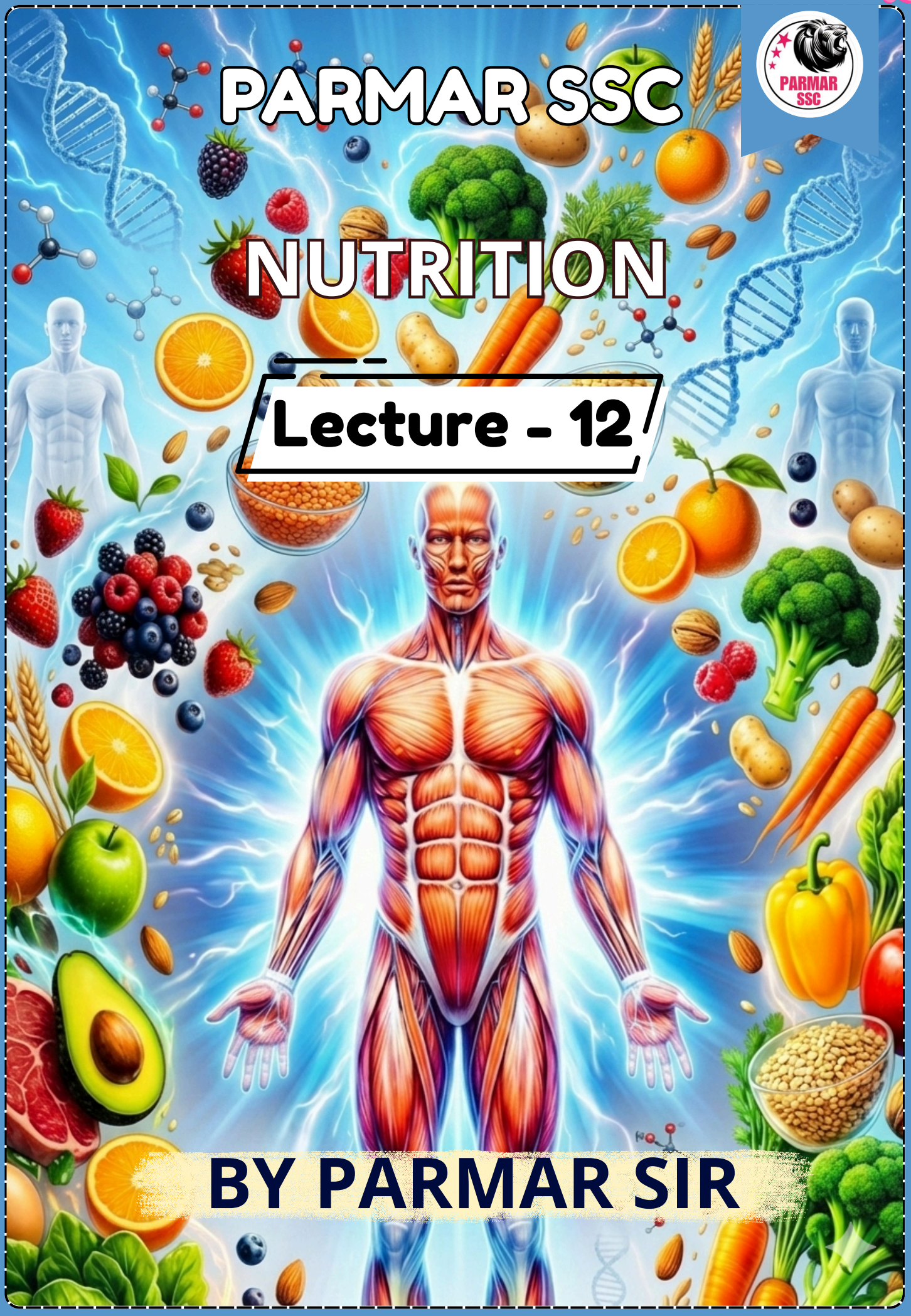
PARMAR SSC

NUTRITION

Lecture - 12

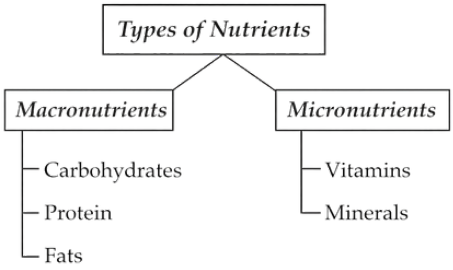


BY PARMAR SIR

Nutrition in animals

- **Nutrients divided into two categories:**

1. **Macronutrients**: Macronutrients are nutrients that the body needs in large amounts to function, including carbohydrates, fats, and proteins
2. **Micronutrients**: Micronutrients are vitamins and minerals that the body needs in small amounts for growth, development, and health.

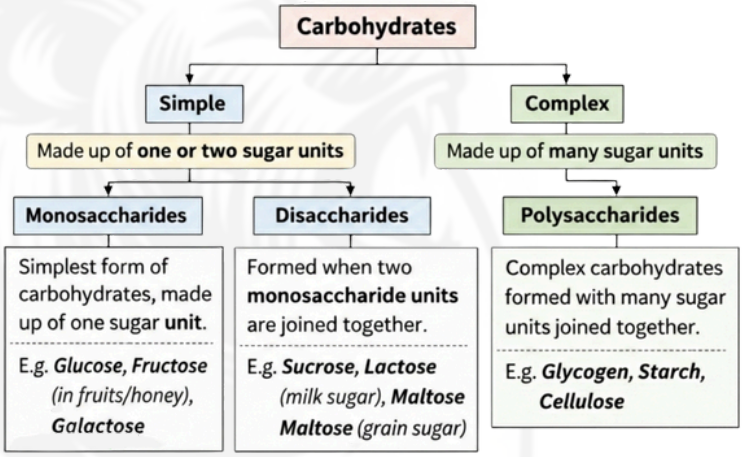


Nutrition in animals

Carbohydrates

- Carbohydrates are biomolecules composed of carbon, hydrogen, and oxygen, primarily used as a source of energy in living organisms.
- These are quick form of energy.
- 4 calories are released from 1 gm of carbohydrates.

Potato contains starch in abundant quantity.



Fats

- 9 calories are released from 1 gm of fat.
- Fats are a crucial type of nutrient, vital for energy, building cell structures, and supporting various bodily functions.
- Adipose tissues in our body store fats in the form of triglycerides.

Types of Fat

Saturated Fat

- They are not easily digested as the molecules are tightly packed together.
- They have higher melting point and are found in red meat, pork, etc.
- Excess intake of saturated fat is considered harmful to health because it increases the level of LDL (low-density lipoprotein), which is often called "bad cholesterol."

Unsaturated Fat

