

# Ch. 12 Economic Importance of Bacteria and Fungi Ch. 13 Nutrition

Fundamentals of Biology for  
Competitive Examinations

Bacteria are single cell organisms with no chlorophyll with kingdom classification of Prokaryotes, and having irregular shaped nucleus.

They are numerous and found every where. As per one estimate, there are more bacteria living on one persons skin than the total world population

Four types of external on basis of their shape (1) Cocci – spherical, found in singles, or sets of two, or in chains and bunches

(2) Bacilli or rod shaped bacteria

Spirilla: spiral or twisted

Vibrio : which has a punctuation comma like shape

On basis of food source they are grouped as saprotrophic - drawing nourishment from decaying organisms, and parasitic – drawing nourishment from living hosts.

# Structure and Characteristics of bacteria

A simple cell containing the living substance protoplast ( cytoplasm + bacterial chromosome) surrounded by a non-living stiff cell wall.

- Bacteria are the smallest living organism. Its average size is 2 micrometres in length and 0.5 mm in breadth.

Bacteria depend on ready made food from external sources and therefore, they are called heterotrophic. Most bacteria have no chlorophyll.

- They re-produce very fast by dividing once in half hour. In 24 hours a single bacterium can become 281,514, 871,750,656 bacteria.

## Structure and Characteristics of bacteria continued Spore form of bacteria

- Bacteria **have spores** to overcome unfavourable conditions. When drying up of vegetation creates unfavourable conditions, the **bacteria cell with draws its content into a spherical mass** which becomes surrounded by a thick and hard protective wall. This spherical body is called a Spore.
- Its structure is contained within the original cell wall. In its spore form, the bacteria **can tolerate extreme dryness and poisonous chemicals**. Some cannot be killed even in boiling water or in frozen state.

# Useful Role of Bacteria

(1) Medicinal use is in production of antibiotics, serum, and vaccines

(2) Antibiotic: is a chemical substance produced by a living organism which can stop the growth of some disease producing bacteria and fungi.

2.1) Criteria of a good antibiotic include ability to kill a variety of disease producing micro organism. It should not kill the normal bacteria of the patient and not have any side effects.

(2.2 ) Penicillin is the product of a fungus mould and not of a bacterium , but it was the first antibiotic to be produced.

(2.3) Other uses of antibiotics: preservation of food, controlling of plant pathogens, and treating of animal feed

( 2.4 ) Toxins are poisonous proteins released by pathogenic bacteria during their growth or on a break down after they die.

(2.4.1) Anti-toxin is a substance produced in animal bodies which react with the poison (toxin) produced by the invading germs.

(2.4.2) Toxoids : are the inactivated toxins of the particular bacteria, which can still stimulate the production of antibodies for producing immunity.

(3.1) Serum is prepared by introducing a small dose of bacterial toxin into the blood of a healthy animal. The animal body produces antitoxins to neutralise the effect of toxin. On extracting and chilling the blood of such an animal , the serum separates as a straw coloured liquid . Human genes can also be utilized in this process and insulin was the first such serum produced through human hormone.

