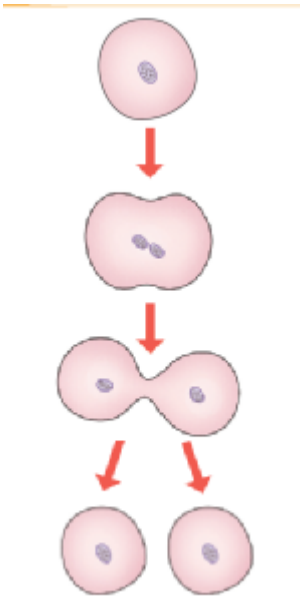


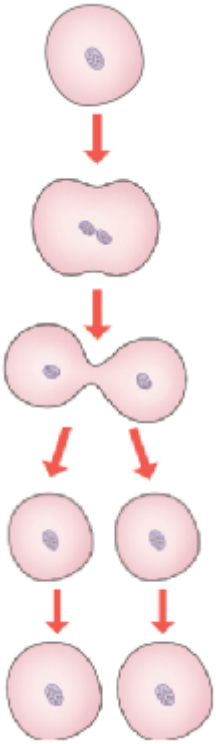
- Cell division and growth
  - cell division
    -
      - When living things grow, the number of cells in their bodies increases by cell division.
    - step 1
      - Before cell division, the genetic materials in the nucleus of the parent cell make an identical copy of themselves.
      -



    - 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.

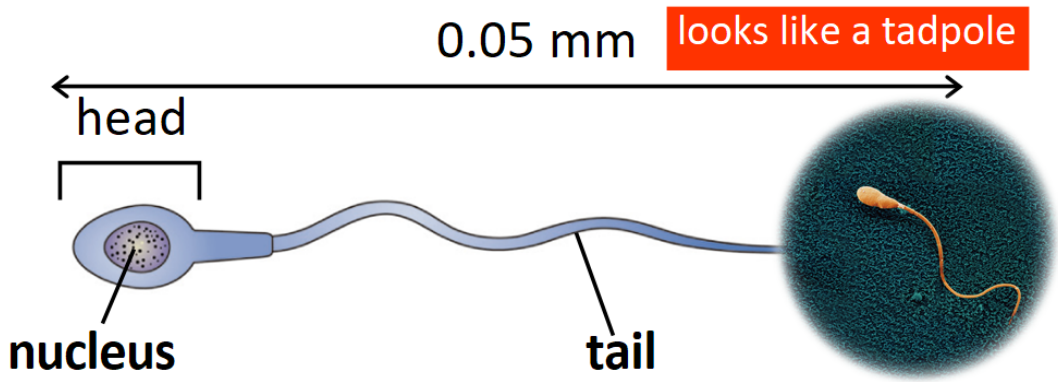
- How are cells organized in living things?
  - The right tools for the job
    - multicellular organisms
      - many different types of cells
        - cells are specialized for carrying out a particular job
    - human body
      - hundreds of different types of specialized cells
        - come from 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 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

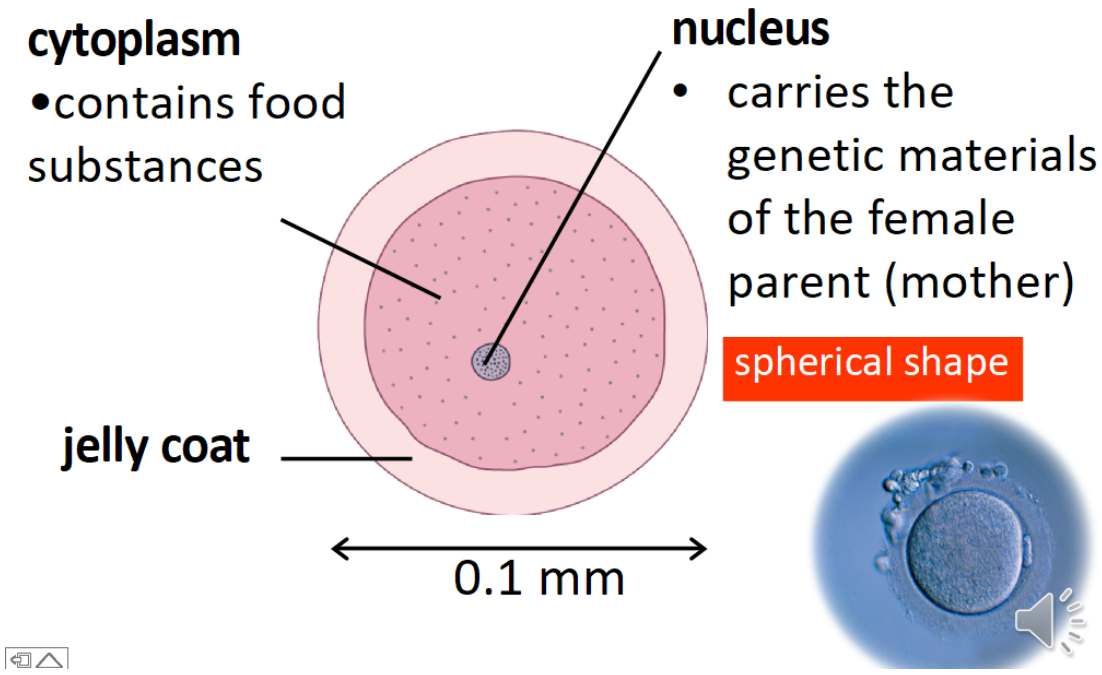
- plants cells
  - Transporting cells
    - long and tube-shaped
    - transport water, nutrients and minerals throughout the plant
  - Leaf cells
    - contain many chloroplasts for the plant to carry out photosynthesis
  - Root hair cells
    - increase the surface area of the root in contact with 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.

