01 NUTRITION IN PLANTS

🎯 Learning Objectives

- Modes of nutrition: Autotrophic and Heterotrophic
- Photosynthesis: Process, requirements, and products
- Other modes of nutrition: Parasitic, Saprophytic, Insectivorous, Symbiotic
- How nutrients are replenished in the soil

1. Mode of Nutrition in Plants

Plants obtain their nutrition by various modes. The mode of nutrition can be divided into two distinct types. Broadly speaking, plants can be divided into **autotrophs** and **heterotrophs**.

📌 Key Concept

- **Nutrition:** The process of taking in food and utilizing it for growth and maintenance.
- **Autotrophs:** Organisms that make their own food.
- **Heterotrophs:** Organisms that depend on others for food.

2. Autotrophic Nutrition

'Auto' means self and 'trophos' means nourishment. Plants are called autotrophs because they make their food themselves.

> **Definition**
>
> The making of food for themselves is called **Autotrophic nutrition**. This mode is found in green plants.

If the autotrophs prepare their own food by utilising chemical energy they are called ***chemoautotrophs***.

3. Heterotrophic Nutrition

The word 'Heterotrophic' is the combination of 'Hetero' (others) + 'Trophos' (nourishment). If organisms depend on others for their food, it is called **Heterotrophic Nutrition**.

> **Important Note**
>
> Animals cannot make their food themselves. They depend for food upon plants. Therefore, nutrition in animals is called Heterotrophic Nutrition. Animals are known as **Heterotrophs**.

Heterotrophic plants can be further divided into **parasites**, **saprophytes**, and **symbiotic plants**.

4. Classification of Modes of Nutrition

Main Mode	Sub-Mode	Examples
Autotrophic	Photo autotrophic	All green plants, Purple, red and green bacteria.
	Chemo autotrophic	Nitrifying bacteria, Iron bacteria, Sulphur bacteria.
Heterotrophic	Parasitic	**Total:** Stem (Cuscuta), Root (Orobanche, Rafflesia) **Partial:** Stem (Viscum), Root (Santalum)
	Saprophytic	Monotropa, Neottia, Agaricus, Rhizopus.
	Symbiotic	Lichen, Root nodules, Mycorrhiza.
	Insectivorous	Drosera, Utricularia, Nepenthes, Dionea.

