1. Reproduction
- To produce a new individual.
- To ensure continuation of species or to increase population.

2. Reproduction

<table>
<thead>
<tr>
<th>Sexual</th>
<th>Asexual</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Involving fusion of male and female gametes.</td>
<td>- Carried out by lower organisms</td>
</tr>
<tr>
<td><strong>Human</strong></td>
<td></td>
</tr>
<tr>
<td>Male (testes)</td>
<td>Female (ovary)</td>
</tr>
<tr>
<td>Sperm (male gamete)</td>
<td>Ovum (female gamete)</td>
</tr>
<tr>
<td><strong>Fertilization</strong></td>
<td></td>
</tr>
<tr>
<td>Zygote</td>
<td>sperm fuses with ovum (fertilization)</td>
</tr>
<tr>
<td>Embryo</td>
<td>division of zygote</td>
</tr>
<tr>
<td>Foetus (2-9 months)</td>
<td>- has complete body shape</td>
</tr>
<tr>
<td>Baby (foetus that is born)</td>
<td></td>
</tr>
</tbody>
</table>

**Plant**
- Male / Stamen (anther) ↓ pollen grain (male gamete) **Fertilization** → Zygote ↓ Embryo ↓ Seed |
- Female / Pistil (ovary) ↓ Ovule (female gamete) |

- **Binary fission** – split into two - such as amoeba, paramecium, euglena, chlamydomonas, and bacteria.
- **Budding** - such as yeast and hydra and spirogyra.
- **Spore formation** - such as ferns, moss, mucour, fungi, lichen, mushroom.
- **Rejuvenation** - such as starfish, fluke, flatworm, tapeworm
- **Vegetative reproduction** - grow from specific vegetative part such as leave, stem or root.
3. **Human Gamete** (are produce after puberty)

<table>
<thead>
<tr>
<th>a. <strong>Sperm</strong> (smallest cell in men body)</th>
<th>b. <strong>Ovum</strong> (biggest cell in female body)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Able to swim / move / tadpole shape</td>
<td>i. Unable to swim / spherical shape</td>
</tr>
<tr>
<td>ii. Contain mitochondria which provide energy.</td>
<td>ii. Contain abundant cytoplasm to supply food and a large nucleus./ female genetic DNA.</td>
</tr>
<tr>
<td>iii. Contain a nucleus with DNA / male genetic</td>
<td>iii. Ovaries take turns to release the ovum every month (28 days).</td>
</tr>
<tr>
<td>iv. Alive less than 72 hours in uterus</td>
<td>iv. Die in 24 hours if it is not fertilize by sperm.</td>
</tr>
</tbody>
</table>

4. **Reproduction**

<table>
<thead>
<tr>
<th>a. Male reproduction system</th>
<th>b. Female reproduction system</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. <strong>Scrotal</strong></td>
<td>i. <strong>Ovaries</strong> produce ovum and female hormones (estrogen and progesterone).</td>
</tr>
<tr>
<td>- Protect the testes.</td>
<td>ii. <strong>Fallopian Tube / Oviduct</strong> - Place of fertilisation</td>
</tr>
<tr>
<td>- To lower temperature for the testes</td>
<td>iii. <strong>Uterus</strong> - Place where the foetus develops</td>
</tr>
<tr>
<td>ii. <strong>Seminal Vesicle.</strong></td>
<td>- Help to push the baby out.</td>
</tr>
<tr>
<td>- Secretes a slippery fluid to nourish the sperms.</td>
<td>iv. <strong>Cervix</strong> - Secrete slippery fluid to active the sperms</td>
</tr>
<tr>
<td>- Activated the sperms and to store sperms.</td>
<td>- Help to push the baby out during labour (widen during childbirth).</td>
</tr>
<tr>
<td>iii. <strong>Testes</strong></td>
<td>v. <strong>Vagina</strong> - Receive sperms</td>
</tr>
<tr>
<td>- Produce sperms and male testosterone hormone.</td>
<td>- Receive sperms</td>
</tr>
<tr>
<td>iv. <strong>Prostate gland</strong></td>
<td>- Control the flow of urine and sperms.</td>
</tr>
<tr>
<td>- Control the flow of urine and sperms.</td>
<td>v. <strong>Urethra</strong> - Release urine / sperms out of the body.</td>
</tr>
<tr>
<td>v. <strong>Urethra</strong></td>
<td>vi. <strong>Sperm duct</strong> - Channel sperms from the testis to the urethra.</td>
</tr>
<tr>
<td>- Release urine / sperms out of the body.</td>
<td>- Channel sperms from the testis to the urethra.</td>
</tr>
</tbody>
</table>
The Important of Pre-natal Care

1. Nutrition for foetal Development
   a. The foetal obtains his source of nutrients from the mother through umbilical cord / placenta.
   b. Therefore, the mother diet must contains:
      i. **Protein** - For formation of protoplasm / to build tissues.
      ii. **Carbohydrates and fats** - Provide energy for growth.
      iii. **Minerals**
          - **Iron** to build heamoglobin red blood cells.
          - **Calcium and phosphate** for bone and cartilage development
      iv. **Vitamins** - Strengthen mother’s immune system and health of foetus.
      v. **Folic acid** - for brain development and nervous system.
   c. **Smoking, alcohol and drugs** on the other hand are harmful to the foetus.