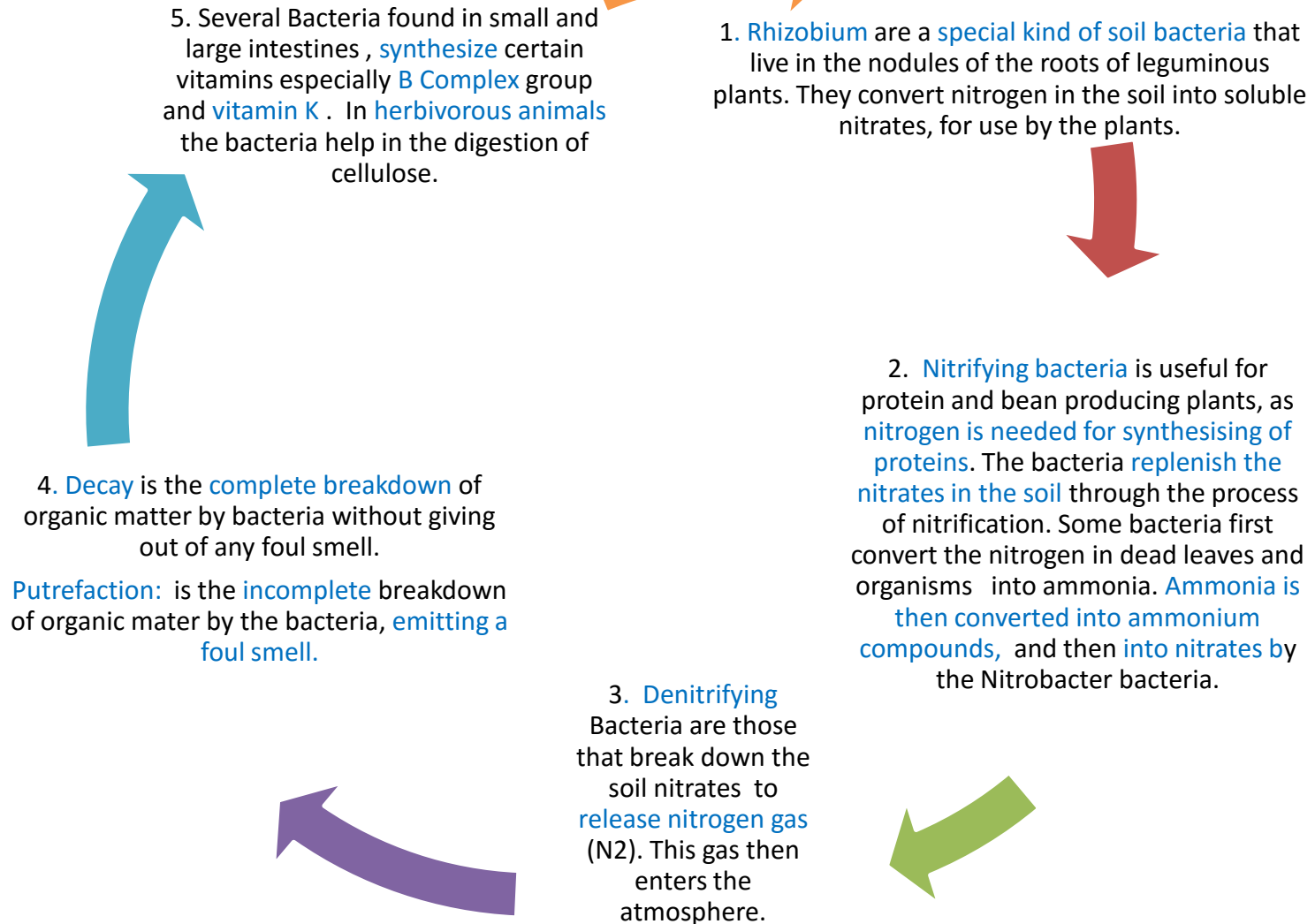
Blood clotting factor VIII for treatment of Haemophilia A and (b) Factor IX for treatment of Haemophilia B are examples of serum compounds produced by genetically modified bacteria.

(3) Serum: is blood plasma from which fibrinogen has been removed. It may contain numerous chemical substances including antibodies / anti – toxins.

Serum contains anti-oxides of a particular pathogen, and are used as a preventive measure against bacterial invasion.

(4) Vaccine is any germ or germ substance introduced into the body for developing resistance to a particular disease. Vaccines are preventive medicines that are available for a wide range of diseases. A mild form of the germ substance is introduced into the body of the sick person, to enable the body to develop anti toxins. The anti toxins serve as a preventive immunity against any attack by that particular disease germ.

# Bacterial Role in Agriculture and Digestion



# Role of bacteria in industry

## 1) Bacteria are used extensively in Tea flavour and leather industries.

- Many bacteria spoil cooked food, milk and milk products, and cause extensive food poisoning. **Botulism** is a very **serious form of food poisoning** due to bacteria found in tinned and sealed foods. On opening of an infected can or sealed package, a gas gushes out. Such cans or packages should be discarded completely.

2) Several methods are used for food preservation: (a) **Boiling** and heating at high temperatures of 110 degree C, and at high pressure. This method is used in the canning industry. (b) **Salting**: pickles are preserved through this method. (c) **Drying** or dehydration as most microbes cannot not grow without water. (d) **Irradiation** : through radioactive radiation to sterilize food. Ultra-violet rays are also used to sterilize air in schools and bakeries. (e) **Pasteurization**: does not completely sterilize milk, but prevents it from decaying for a few hours. For it partial sterilization is introduced to milk at temperature of 60degree C for 30 minutes, and then chilled quickly.

