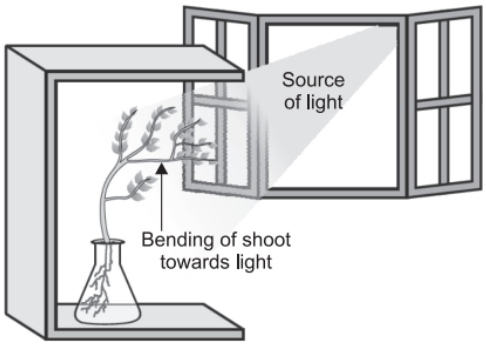
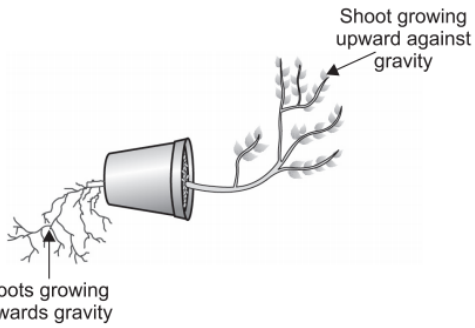
- **Coordination in Plants**
  - ➢ Plants also respond to stimuli, e.g. if we touch the leaves of a sensitive plant of Mimosa family, they begin to fold up and droop. There is no growth involved in this movement.
  - ➢ When a seed germinates, the root goes down and shoot goes up forming the stem in air.

The directional movement is caused by growth.

- ➢ The plants show two different types of movements. They are movement dependent on growth. They are directional movements in which growth is involved, *e.g.*, when seed germinates, root grows downward and stem grows upwards.



(*a*) Response of the plant to the direction of light



(*b*) Plant showing geotropism

Types of Plant Movements

Dependent on Growth (Tropic Movements)

- Growth is visible.
- Type of tropic movements
  - ➢ Thigmotropism
  - ➢ Phototropism
  - ➢ Geotropism
  - ➢ Hydrotropism
  - ➢ Chemotropism

Independent on Growth (Nastic Movements)

- No growth is visible.
- Movement happens at a point different from the point of touch.
- Plant uses electrical-chemical means to convey information from cell to cell.

- **Growth independent movements:**
  - ➢ They are also called *nastic movements*. Since no growth is involved, therefore sensitive plant must actually move its leaves in response to touch or any other stimuli.
  - ➢ The movement happens at a point different from the point of touch. It means information of touch that has occurred needs to be communicated.
  - ➢ Plants also use electrical-chemical means to convey information from one cell to another cell.
  - ➢ Plant cells change their shape by changing the amount of water in them, resulting in swelling or shrinking.
- **Growth dependent/directional movements:**
  - ➢ They are also called *tropic movement*.
  - ➢ Pea plant climbs up other plants or fences by means of tendrils.
  - ➢ These tendrils are sensitive to touch. The part of tendril which is in contact with the object does not grow rapidly as the part of tendril away from object.
  - ➢ This causes the tendril to circle around the object and thus cling to it.

➢ Plants respond to the stimuli slowly by growing in a particular direction.
➢ Since this growth is directional therefore, it appears as if plant is moving.