- They are easily digested in our body and healthier in comparison to saturated fats.
- They are found in vegetable oil, nuts, and seeds.
- Unsaturated fats are considered "good" because they promote the level of HDL (high-density lipoprotein) in the body, which is called "good cholesterol."

Trans fat is the most harmful because it is formed when unsaturated fats are converted into saturated fats through the process of hydrogenation; for example, in fast food.

Proteins

- Proteins are built from smaller units called amino acids.
- **Requirement**: 0.8~gm/kg of body weight per day.
- **Present in**: Egg, yolk, soybeans, pulses, chicken, fish, etc.
- **Main sources of protein**:
- **Milk**: Casein
- **Hair/Nail**: Keratin
- **Rice**: Glutelin, Albumin
- **Grains**: Gluten
- **Egg white**: Albumin

The white part of an egg solidifies when cooked due to the process of protein denaturation.

Amino Acids

- Amino acids are the fundamental building blocks of proteins.
- There are total 20 amino acids, out of which 9 are essential amino acids and 11 are non-essential amino acids.

Types of Amino Acids

1. **Non-essential amino acids:** Non-essential amino acids can be produced by the body, but certain circumstances can make them temporarily essential.
   - **Types:** Glycine, Serine, Proline, Glutamic acid, Alanine, Aspartic acid, Cystine, Tyrosine, Asparagine, and Glutamine.

2. **Essential amino acids:** Essential amino acids, which the body cannot synthesize, must be obtained through the diet.