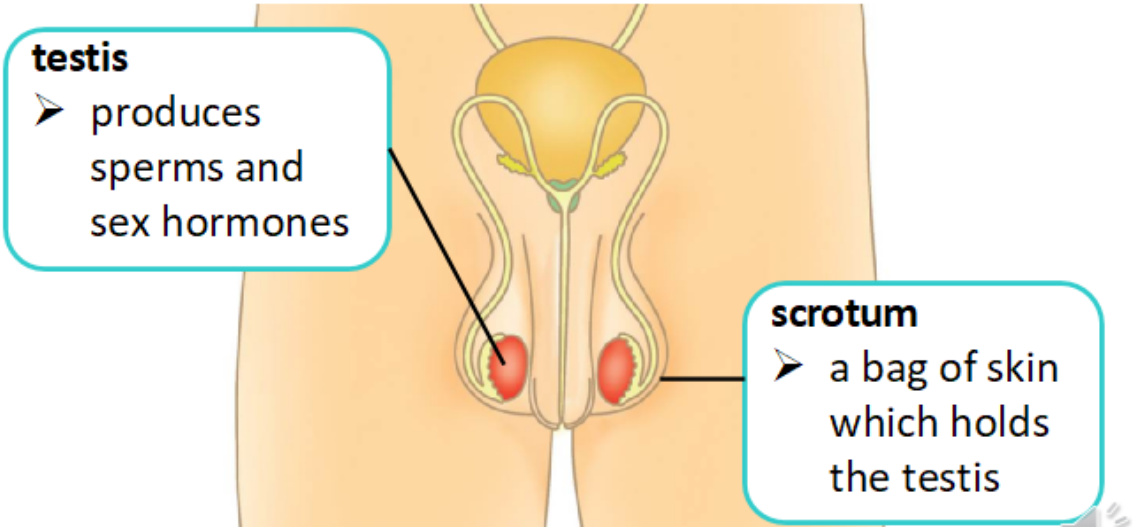
- Sperms
  - has head & tail
  - look like a tadpole
  - nucleus
    - carries the genetic materials of the male parent (father)
  - tail
    - beats to allow the sperm to swim
  - 

- Ovum / Ova / Egg
  - a spherical shape球體
  - much large than a sperm
  - surrounded by a jelly coat
  - nucleus
    - carries the genetic materials of the female parent (mother)
  - cytoplasm
    - contains food substances
  - cannot move
  -

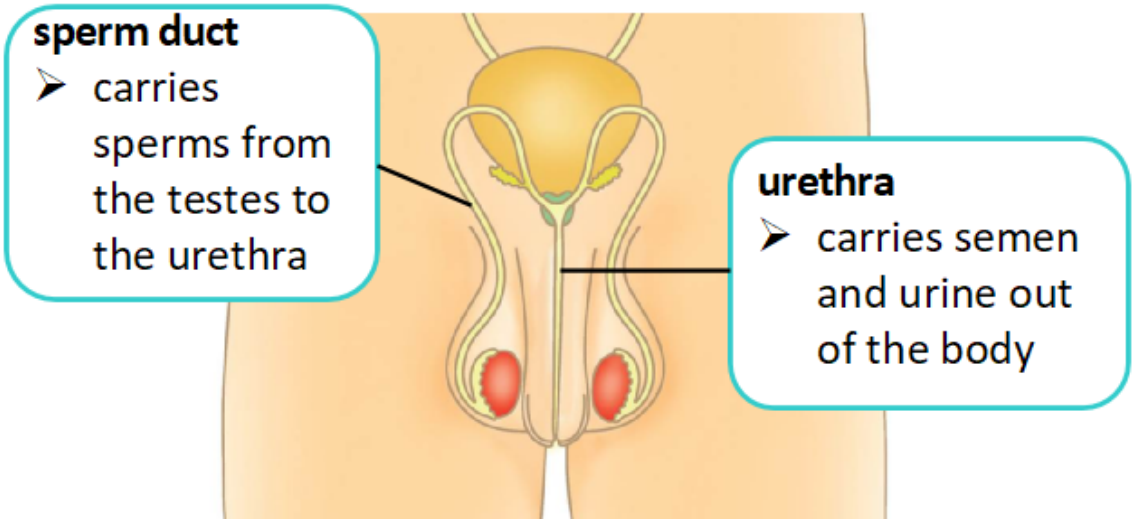


- Chromosomes in human sex cells
  - sex chromosomes
    - sex chromosomes in female body cells → XX
    - sex chromosomes in male body cells → XY
  - Sperms
    - formed from father's sperm-producing cells
    - During their formation, each pair of autosomes and the pair of sex chromosomes separate.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

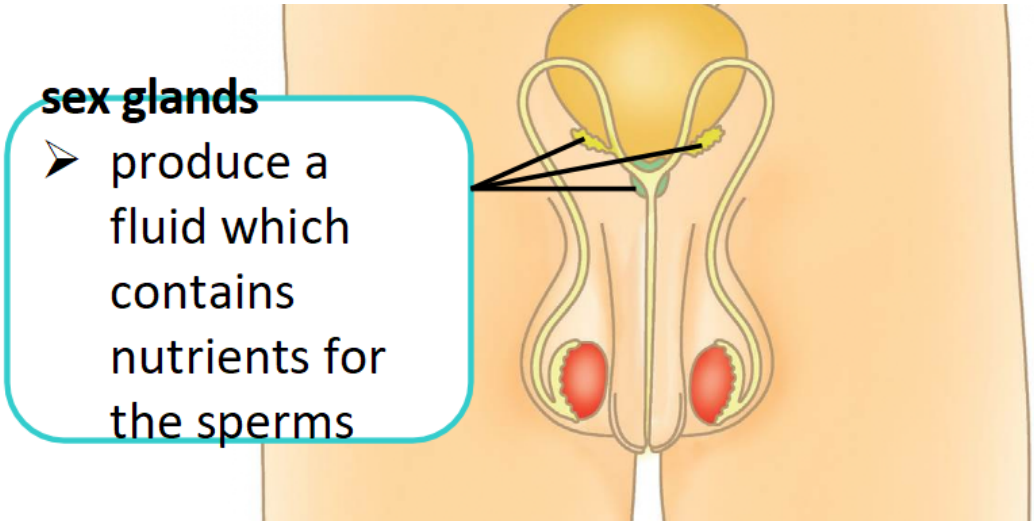
	Male		Female	
	Body cell	Sex cell (sperm)	Body cell	Sex cell (ovum)
No. of chromosomes	46 (in 23	23	46 (in 23 pairs)	23
No. of autosomes	44	22	44	22
Sex chromosomes	XY	half in number: X half in number: Y	XX	X

- 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
    - 

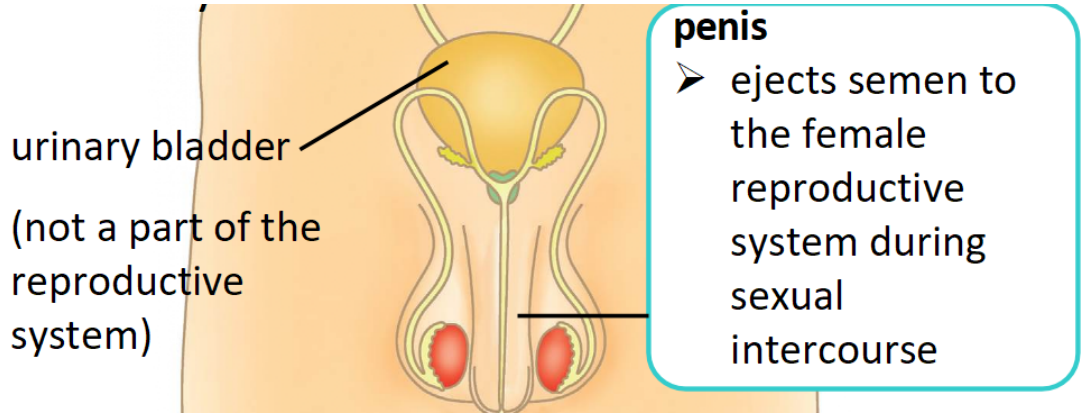
    - sperm ducts 輸精管
      - connect the testes to the urethra
      - carries sperms from the testes to the urethra
    - urethra 尿道
      - carries semen and urine out of the body
    -