- (f) **Refrigeration**: does not allow microbes to grow due to cold. (g) Strong concentration and chemicals are used in jams and pickles to prevent them from getting spoiled due to strong concentration of sugar and salt, respectively.

Fungi do not have chlorophyll and are heterotrophic. Mushrooms can be poisonous or edible. Yeast is a one cell fungi, that grows in nectar of plants or grapes

# 13. Nutrition

(1) Nutrition means supply of essential organic and inorganic chemical compounds to the body. Food is the substance that living organisms eat and drink to get their supply of nutrition.

(2) Food is the substance that living organisms eat and drink to get their supply of nutrition.

Meal is the food taken at one time to satisfy appetite.

Appetite is the desire to eat and hunger is the uneasy sensation due to lack of food

(3) Need for Nutrition: Growth for building new cells and protoplasm; Repair of worn out cell; Energy for various life functions; Maintenance of chemical composition of cells; Provision for raw materials for enzymes, hormones, milk, sweat; Protection from infection and diseases.

(4) Six classes of nutrients: carbohydrates, proteins, fats, mineral salts, vitamins, water. (4.1) Carbohydrates are composed of carbon, hydrogen and oxygen. They include sugar, starch, cellulose and oxidize in cells to release energy. Carbohydrates are principle sources of energy in the body. On mole of glucose releases 6.86 kilocalories of energy.

(4.2) Protein provide chemical material for growth and repair of body cells and tissues. They are chemical molecules that contain carbon, hydrogen, oxygen and nitrogen. If the supply of carbohydrates is exhausted, proteins are oxidized by the cells to release energy for life support functions. Deficiency of proteins leads to weakness.



## 13. Nutrition continued

(4.3) Fats are composed of carbon, hydrogen and oxygen, but the oxygen content in fats is less than that in carbohydrates. They produce more energy than carbohydrates.

One mole of fat releases 9.45 Kcal of energy. Fats and Oils are made up of fatty acids and glycerol. Functions of fat include production of energy, storage of food, serve as a solvent for fat soluble vitamins, insulating the body against a rapid loss of heat.

(4.4) Mineral Salts: are needed in small quantities. Table salt contains sodium chloride, and other salts are obtained from vegetables and fruits. Calcium and phosphorus are needed for strengthening of bones and teeth. Iron for forming haemoglobin, Potassium and sodium for cell permeability in nerve cells

(5) Vitamins are chemical substances needed in minute amounts to maintain a healthy body. Most vitamins act as catalysts or enzymes in the chemical changes and some special functions. Vitamins are obtained from fruits and vegetables, but a few are synthesized in the body.

(5.1) Vitamins A, D, E and K are fat solubles and can be stored in the body for a longer period of time. Others such as B complex containing several vitamins are water soluble and cannot be stored for long. Absence or shortage of vitamins in diet over a continued period causes deficiency diseases. In low concentrations, vitamins have a catalytic and regulatory function in cell metabolism. Excess of vitamins is also harmful.

(6) Water: is indispensable, and serves several functions: (a) It acts as a solvent for thousands of organic and inorganic substances in the body (b) It produces digestive juices, (c) helps in transportation of digested foods and oxygen throughout the body (d) It is involved in the maintenance of body temperature. (e) It is used in excretion of soluble waste matter from the body.  $\frac{2}{3}$ <sup>rd</sup> of human body is water.

# A Balanced Diet

A balanced diet is one that contains all the six classes of constituents of food in proper quantity. Its special aspect is that it should provide sufficient number of calories needed by the individual.

- A calorie is the amount of heat required to raise the temperature of one gram of water by one degree Celsius. For a balanced diet the unit normally used is the 'Kcal' or 'Kilocalorie'. Kcal is 1000 times the unit calorie. When at rest an adult man requires 1600 Kcal per day, a woman needs 1450 Kcal, and a 6 year old child needs 1100 Kcal. A physical labourer needs 3500 Kcal, while a clerk needs 1800 to 2500 Kcal.

For continuation of the life support processes, Oxidation needs carbohydrates and fats; Repairing and Building of cells and tissues, production of hormones, enzymes, the body needs Proteins, water, fats and mineral salts; and for regulation of body processes Water, Vitamins, and mineral salts are needed.

Malnutrition is the condition in which a person suffers from lack of one or more essential constituents of food.