Amino Acids	Functions
Histidine	Important for growth, tissue repair, and production of histamine (immune response)
Isoleucine	Helps in muscle metabolism and energy regulation; found in muscle tissue
Leucine	Stimulates protein synthesis, muscle repair, and regulates blood sugar levels
Lysine	Aids calcium absorption, collagen formation, and immune system function
Methionine	Involved in metabolism and detoxification; precursor of other amino acids
Phenylalanine	Precursor to neurotransmitters (dopamine, epinephrine); improves mood and alertness
Threonine	Helps with protein balance, tooth enamel, and fat metabolism
Tryptophan	Precursor of serotonin and melatonin (affects mood and sleep)
Valine	Promotes muscle growth and tissue repair; provides energy

Disease caused by deficiency of proteins

Kwashiorkor:

- Kwashiorkor is a type of malnutrition characterized by severe protein deficiency.
- It causes fluid retention and a swollen, distended abdomen.
- Kwashiorkor most commonly affects children, particularly in developing countries with high levels of poverty and food insecurity.

Marasmus:

- Marasmus is a severe form of malnutrition caused by a lack of calories and protein, resulting in significant loss of muscle mass and subcutaneous fat.
- It's characterised by emaciation and wasting of the body, often affecting children in developing countries due to factors like poverty and food scarcity.

Micronutrients

Vitamins

- Vitamins are essential, organic substances found in foods that are needed in small amounts for various bodily functions, including growth, metabolism, and nervous system activity.
- **1912**: Casimir Funk, coined the term "Vitamin".

Types of Fat

Water Soluble Vitamins

- These vitamins dissolve in water and are not stored in the body:
- Vitamin B and Vitamin C.



Fat Soluble Vitamins

- These vitamins dissolve in fat and are stored in the body's fatty tissues and liver:
- Vitamin A, Vitamin D, Vitamin E, Vitamin K



Vitamin D

- It is also known as "Sunshine Vitamin". It is also considered as a hormone.
- Vitamin D is produced in the skin by sunlight. It is converted into calcitriol (its active form) by the liver and kidneys, and through the blood it helps the bones absorb calcium.
- **Types**:
  - **Vitamin D2 (Ergocalciferol):** Helps in calcium absorption.
  - **Vitamin D3 (Cholecalciferol):** More effective at raising vitamin D levels in the blood.

Diseases caused by deficiency of Vitamin D:

- **Osteoporosis:** It is a bone disease that develops when bone mineral density and bone mass decrease.
- **Osteomalacia:** Osteomalacia, also known as "soft bones," is a metabolic bone disease that weakens the bones and increases the risk of fractures.
- **Rickets:** It mainly occurs in children; their bones become soft and bent.

- Pellagra is mainly called the 3D disease and is caused by a deficiency of Vitamin B3 (niacin).
- 3D – Dementia, Dermatitis, and Diarrhea.

Vitamin	Scientific Name	Deficiency/Symptoms
Vitamin A	Retinol	Night blindness
Vitamin B1	Thiamine	Beriberi disease
Vitamin B2	Riboflavin	Decrease in RBC
Vitamin B3	Niacin	Pellagra
Vitamin B5	Pantothenoic Acid	Fatigue, numbness, muscle cramps
Vitamin B6	Pyridoxine	Anaemia
Vitamin B7	Biotin	Hair loss, brittle nails, skin rashes
Vitamin B9	Folic acid	Fatigue, neural tube defects in babies
Vitamin B12	Cyanocobalamin	Pernicious anemia, memory loss, fatigue
Vitamin C	Ascorbic Acid	Scurvy (bleeding gums)
Vitamin D	Calciferol	Osteomalacia, muscle pain, rickets
Vitamin E	Tocopherol	Anti-sterility, vision problems
Vitamin K	Phylloquinone	Excessive bleeding, poor blood clotting

Vitamin	Sources
Vitamin A	Spinach, carrots, yellow fruits, sweet potatoes
Vitamin B	Meat, seafood, poultry, eggs, dairy products, legumes, green leafy vegetables
Vitamin C	Spinach, lemon, oranges, amla, strawberries
Vitamin D	Cod liver oil, salmon, swordfish, tuna, egg yolk
Vitamin E	Kale, spinach, lettuce, parsley
Vitamin K	Soya bean, coriander, green leafy vegetables, peas

Sources of Omega-3: Flax seeds, chia seeds, walnuts, fatty fish, and eggs

Minerals

- Minerals are naturally occurring, inorganic chemical elements that the body needs in small amounts for proper development and functioning.
- Millets like Jowar, Bajra, Ragi have abundant minerals in them.