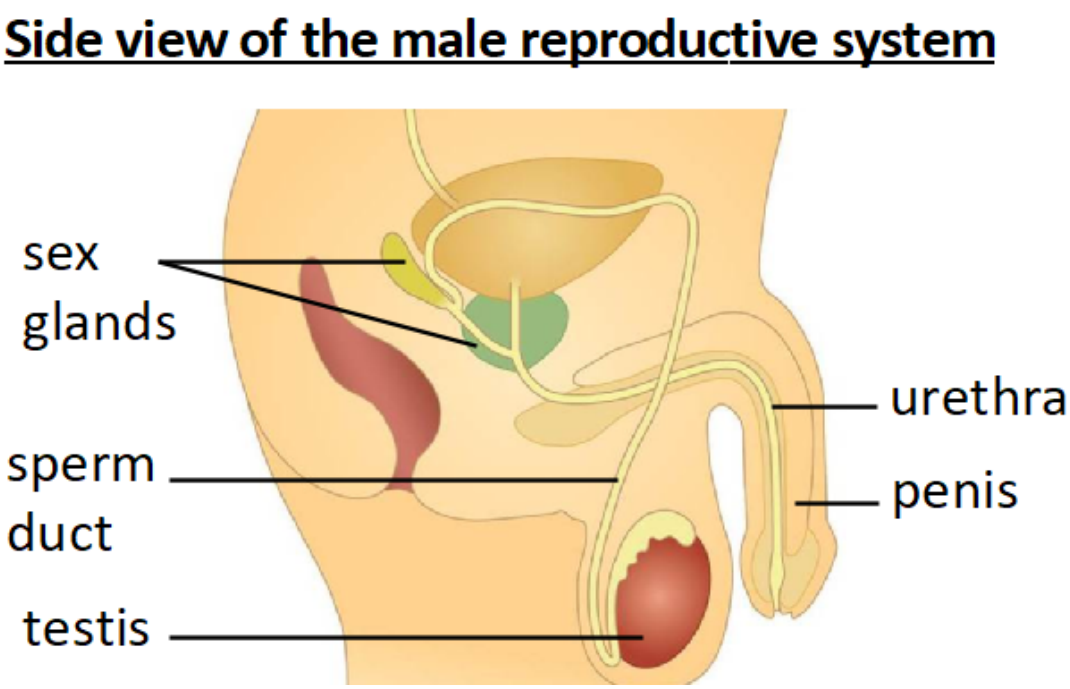


- sex glands 性腺體
  - When the sperms travel up the sperm ducts, they are mixed with a fluid from the sex glands
  - produce a fluid which contains nutrients for the sperms
    - keep the sperms alive
  - The sperms and the fluid together form the semen 精液
  -

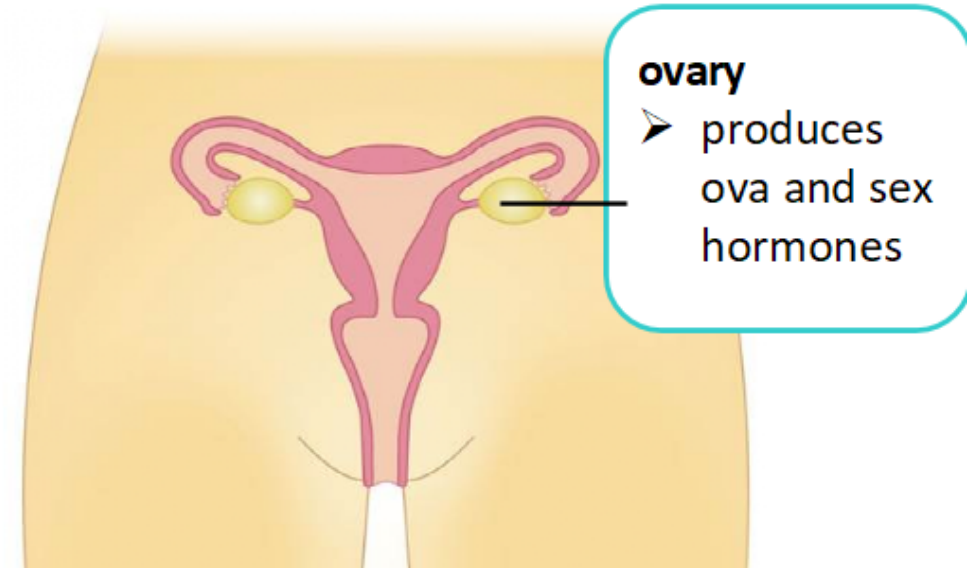


- penis 陰莖
  - The semen flows through the urethra to the tip of the penis & passed out of the body
  - ejects semen to the female reproductive system during sexual intercourse
  -