5. Saprotrophic Nutrition

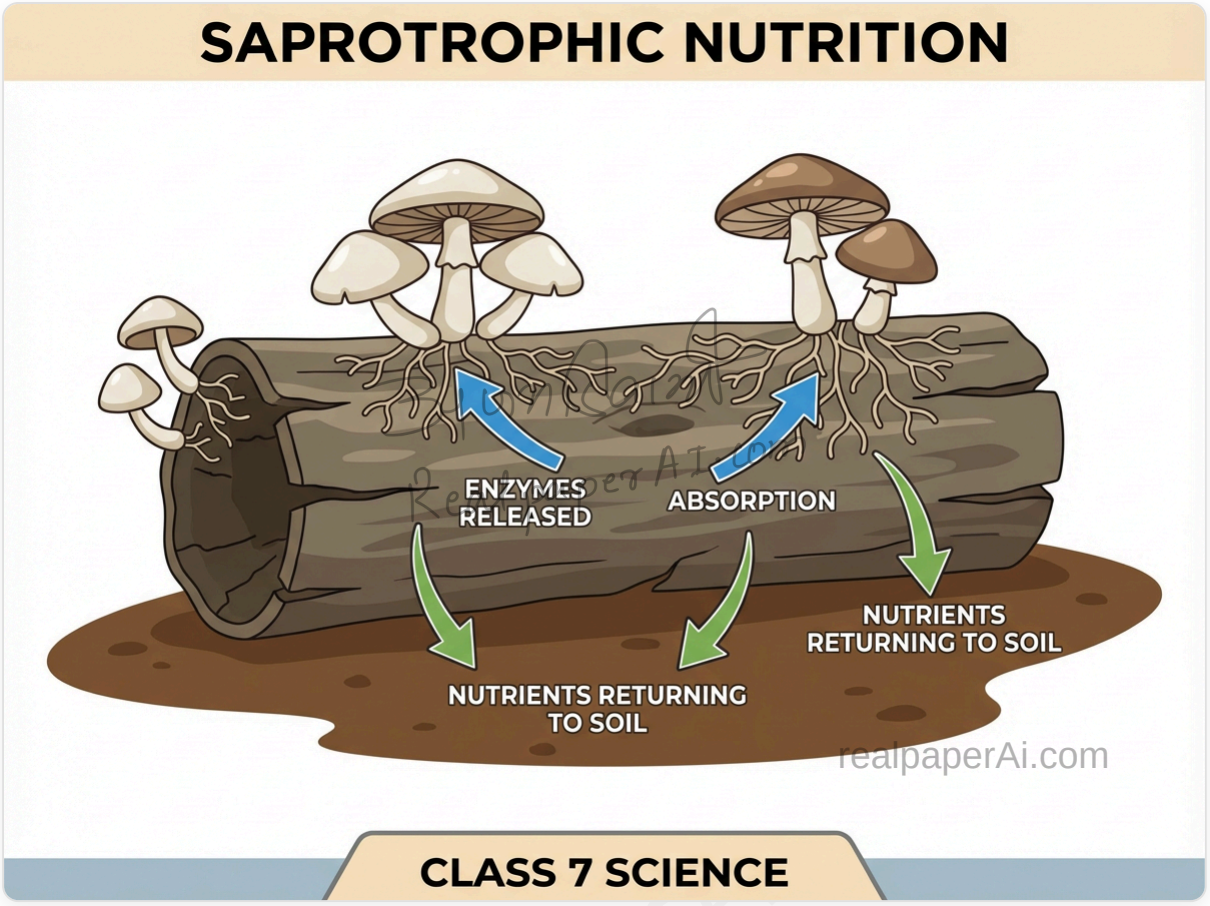

Fig. 5.1 — Saprotrophic nutrition: Fungi decomposing dead organic matter

Definition

The taking of nutrients by an organism from **dead and decaying matter** in the form of solution is called **saprotrophic nutrition**.

Examples

The organisms which use saprotrophic mode of nutrition are called **saprotrophs**.
Example: **fungi** (mushrooms, yeast).