Magnesium:

- Involved in metabolism, supports bone health.
- A typical adult human body contains about 25g of magnesium.

Zinc:

- Important for wound healing, involved in protein synthesis and cell growth.

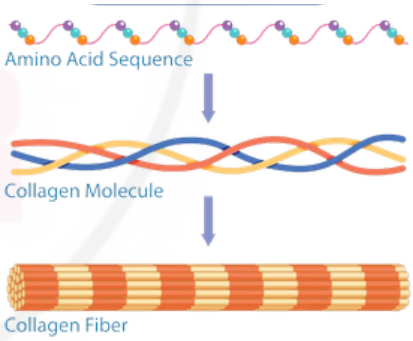
Iodine:

- Essential component of thyroid hormone which regulates metabolism, growth, and development. Iodine also impacts brain function and cognitive development.

Excess fluoride in water causes a disease called fluorosis

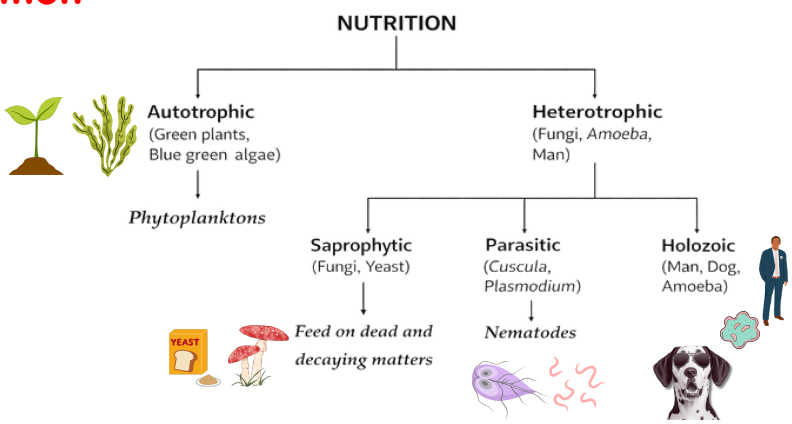
Collagen

- Collagen is the most abundant protein of our body that are found in extracellular spaces (skin, bone joints).
- Triple helical structure of collagen was discovered by: G. N. Ramachandran.
- Vitamin C is important for synthesis of collagen.



Nutrition in Plants

Modes of nutrition



Autotrophic

- In this mode of nutrition an organism can produce its own food, using light, water, carbon dioxide, and other chemicals.
- **Examples**: Green plants, Blue green algae, Phytoplanktons.

Heterotrophic

- In this mode of nutrition an organism cannot produce its own food, however, takes nutrition from other organisms, primarily plant or animal matter.

Heterotrophic

Saprophytic



In this type of nutrition, the organism, particularly fungi, obtain nutrients directly from dead organic matter or wastes.

Parasitic



In this type of nutrition, plants derive some or all of its nutrition requirements from another living plant (host).