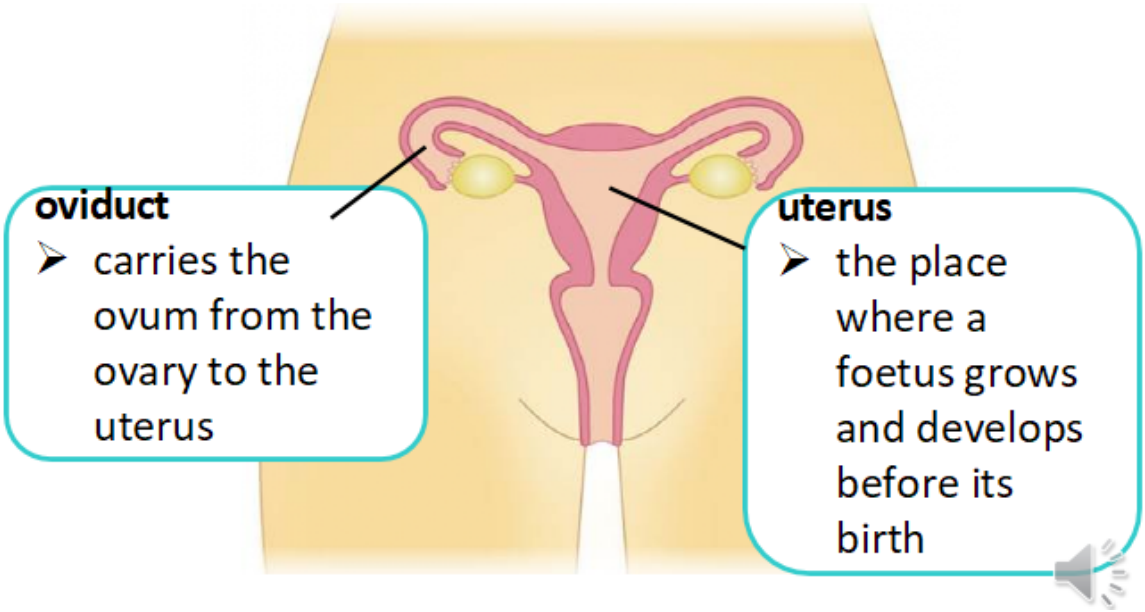




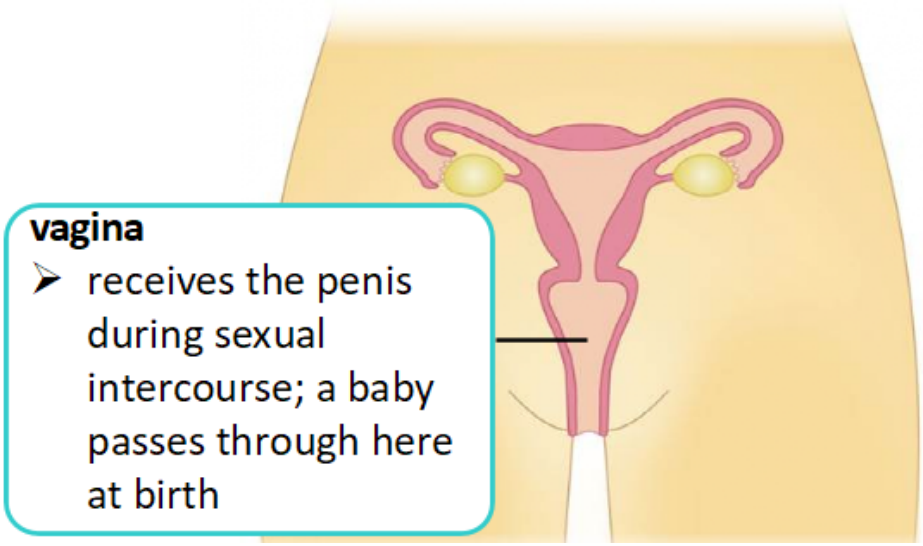
- Female reproductive system
  - ovaries （ovary）卵巢
    - produces ova and sex hormones
    - Usually only one ovum is released into the oviduct each month
      - called ovulation 排卵
    - The ovum is then moved through the oviduct to the uterus

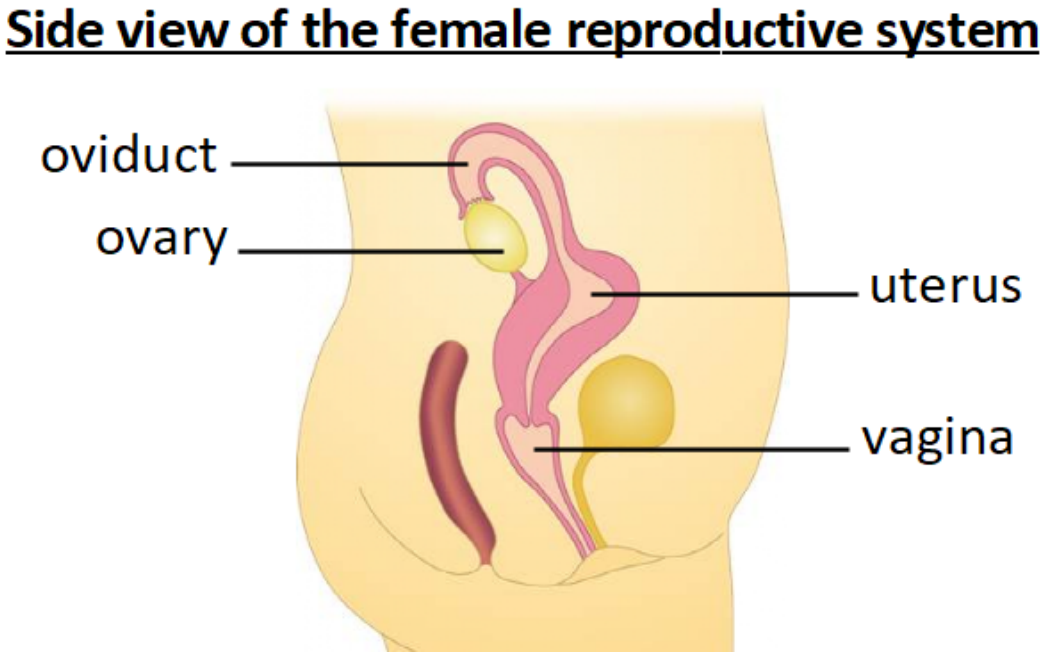


- oviduct 輸卵管
  - carries the ovum from the ovary to the uterus
- uterus 子宮
  - the place where a foetus grows and develops before its birth
-

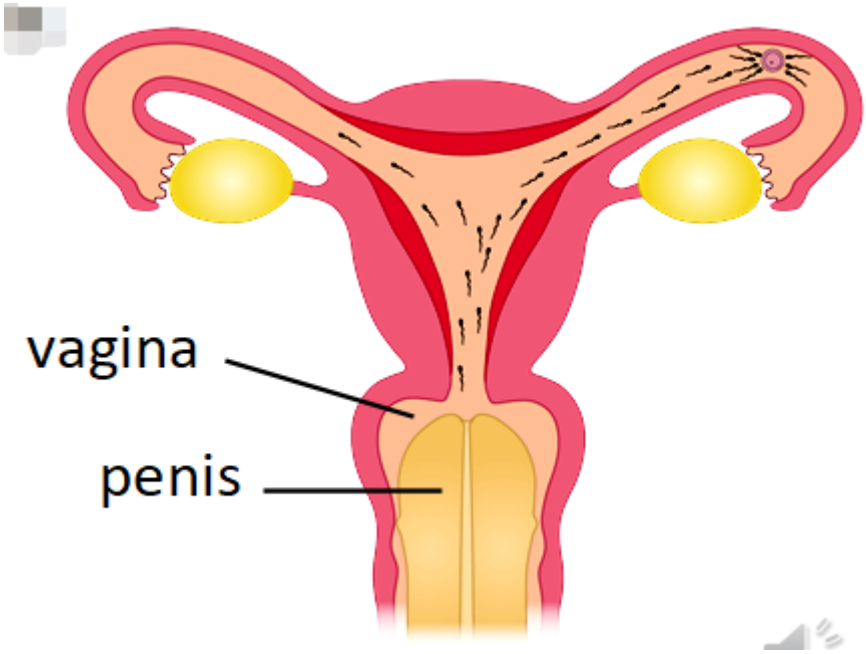


- vagina 陰道
  - The uterus opens to the vagina.
  - receives the penis during sexual intercourse; a baby passes through here at birth
  -