6. Photosynthesis — Food Making Process

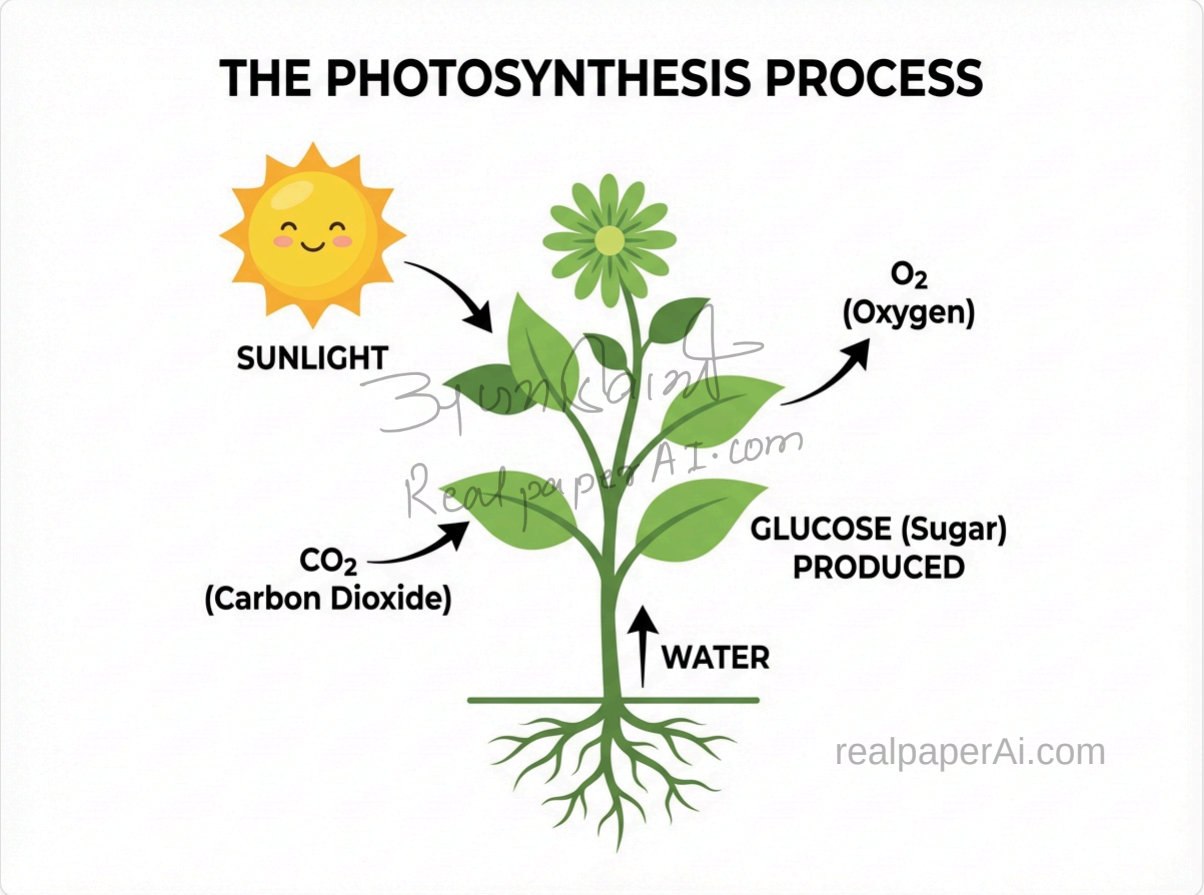

Fig. 6.1 — Photosynthesis: Plants use sunlight, CO_2 and water to make food

The process of making of food by green plants in the presence of **sunlight** and **chlorophyll** is known as **photosynthesis**.

Photosynthesis is the combination of two words: **'Photo'** (light) + **'Synthesis'** (to make).

Mechanism

- **Roots:** Absorb **water** and **minerals** from soil via **Xylem**.
- **Leaves:** Have tiny pores called **stomata** to take in **carbon dioxide**.
- **Chlorophyll:** Green pigment that captures **sunlight** energy.
- **Process:** Converts CO_2 and water into **carbohydrates** (food) and **oxygen**.

Carbon Dioxide + Water → Carbohydrate + Oxygen

(In the presence of Sunlight & Chlorophyll)

⚠️ **Common Mistake**

Students often confuse photosynthesis with respiration. Remember: Photosynthesis **PRODUCES** oxygen; Respiration **CONSUMES** oxygen.

7. Conditions Necessary for Photosynthesis

- ☀️ Presence of **Sunlight**
- 🌿 Presence of **Chlorophyll**
- 💧 Presence of **Water**
- 🌬️ Presence of **Carbon Dioxide**

Fact: Desert Plants

Cactus plant leaves are modified into spines to reduce water loss. In these plants, photosynthesis takes place in the green stems! Pine trees grow in triangle shapes to expose needles to sun.

💡 **Tip**

A simple way to remember: **'SWaCS'** — Sunlight, Water, Chlorophyll, CO_2 are needed for photosynthesis.

8. Photosynthesis in Algae

Green patches in ponds are living organisms called **algae**. Algae look green because of the presence of **Chlorophyll**. Algae prepare their own food by the process of **photosynthesis**.

9. Synthesis of Plant Food Other Than Carbohydrate

Plants need **proteins** and **fats** besides carbohydrates. **Proteins** are **nitrogenous substances**.

Nitrogen Fixation

Certain types of bacteria called ***Rhizobium*** in the soil convert gaseous **nitrogen** into a usable form. Farmers also add **nitrogenous fertilizer** to the soil.