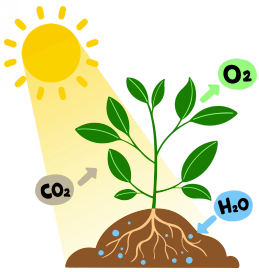
Holozoic

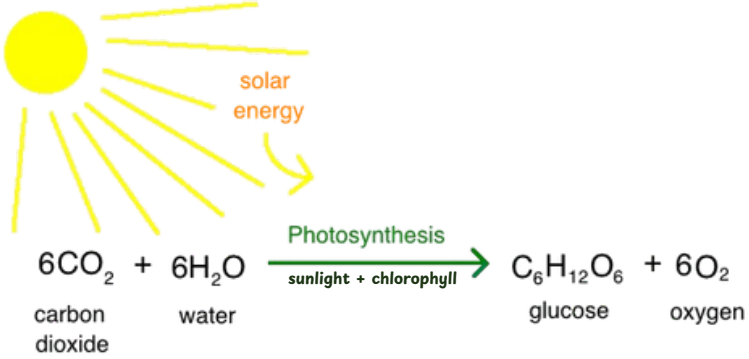


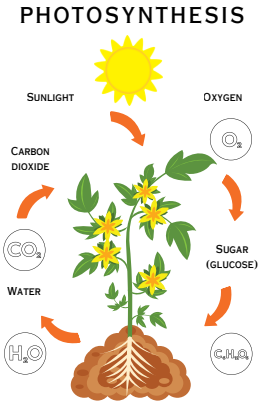
In this type of nutrition, the organism consume solid or liquid food and break it down internally.

Photosynthesis

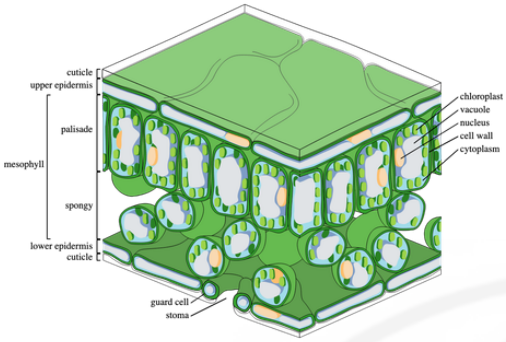
- Photosynthesis is the process by which green plants make their own food using sunlight, carbon dioxide, and water.
- It takes place in the leaves, in cells containing chlorophyll.
- Sunlight provides energy to split water into hydrogen and oxygen.
- Carbon dioxide from the air combines with hydrogen to form glucose (sugar).
- Oxygen is released as a byproduct.

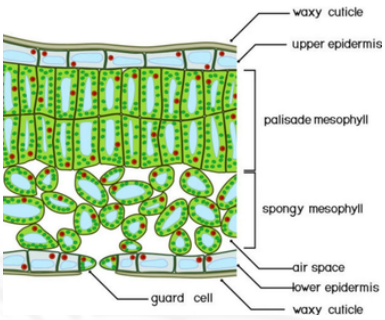






- Mesophyll cells are primary site for photosynthesis.
- Guard cells regulate the opening and closing of stomata pores, and they respond to changes in carbon dioxide concentration in leaves.

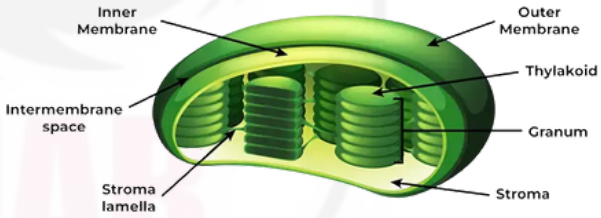




Chloroplast

- A chloroplast is an organelle in plant cells and algae that converts sunlight into chemical energy through photosynthesis.
- Chlorophyll makes plant appear green because it absorbs red and blue light from sunlight while reflecting green light.

Structure of Chloroplast



- **Inner membrane:** Controls the movement of materials in and out.
- **Outer membrane:** Protective layer; allows small molecules to pass.
- **Stroma:** Fluid-filled space where the Calvin cycle occurs.
- **Thylakoids:** Disc-shaped sacs that contain chlorophyll.
- **Grana (Granum):** Stacks of thylakoids where light reactions take place.
- **Lamella:** Membranous bridges connecting grana.

Light and Dark reaction in Chloroplast

- **Light Dependent Reaction:** The light-dependent reactions occur in the thylakoid membranes where light splits water into Hydrogen and Oxygen in the form of ATP and NADPH.
- **Light Independent Reaction:** Light Independent Reaction (Calvin Cycle): The light-independent reactions occur in the stroma where there is a use of ATP and NADPH to convert Carbon Dioxide into Glucose.