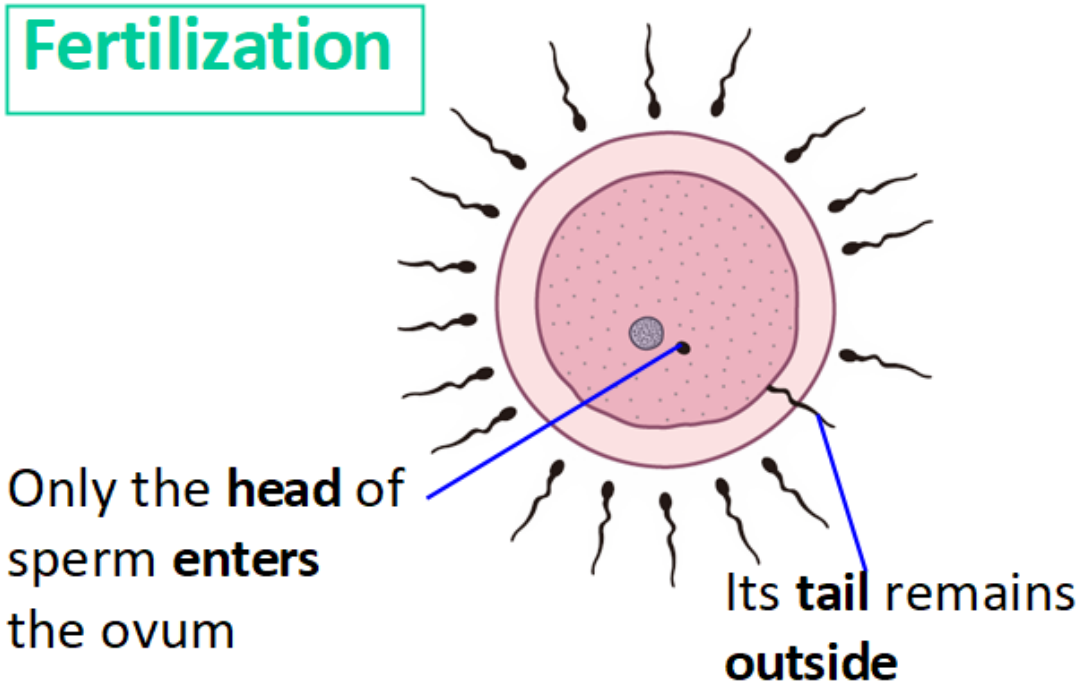




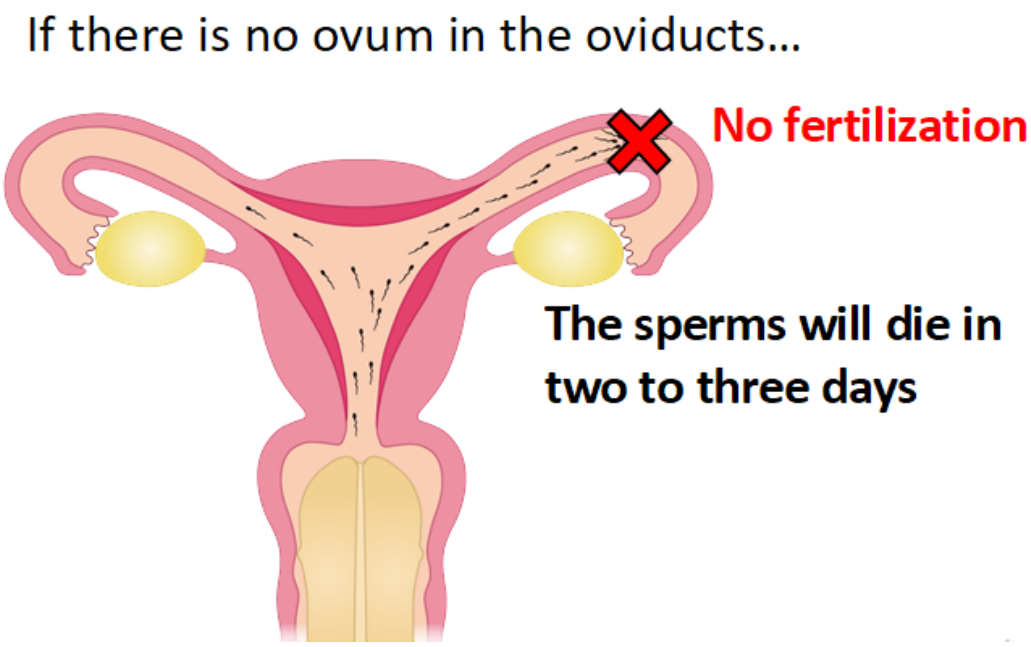
- Process of human reproduction
  - Fertilization 受精
    - A new life begins when a sperm fuses with an ovum.
    - sexual intercourse 性交
      - During sexual intercourse, the husband inserts his erect penis into the vagina of his wife.
        - Semen containing millions of sperms is ejected into the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