10. Modes of Nutrition in Non-Green Plants

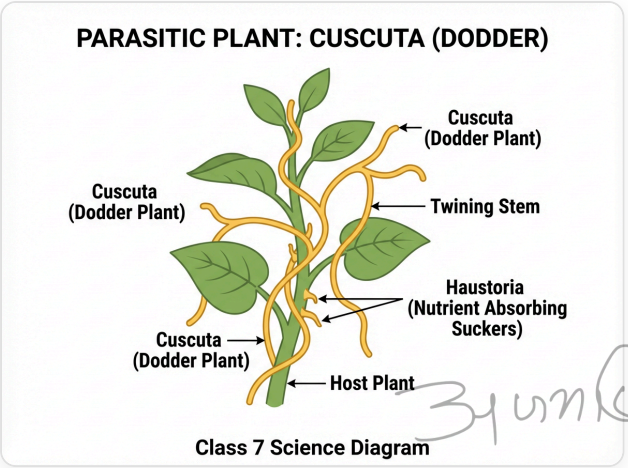

Fig. 10.1 — Cuscuta: Total stem parasite on host plant

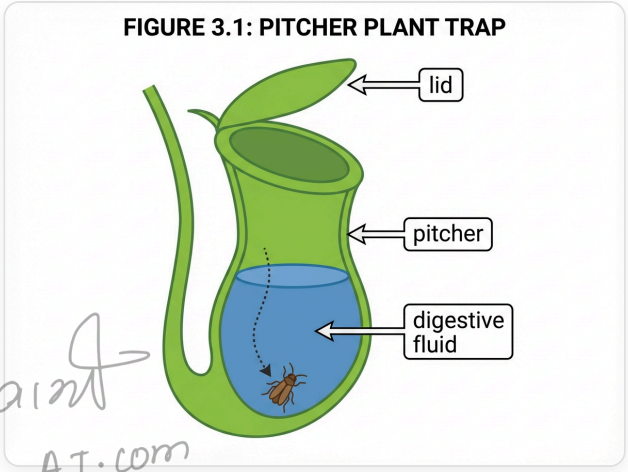

Fig. 10.2 — Pitcher Plant: Insectivorous plant trapping insects

Parasitic Plant

Lives on/inside another organism (host) for food.

Ex: Cuscuta (Dodder), Rafflesia.

Partial Parasite

Receives part of nutrients from host.

Ex: Viscum (Mistletoe), Santalum.

Insectivorous Plant

Traps insects for nitrogen.

Ex: Pitcher plant, Venus flytrap.

Saprotrophs

Feed on dead organic matter.

Ex: Mushroom, Yeast.

📌 Important

Cuscuta is a **total stem parasite**. It has no chlorophyll and depends entirely on its host for food and water.