Feature	Chlorophyll *a*	Chlorophyll *b*
Role	Primary pigment	Accessory pigment
Function	Converts light → chemical energy	Transfers energy to chlorophyll *a*
Color	Blue-green	Yellow-green
Present in	Reaction center	Light-harvesting complex

- **Carotenoids:** These pigments give yellow and orange colour to plants, fruits, and vegetables, such as carrot, papaya, and autumn leaves.
- **Anthocyanins:** These pigments provide red, purple/violet, and blue colour to plants, such as red cabbage, berries, and apple.
- **Chlorophyll:** It gives the natural green colour to the leaves and stems of plants and plays the most important role in photosynthesis.

Macronutrients and Micronutrients in plants

Macronutrients	Micronutrients
N: Nitrogen	Fe: Iron
P: Phosphorus	Mn: Manganese
K: Potassium	Cu: Copper
S: Sulphur	Zn: Zinc
Ca: Calcium	B: Boron
Mg: Magnesium	Cl: Chlorine
C: Carbon, H: Hydrogen, O: Oxygen	Mo: Molybdenum

They are obtained from the soil.

They are obtained from air and water.

Macronutrients	Symbol	Main function
Nitrogen	N	Promotes rapid, green, leafy growth. It is the core building block of chlorophyll, which the plant needs to make food.
Phosphorus	P	Vital for root development, flowers, and seeds. Acts as the energy transfer system from roots to leaves.
Potassium	K	Boosts overall immunity and regulates water balance. Helps fight diseases and survive drought by controlling the pores (stomata) on leaves.

Major Macronutrients

Macronutrients	Symbol	Main function
Calcium	Ca	Provides structural support. Acts like "cement" building and holding plant cell walls together so plants stay strong and upright.
Magnesium	Mg	Drives photosynthesis. It is the central atom in the chlorophyll molecule; without it, leaves cannot capture sunlight and turn yellow.
Sulphur	S	Essential for creating amino acids, which are used to build plant proteins, necessary enzymes, and vitamins.

- **1828:** Friedrich Wohler synthesised Urea.
- Urea (CH4N2O or NH2CONH2) is a Nitrogen containing fertilizer
- Legumes such as lentils do not require fertilisers as their roots have Nitrogen Fixing Bacteria such as Rhizobium, Azotobacter.
- They convert atmospheric Nitrogen into fixed Nitrogen that is usable by plants.

Venus flytrap, pitcher plant, sundew, and bladderwort are all insectivorous or carnivorous plants.

Few Important terms

- **Xerophytes:**
  - Xerophytes are plants adapted to survive in dry or arid environments, characterized by limited water availability.
- **Heliophytes:**
  - Heliophytes, also called sun-loving plants, are those that require full exposure to the sun for their optimum growth.
- **Neophytes:**
  - A neophyte is a plant species which is not native to a geographical region and was introduced in recent history.
- **Protophytes:**
  - Protophyte plants are primitive, simple, and often microscopic plants that represent the earliest forms of plant life.



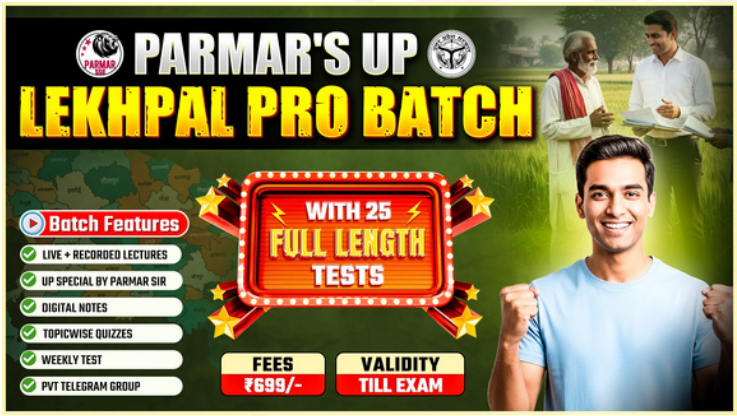


Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE





Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE





Join Now – Start Your Smart Preparation Today!

CLICK HERE