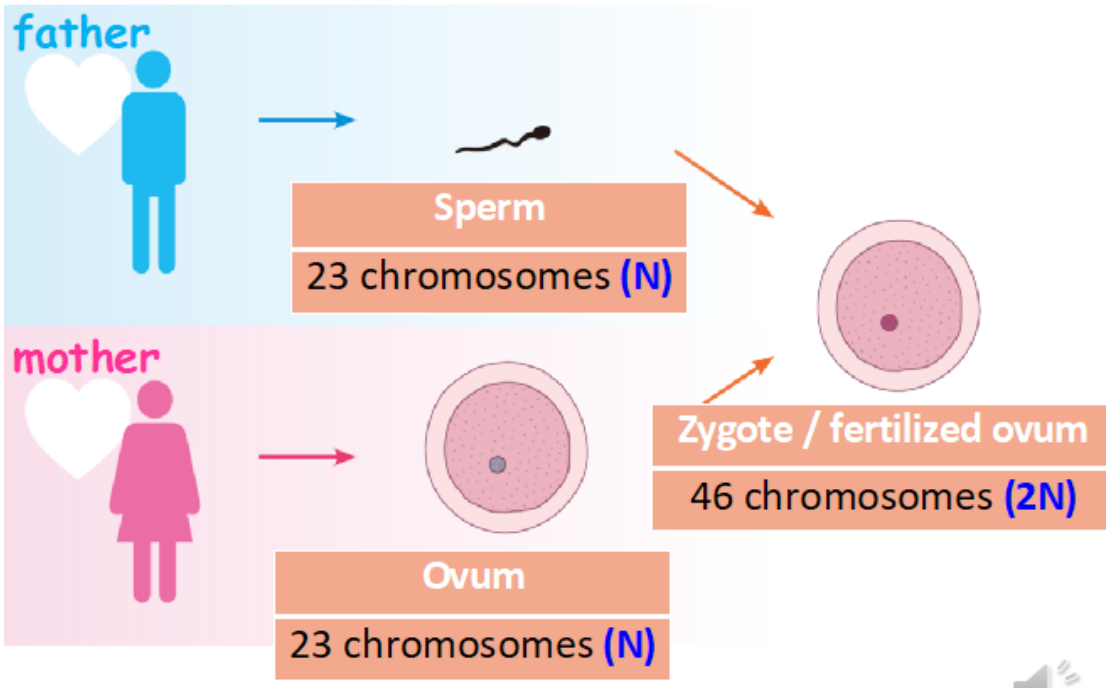


- If an ovum is present in the oviduct
  - one of the sperms may fuse with the ovum
    - form a zygote (also called a fertilized ovum)

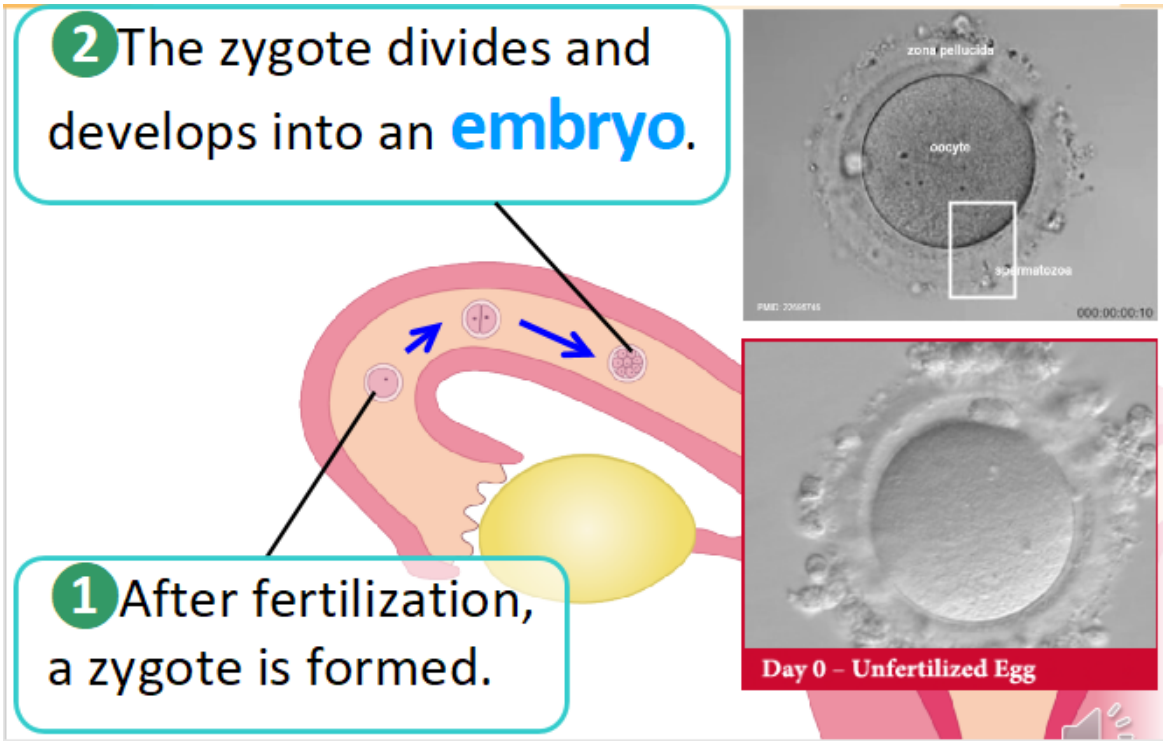


- The nucleus of the sperm fuses with the nucleus of the ovum to form a zygote.
- no ovum in the oviducts
  - sperms will die in two to three days

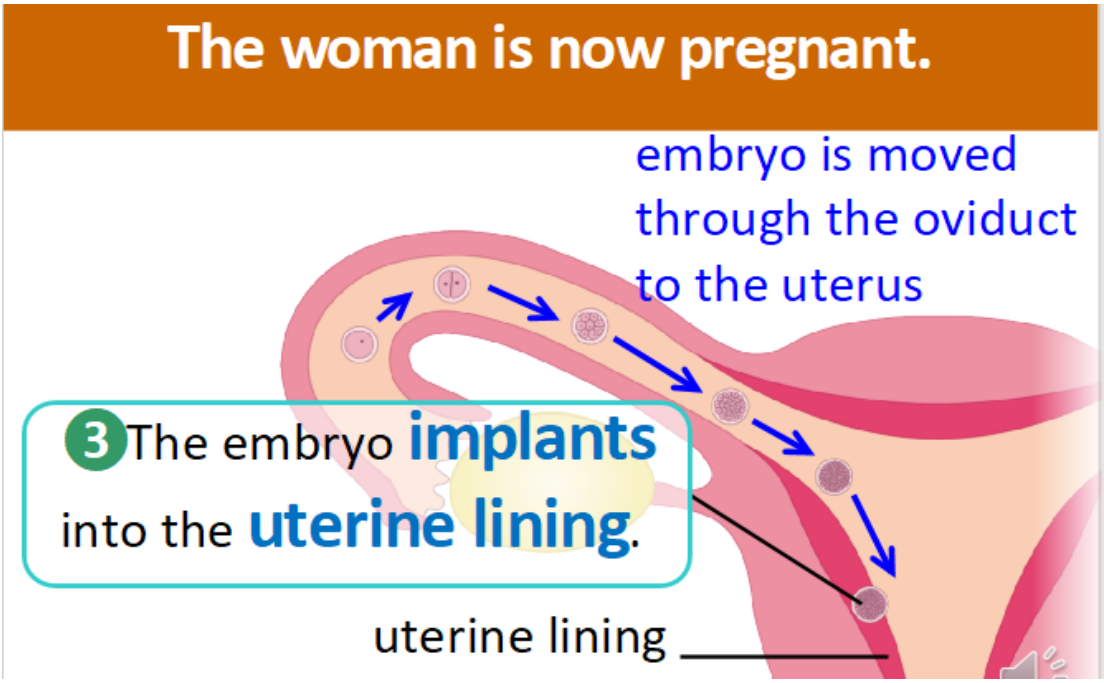


- chromosomes
  - The sperm and the ovum each carries 23 chromosomes (one set of chromosomes).
    - use ‘N’ to denote one set of chromosomes
  - 