11. Symbiosis or Mutualism

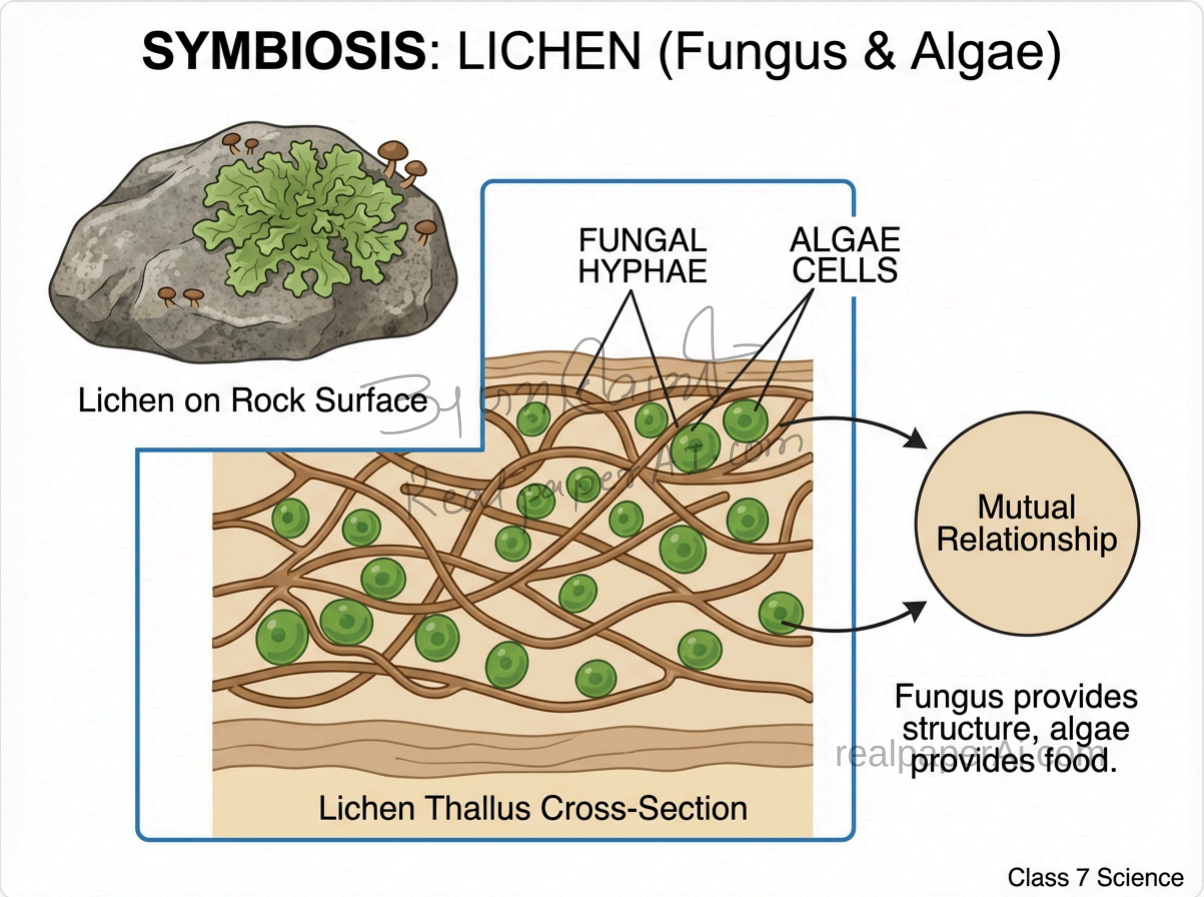

Fig. 11.1 — Lichen: A symbiotic association between Fungus and Algae

Definition

Two different types of organisms live and work together for **mutual benefit**.

Examples

- **Lichens:** Association between **Fungus** (shelter/water) and **Algae** (food).
- **Rhizobium:** Bacteria in **root nodules** of leguminous plants.

📌 Important

Lichens are indicators of air pollution — they cannot survive in polluted air.