2. Sterility/ Infertility – unable to have children.
   a. **In Man**
      - Low sperms count in the semen.
      - Disorder of testicle.
      - Blockage in sperm duct.
      - Inability to erect
      - Hormone imbalance.
   b. **In Woman**
      - Inability to release ovum. (no ovulation)
      - Blockage in fallopian tube.
      - Disorder in uterus/ovary.
      - Hormone imbalance.

3. Overcome Sterility / Infertility
   a. **In vitro fertilization / artificial insemination**.
      - Retrieving ovum from the women and fertilizing them with sperms in a dish and then implanted into the woman uterus.
   b. **Hormone treatment**
      - Help the inability ovary to release ovum.

4. Birth Control Method – for family planning
   a. **In Woman**
      i. **Contraceptive pills.**
          - To prevent ovulation.
      ii. **Spermicides.**
          - Introduce into vagina to kill sperms.
      iii. **IUD**
          - Inserted into uterus to prevent zygote from implanting into uterus.
      iv. **Diaphragms**
          - Rubber cap fitted into cervix to prevent sperm from entering the uterus.
      v. **Tubectomy**
          - Legition of both fallopian tubes
   vi. **Natural method (Rythemic Method)**
      - Avoid having sex during fertile phase which is day 11 to 17.
      - Unreliable as the menstrual cycle is not constant.
   b. **In Man.**
      i. **Condom**
          - To prevent sperms from entering vagina.
      ii. **Vasectomy**
          - Cutting and trying up both sperm duct to prevent flow of sperm.
**Type of fertilization in animals**

4. **Fertilisation**
   
<table>
<thead>
<tr>
<th>a. Internal</th>
<th>b. External</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Occur <strong>inside</strong> of the female’s body.</td>
<td>- Occur <strong>outside</strong> of the female’s body.</td>
</tr>
<tr>
<td>- eg. mammals, reptile, bird.</td>
<td></td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td><strong>Advantages:</strong></td>
</tr>
<tr>
<td>a. Less gametes are produced</td>
<td>No specific reproduction organs.</td>
</tr>
<tr>
<td>b. Zygote / embryo is protected in the female’s body.</td>
<td></td>
</tr>
<tr>
<td>c. Chances of fertilisation is high.</td>
<td><strong>Disadvantage:</strong></td>
</tr>
<tr>
<td>- <strong>Disadvantage:</strong></td>
<td>a. Lot of gametes are produced</td>
</tr>
<tr>
<td>Require specific reproduction organs.</td>
<td>b. Need water as medium of transport.</td>
</tr>
<tr>
<td></td>
<td>c. Fertilization chances is low as lots of gametes are washed away or eaten by predators.</td>
</tr>
</tbody>
</table>

**The Sexual Reproductive of flowering plants.**

1. **Pollination**
   
   a. The transfer of pollen grains from the **anther** (male flower) to the **stigma** (female flower).

   - **Pollination**
     
     | Self | Cross |
     |------|------|
     | - occur in the **same** flower. | - occur in different flowers in **different** plants. |
     | - occur in the different flowers but in the **same** plant. | |

   - **The advantages of cross – pollination**
     
     i. Offspring which have good qualities in terms of size and taste.
     
     ii. Offspring which is healthier and can adapt to environmental changes.
     
     iii. More resistant to diseases.
     
     iv. More varieties

   - **Method to avoid self-pollination**
     
     i. The stamen and pistil mature on different time.
     
     ii. The male flowers and female flowers on different trees.
     
     iii. The anther is located below the stigma.

2. **Pollinating Agents.**

<table>
<thead>
<tr>
<th>Characteristic of flowers</th>
<th>Pollinated by</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Insect</td>
<td>ii. Wind</td>
</tr>
<tr>
<td>a. Petals</td>
<td>Large, bright, colourful</td>
</tr>
<tr>
<td>b. Pollen grains</td>
<td>Large, sticky.</td>
</tr>
<tr>
<td>c. Stamens</td>
<td>Short</td>
</tr>
<tr>
<td>d. Stigma</td>
<td>Short and sticky</td>
</tr>
<tr>
<td>e. Produces</td>
<td>Scented and with nectar</td>
</tr>
<tr>
<td>f. Examples</td>
<td>Hibiscus, lotus, orchid, sunflower and rose.</td>
</tr>
</tbody>
</table>
3. a. **Stamen** (Male flower)  
   ↓  
   **Anther**  
   ↓  
   **Pollen grains**  
   ↓  
   **Pollination**  
   ↓  
   **Pollen tube**  
   ↓  
   **Fertilisation**  
   ↓  
   **Zygote**  
   ↓  
   **Seed**  
   ↓  
   **Germination**  
   ↓  
   **Seedling**  