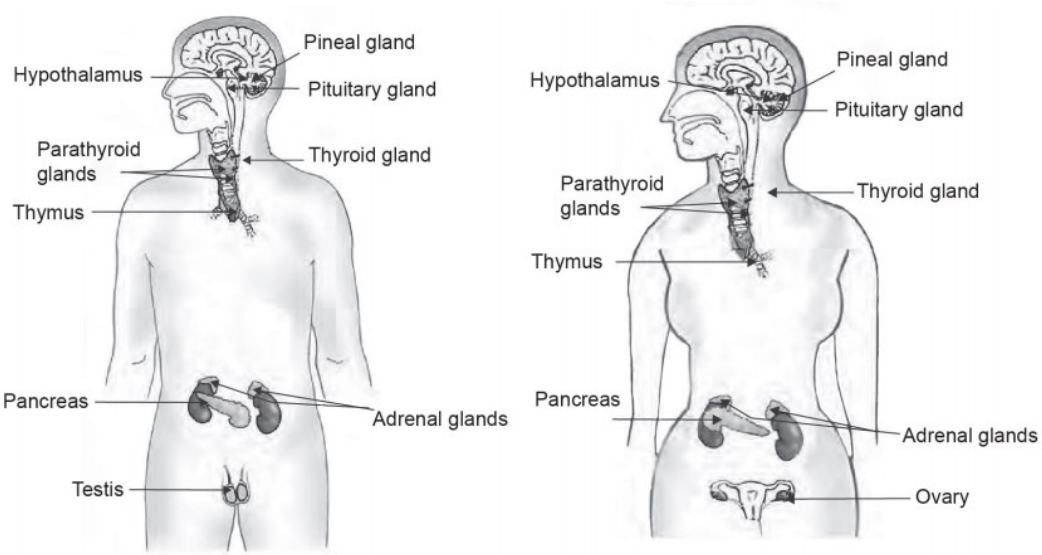
- Growth dependent movements are of different types:
  (*a*) **Phototropism** is the movement towards the direction of light or away from it *e.g.,* shoots bend towards light while roots grow away from it. Hence shoots is positively phototropic and root is negatively phototropic.
  (*b*) **Geotropism** can be exhibited by the growth of roots downward the earth hence positively geotropic. A stem grows upward, away from earth hence it is negatively geotropic.
  (*c*) **Chemotropism** is the growth due to a chemical stimulus *e.g.,* pollen tubes grow towards ovules inside the ovary.
  (*d*) **Thigmotropism:** The movement of a plant when it comes in contact with any support like the pea plant climbs up other plants or fences by means of tendril.
  (*e*) **Hydrotropism:** The movement of roots towards greater water potential region. It help in absorption and transport of water to stem and leaves.

Chemical Coordination in Plants

Unlike animals, plants do not have specialised tissue (nerve cells) to conduct information. Rather, the stimulated cells in plants release chemical compounds called *Hormones*/growth regulators which diffuse all around from the original cells which secrete them. The other cells detect these compounds using special molecules on their surfaces, recognize the information and even transmit it. The various plant hormones which coordinate growth, development and responses to the environment are:

- **Plant hormones (Phytohormones):** These are the chemicals produced naturally in plants and are capable of translocation and regulate one or more physiological processes when present in low concentration.

Chemical Coordination in Animals



Endocrine glands in human beings (*a*) male, (*b*) female

- **Hormone:** A chemical messenger secreted by the endocrine glands. It is poured directly in to the blood and transported to a target organ to coordinate an activity.

- **Endocrine Glands:** Ductless glands which pour their secretions directly into the blood. Endocrine glands of human body are:
  - ➢ **Pituitary:** Located in lower side of fore brain. Secretes growth hormone and many other hormone. Growth hormone regulates growth and development of body.
  - ➢ Deficiency of growth hormone leads to dwarfism. Excess of growth hormone leads to Gigantism.
- **Thyroid:** A pair these glands is located in the neck region, one on either side of trachea.
  - ➢ **Hormone:** *Thyroxin*, an iodine containing hormone which regulate metabolism of carbohydrates, proteins and fats thereby regulating growth.
  - ➢ **Goitre:** Swelling of neck due to enlargement of thyroid gland. It occurs due to deficiency of iodine in our food, hence deficiency of thyroxin.
- **Pancreas:** Located below the stomach and secretes *insulin* which lowers the blood sugar level.
- **Diabetes:** Rise in sugar level in the blood due to deficiency of insulin.
- **Adrenal:** A pair one on top of each kidney. Secretes *Adrenaline*.
- **Adrenaline** helps the body to handle emergency situations like anger, excitement, frightening etc. by increasing heart beat, breathing rate, more supply of oxygen to the muscles etc.
- **Testes** in males, secrete a hormone called *Testosterone* which stimulates secondary sexual characteristics during puberty (13–14 years).
- **Ovaries:** In females, secrete *estrogens* which stimulate development of secondary sexual characteristics at puberty (10–12 years).
- **Feed Back Mechanism** regulates timing and amount of hormone to be released in the body *e.g.*, rise in sugar in the blood is detected by pancreas, hence insulin secretion is increased. But when sugar falls, its secretion decreases.