Fungi: They are a group of diverse organisms that lack chlorophyll and feed on decaying matter. They are present everywhere but they grow best in dark, warm and moist places. As chlorophyll is absent they cannot make their own food so they are either saprophytic or parasitic. Yeast and moulds are examples of microscopic fungi.

Saprophytic Fungi: they grow on dead and decaying plants and animals. They can be seen on bread, old pickles and rotting fruits. Mushrooms are the example of this kind of fungi.

Parasitic Fungi: They grow on living plants and animals from which they take readymade food.

Uses:

Food : Mushrooms can be eaten. Cakes and bread is made with the help of yeast. The yeast reproduces very fast at suitable temperature and produce carbon dioxide by the fermentation of sugar. The process of making bread involves kneading a mixture of flour, salt, sugar, yeast cells, and water into dough. Yeast converts sugar to alcohol and carbon dioxide. As more and more carbon dioxide is produced, the dough rises in volume. This makes the bread porous and spongy. Baking the expanded dough at 180°C kills the yeast and stops fermentation. The alcohol evaporates during the baking process.

Making vinegar, coffee, and tobacco Bacteria are used in the production of vinegar (acetic acid), coffee, and tobacco.

1. This makes bread and cakes porous and spongy. They are also used in the making of alcohol.
2. Medicine: They are made from fungi. Penicillin is obtained from fungus Penicillium.
3. They help in decomposition of dead tissues of plants and animals which increase fertility of soil.

Harmful effects:

1. Spoilage of food: mould grow of food and makes it unfit for consumption.
2. Fungi cause disease in human beings. The cause disease like Athlete foot and ringworm
3. Fungus grows on leather footwear and cotton cloth when they stay moist for long time.

Algae: They are a group of simple plants. They have cell walls and chlorophyll within the cells. They make their own food by photosynthesis so they are autotrophic and live in water and moist places. Chlovella, Chlamydomonas, and diatoms are examples of microscopic algae.

1. Green Algae: Chlamydomonas, Spirogyra, Volvox, Ulothrix.
2. Blue Green Algae: Oscillatoria, Anabaena, blue-green algae are single celled, colonial autotrophs. They have a primitive cell structure. Some algae can be used as fertilizer as they can fix atmospheric nitrogen by usable compounds. This is helpful in crop growth and the capacity of soil to hold water improves.
3. Diatoms: Diatoms are marine algae which float on water due to the presence of light storage fats along with silica.

Uses of Algae:

1. In Medicine: Antibiotics re prepared from some algae like chlorellin.
2. In Industry: Different commercial products are obtained from algae like agar, sodium, potassium, iodine.
3. As Food: Algae are rich in nutrients so eaten as salads or soups.
4. In Agriculture: Some algae (Blue-green algae) help in nitrogen fixation. Some sea weeds are used as fertilizers.
5. In Space: In recent years algae is used as source of oxygen in spaceship and also as food.

Harmful Algae:

1. Toxic: Some algae produce toxic substances which affect the fishes in water.
2. Parasitic: Some algae are parasite and cause serious diseases.
3. Water Pollution: Some algae grow in water and their multiplication can change the odor and taste of water.
4. Algae can damage textile and buildings.

Viruses: They are so small that they cannot be seen using ordinary light microscopes and are usually studied with the help of powerful microscopes called electron microscopes. Viruses are hard to classify as living or non-living as, on their own, they show no signs of life. However, they reproduce inside the cells of organisms like plants, animals, or bacteria. Tobacco Mosaic Virus (TMV) and Human Immunodeficiency Virus (HIV) are examples of viruses. The widely feared avian flu and swine flu are also caused by viruses.

Useful microorganisms: Microorganisms benefit us in a number of ways. Their uses can be divided into four categories: commercial, medicinal, agricultural, and environmental. Let us discuss each of these in detail.

Commercial Uses: Some of the commercial uses of microorganisms are given below. The production of cheese and paneer (cottage cheese) also involves the use of bacteria like Lactobacillus and Streptococcus. Curd and cheese manufacturers also add a substance called rennet (usually obtained from stomach linings of young cattle) to milk to make the process faster. Addition of rennet results in the formation of lactic acid, which makes the milk more acidic.

Making alcoholic beverages: Production of alcoholic beverages like beer and wine involves fermentation of sugar present in barley and grapes etc. by a microscopic fungus called yeast. Fermentation by yeast produces alcohol and carbon dioxide.

Making toothpaste Shells of diatoms (a type of algae) are used in toothpaste to give it a gritty texture that helps in cleaning teeth. Xanthum gum, obtained from the bacteria Xanthomonas campestris, is also used in making toothpaste.

Medicinal Uses: Some of the medicinal uses of microorganisms are given below

Making antibiotics. Certain bacteria and fungi are used in the production of medicines called antibiotics that destroy certain disease-causing microbes. Penicillin (obtained from the fungus Penicillium), streptomycin, and tetracycline (both obtained from Streptomyces bacteria) are examples of antibiotics. Antibiotics are also used to control microbial diseases in animals and plants. When a disease-causing microbe enters our body, our body produces substances called antibodies. These antibodies fight and destroy the disease-causing microbe and remain in the body to fight future infections by the same microbe. **A vaccine is a preparation of killed or weakened disease-causing microbes.** When a vaccine is

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introduced in the body of a healthy person (by swallowing or injection), his/her body produces antibodies against these killed or weakened microbes. These antibodies remain in the body and protect us from future infections by the same microbe(s). Thus, vaccines help in preventing diseases caused by microbes (e.g., polio, cholera, typhoid, smallpox, and hepatitis).

Making food supplements Microbes like Chlorella (a type of algae) are rich in proteins and other nutrients and are used as food supplements.

In human body: Bacteria like Lactobacillus acidophilus live in human intestines, where they help to digest food and destroy disease-causing microbes.

Agricultural Uses: Blue-green algae and bacteria like Rhizobium (that live in the root nodules of leguminous plants like pea and soya bean) help in fixing atmospheric nitrogen and increasing soil fertility.

Environmental Uses: Microbes like bacteria and fungi act on the bodies of dead plants and animals and convert them into simple substances. These substances are used by other plants and animals. Removal of dead bodies by the action of microbes keeps our planet clean. Bacteria are also used in sewage treatment, where they help in the decay of waste organic matter.

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