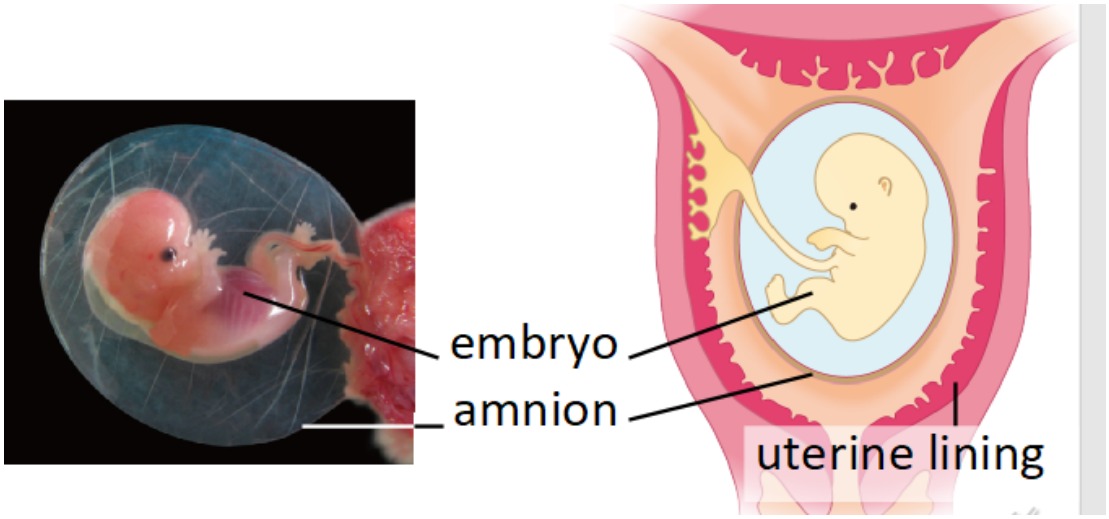
  - The zygote formed from fertilization carries 46 chromosomes (two sets of chromosomes).
- Implantation 植入
  - 1. After fertilization, a zygote is formed.
  - 2. The zygote divides and develops into an embryo
  -



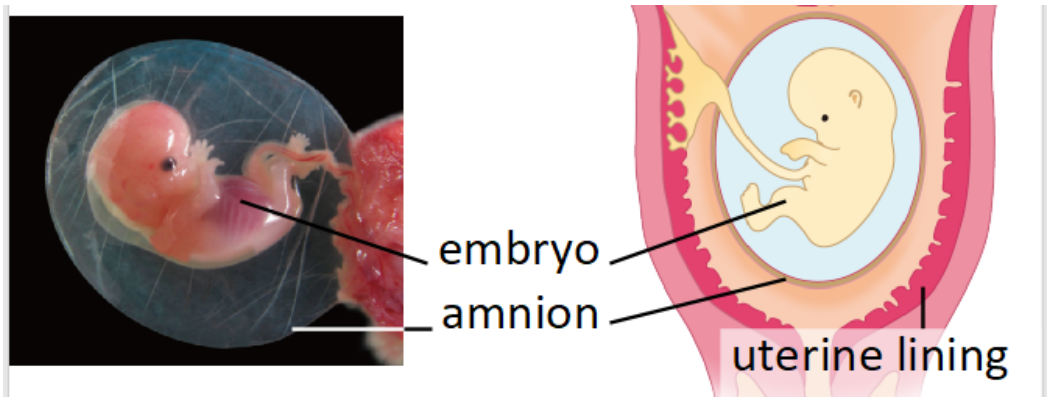
- 3. The embryo implants into the uterine lining （The woman is now pregnant）
  - embryo is moved through the oviduct to the uterus
  -



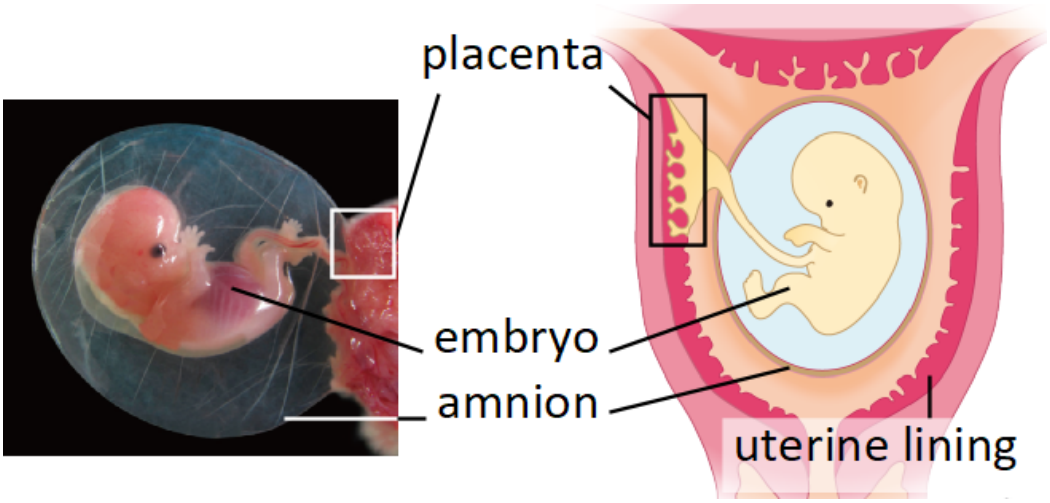
- Development of the embryo
  - After implantation, the embryo begins to develop in the uterus of its mother
    - develops inside a bag called the amnion 羊膜
    -