12. Replenishment of Nutrients in Soil

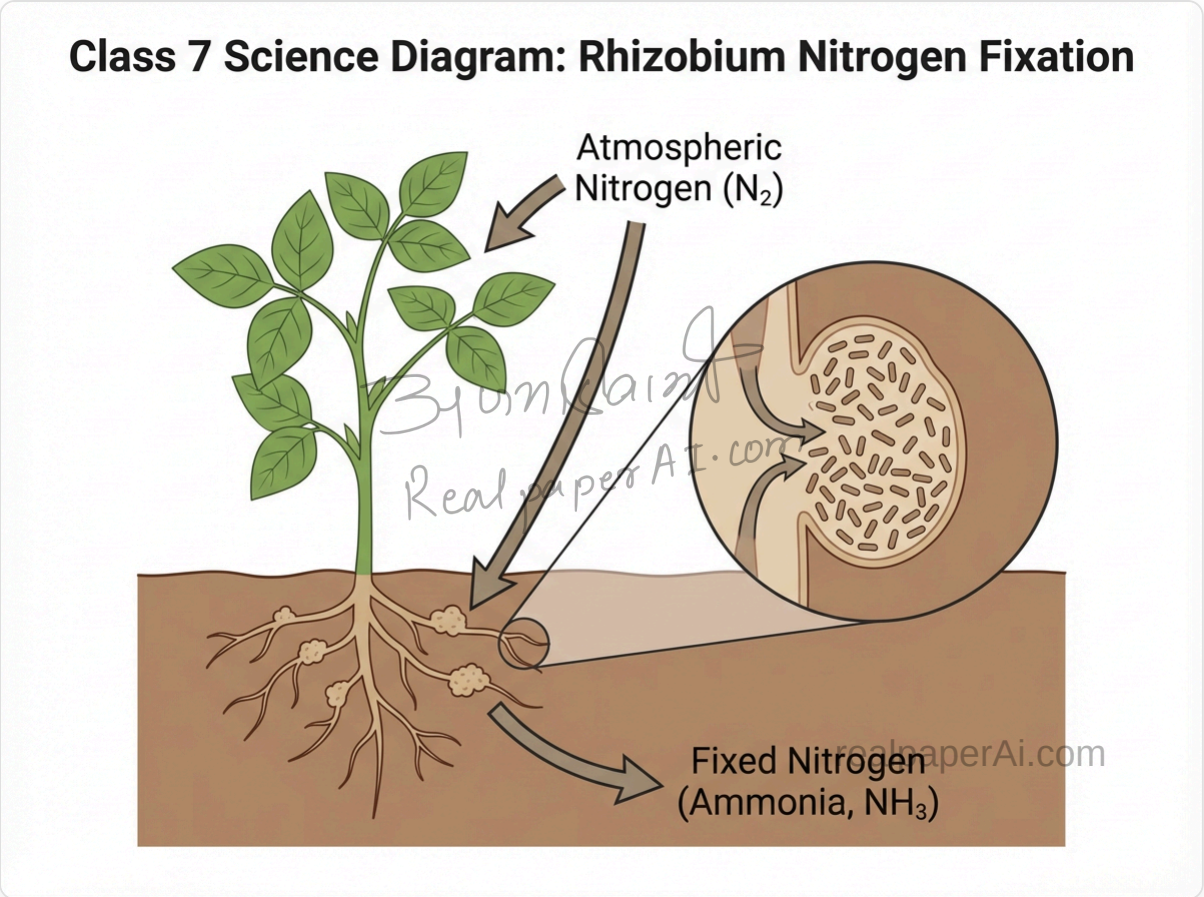

Fig. 12.1 — Rhizobium bacteria in root nodules fixing atmospheric nitrogen

Fertilizers are added to replenish nutrients. ***Rhizobium*** bacteria convert **atmospheric nitrogen** into soluble forms for plants like peas and moong beans, enriching the soil naturally.

NUTRITION IN PLANTS

AUTOTROPHIC

- Photo autotrophic
- Chemo autotrophic

HETEROTROPHIC

- Parasitic
- Saprophytic
- Symbiotic
- Insectivorous

PHOTOSYNTHESIS

- $CO_2 + H_2O \rightarrow$ Glucose + O_2
- Needs: Sunlight, Water, Chlorophyll

SOIL NUTRIENTS

- Rhizobium
- Fertilizers
- Nitrogen fixation

🎯 Practice MCQs

Q1. Which of the following is an autotroph?

a) Mushroom b) Cuscuta c) Mango tree ✅ d) Tapeworm

Explanation: Mango tree makes its own food through photosynthesis.

Q2. The green pigment in leaves responsible for photosynthesis is:

a) Haemoglobin b) Chlorophyll ✅ c) Melanin d) Carotene

Explanation: Chlorophyll absorbs sunlight to power photosynthesis.

Q3. Which gas is released during photosynthesis?

a) Carbon dioxide b) Nitrogen c) Oxygen ✅ d) Hydrogen

Explanation: Oxygen is the by-product of photosynthesis.

Q4. Cuscuta is an example of:

a) Autotroph b) Saprophyte c) Total parasite ✅ d) Symbiont

Explanation: Cuscuta has no chlorophyll and takes all nutrition from its host.

Q5. The water-conducting tissue in plants is called:

a) Phloem b) Xylem ✅ c) Cambium d) Epidermis

Explanation: Xylem transports water from roots to leaves.

Q6. Rhizobium bacteria are found in:

a) Stem of wheat b) Root nodules of legumes ✅ c) Leaves of mango

d) Bark of trees

Explanation: Rhizobium fixes atmospheric nitrogen in root nodules of leguminous plants.

Q7. Which of the following is an insectivorous plant?

a) Cuscuta b) Rafflesia c) Pitcher plant ✅ d) Sandalwood

Explanation: Pitcher plant traps and digests insects to obtain nitrogen.

Q8. The association between fungus and algae is called:

a) Mycorrhiza b) Lichen ✅ c) Root nodule d) Parasite

Explanation: Lichen is a symbiotic association between fungus and algae.

✅ QUICK REVISION

- **Autotrophs** make their own food; **Heterotrophs** depend on others.
- **Photosynthesis:** $CO_2 + H_2O \rightarrow$ (Sunlight/Chlorophyll) $\rightarrow$ Carbohydrates + O_2
- Four conditions for photosynthesis: **Sunlight, Water, Chlorophyll, CO_2**
- **Saprotrophs** feed on dead/decaying matter (e.g., Fungi)
- **Cuscuta** = total parasite | **Mistletoe** = partial parasite
- **Lichens** = Fungus + Algae (symbiosis)
- **Rhizobium** fixes atmospheric nitrogen in root nodules of legumes

13. Key Words

Nutrition: Taking in food and using it for growth.

Autotrophs: Organisms making their own food.

Heterotrophs: Organisms obtaining food from other sources.

Parasite: Organism living on others for food.

Saprophyte: Plant living on dead organic matter.

Symbiotic: Two organisms living for mutual benefit.