**Stamen** (Male flower)  
↓  
**Anther**  
↓  
**Pollen grains**  
↓  
**Pollination**  
↓  
**Pollen tube**  
↓  
**Fertilisation**  
↓  
**Zygote**  
↓  
**Seed**  
↓  
**Germination**  
↓  
**Seedling**

**Pistil** (Female flower)  
↓  
**Ovary**  
↓  
**Ovule**  
↓  
**Pollination**  
↓  
**Pollen tube**  
↓  
**Fertilisation**  
↓  
**Zygote**  
↓  
**Seed**  
↓  
**Germination**  
↓  
**Seedling**

### The Germination of Seeds

1. **The germination of seeds** need water, air and suitable **temperature** / heat (except sunlight because they do not have any leaves for photosynthesis.)

   a. **Sequences of germination**
      1. Absorb of water – the seed swells and increase in size
      2. **Testa** → soften and crack
      3. **Radical** → become roots (grow first)
      4. **Plumule** → become shoots
      5. **Cotyledon** getting smaller (as food being used up for growing)

2a. **Type of Germination**

<table>
<thead>
<tr>
<th>Epygeal Germination</th>
<th>Hypogeal Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cotyledon is brought <strong>above the soil surface</strong> during germination such as peanut, long beans, groundnuts and kidney beans.</td>
<td>- Cotyledon is <strong>below the ground</strong> during germination such as like maize, paddy and rubber tree.</td>
</tr>
</tbody>
</table>

5. During germination, the cotyledon is getting **smaller** because the **food** has been used up for growing / germination.

6. **Reproduction**
Sexual (produce variation)
- New individual is produced from two parents of different genders.

Asexual
- New individual is produced from a single parent.

**Advantages**
- Involving a single parent
- A quick reproduction process.

**Disadvantages**
- No variation
- Less adaptable to environmental changes.

Vegetative
- Rhizomes - Corms - Stem tubers - Leaves - Runners - Stem cuttings

Binary Fission
- Amoeba - Bacteria - Paramecium - Euglena - Chlamydomonas

Budding
- Yeast - Hydra - Spirogyra

Spore formation
- Ferns - Lichens - Mushroom - Mücor - Moss

Rejuvenation / Regeneration
- Star fish - Fluke - Flatworm - Tapeworm

Vegetative Reproduction In Flowering Plants
1. Grow from specific vegetative parts of the plant, such as stems, leaves and roots.
   - Involving a single parent plant.
   - No variation.
iii. A quick process.
   a. **Rhizomes**
      - Grow **horizontal underground** stems like lalang, ginger, lotus and tumeric.
      ![Rhizomes](image)
   b. **Corms**
      - Thick, **short underground stem swollen** with food reserves, like water chestnut and yam.
      ![Corms](image)
   c. **Bulbs**
      - With fleshy **scale leaves**.
      - Food is stored in leaves, like onion and garlic, tulips, lilies.
      ![Bulbs](image)
   d. **Stem Tubers**
      - Swollen underground stem with a number of buds.
      - Buds produce young shoots like potatoes and dahlias.
      ![Stem Tubers](image)
   e. **Leaves**
      - Plants growing from leaves like bryophyllum leaf and aloe vera.
      ![Leaves](image)

f. **Runners**
   - With stems (runner / stolans) that grow **horizontally above the ground** like sweet potato and strawberry.
   ![Runners](image)

   g. **Stem cutting**
   - Growing from buds, found on the stem, like tapioca, rose, sugar cane, bougainvillea and hibiscus.
   ![Stem Cutting](image)

   h. **Suckers**
   - Shoot growing from the stem, like banana, bamboo and pineapple plants.
   ![Suckers](image)

2. Advantages of Vegetative Reproduction are as follow:
   a. **It takes a shorter time for new plants to develop** by vegetative reproduction than from seeds because no pollination or fertilization takes place as only one parent is needed.
   b. **The new plants can survive better in harsh condition** because they can still obtain food from the parent plant.
   c. Since vegetative reproduction is a form of asexual reproduction.
      i. **The daughter plant will resemble the parent** plant in every way.
      ii. **The good qualities of the parent plant can be directly passed down**
to the daughter plant without any changes.

3. **Disadvantages of Vegetative Reproduction are as follow:**
   a. Compare to the new plants produced by seed, those produced by vegetative reproduction are of **lesser variety** and hence this makes them less adaptable to changes in the environment.
   b. The **lack of dispersal** make the new plants grow close together and have to compete for sunlight and nutrients with the parent plant.
   c. **No variation** occur

![Diagram of the life cycle of flowering plants](image)

4. **Classification of vegetable reproduction**

<table>
<thead>
<tr>
<th></th>
<th>P: Bryophyllum</th>
<th>Q: Potato</th>
<th>R: Yam</th>
<th>S: Aloe Vera</th>
</tr>
</thead>
<tbody>
<tr>
<td>P, Q, R/S</td>
<td>Reproduce from leaves</td>
<td>Reproduce from stem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P, S</td>
<td>Q, R</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>