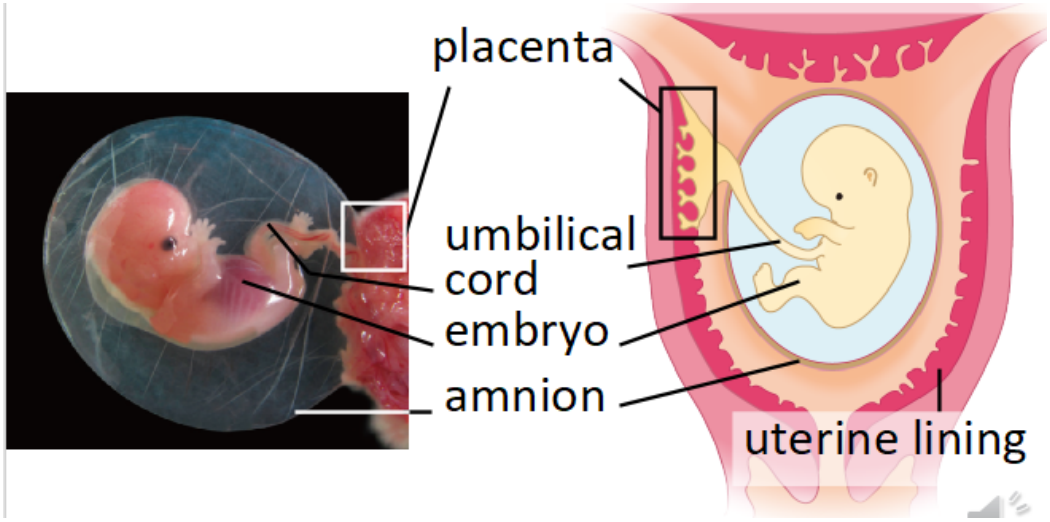
- The amnion is filled with a watery liquid
  - a cushion to protect the embryo against shock
  -



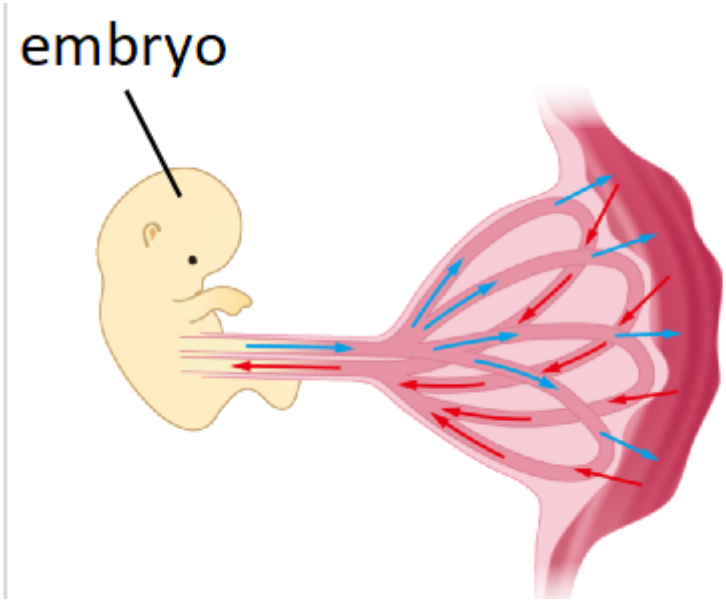
- At the site where the embryo is implanted
  - a placenta 胎盤 begins to form
  -



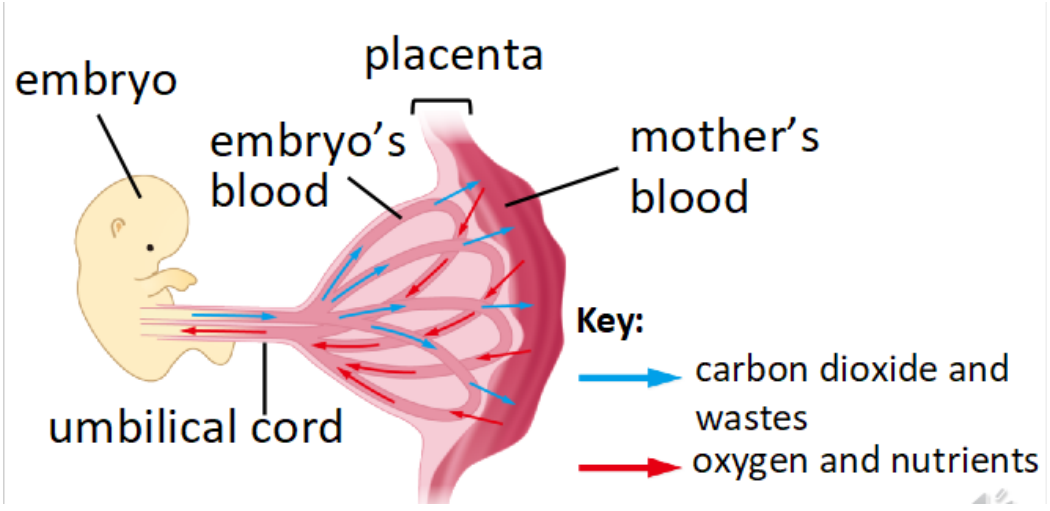
- The placenta is attached to the embryo by an umbilical cord
  -



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

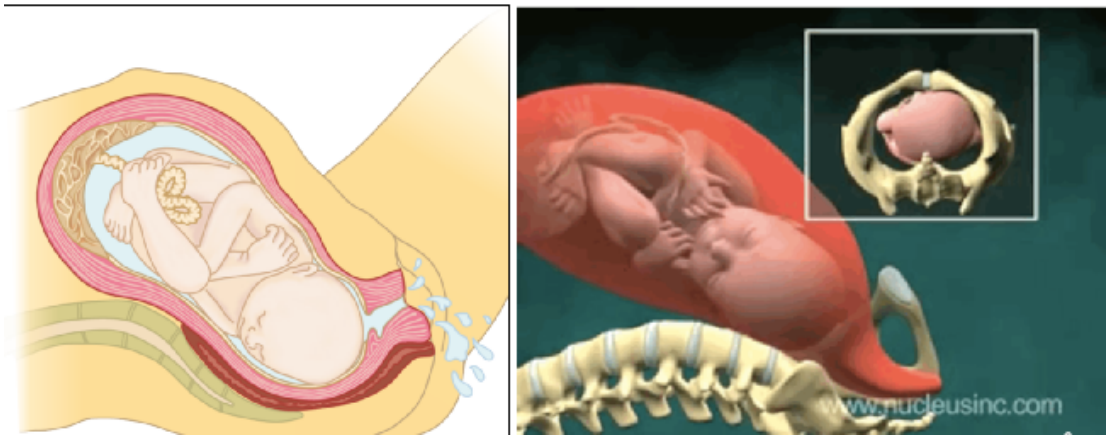


- placenta allows this exchange of materials
  -



- 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 and cuts the umbilical cord.
    - remains will dry up and fall off. The scar left behind is the navel.
  - The placenta is expelled after the baby is born.