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**Q No 1 : Classify Protozoa into its 4 main types on the basis of their motility and methods of Reproduction ?**

Organisms traditionally classified as protozoa are abundant in [aqueous](https://en.wikipedia.org/wiki/Aqueous) environments and [soil](https://en.wikipedia.org/wiki/Soil), occupying a range of [trophic levels](https://en.wikipedia.org/wiki/Trophic_level). The group includes [flagellates](https://en.wikipedia.org/wiki/Flagellate) (which move with the help of whip-like structures called [flagella](https://en.wikipedia.org/wiki/Flagella)), [ciliates](https://en.wikipedia.org/wiki/Ciliate) (which move by using hair-like structures called [cilia](https://en.wikipedia.org/wiki/Cilia)) and [amoebae](https://en.wikipedia.org/wiki/Amoeba) (which move by the use of foot-like structures called [pseudopodia](https://en.wikipedia.org/wiki/Pseudopodia)). Some protozoa are [sessile](https://en.wikipedia.org/wiki/Sessility_(zoology)), and do not move at all.

Protozoa are single-celled, microscopic, animal-like organisms that are a part of the Kingdom Protista. This kingdom includes single-celled organisms, like some algae, slime molds, and protozoa. Informally, the terms 'protozoa' and 'protists' are sometimes used interchangeably. Protozoa are eukaryotes, meaning they have a nucleus and some organelles. They're also classified as heterotrophs, meaning they feed on other organisms to obtain energy.

Protozoa are divided into four groups based on how they move.

* Ciliates (who are the largest group of protozoa) - Move via hairlike projections called cilia
* Amoebas - Ooze about using body extensions called pseudopods (false feet)
* Flagellates - Move via long whip-like projections
* Apicomplexans or sporozoans (known as both) - Move by gliding

Protozoa can, and do, inhabit almost every type of aquatic and soil environment, and they also live in the intestines of many organisms! Most protozoa that live in organisms, including humans, do not cause them harm, with a few exceptions, like plasmodium, which is responsible for malaria.

**Reproduction in Protozoa:**

Protozoa reproduce by both asexual and sexual means, though sexual reproduction is less common and occurs in certain groups. Most protozoa reproduce asexually by cell division producing two equal or sometimes unequal cells. The cell division in certain protozoa is longitudinal, while in others transverse. In some protozoa multiple fission or schizogamy is known to occur.

In this process, the nucleus divides mitotically to produce a large number of nuclei before the cell divides. Each nucleus, with the surrounding cytoplasm, forms a daughter cell. The daughter cells then separate. Multiple fission is best known in the malarial parasite, Plasmodium, though it has also been reported in certain amobae, like foraminiferans and radiolaria.

Many protozoa also reproduce asexually by budding. In this process, daughter nuclei produced by mitotic division migrate into a cytoplasmic protrusion (bud) which is ultimately separated from the mother cell by fission.

Asexual reproduction in amoebae takes place by binary fission. Before division, the pseudopodia are withdrawn into the protoplast. Then the nucleus divides and the protoplast is divided by a constriction in the middle resulting in production of two daughter amoebae.

In the flagellated protozoa also binary fission occurs, but the fission is generally along the long axis of the cell (longitudinal binary fission). The flagella are regenerated from the basal bodies which divide before the nuclear division starts. In the ciliates, fission takes place in a transverse plane at right angles to the long axis.

The fission develops across the narrow part of the protozoan cell. This type is sometimes referred to as homothetogenic fission. Ciliates generally possess two types of nuclei, a macronucleus and a micronucleus. The nuclei also divide prior to cell division, but in different manners.

While the micronucleus divides by regular mitosis, the division of the macronucleus is amitotic. The macronucleus elongates and pinches off in two fragments. Each daughter cell receives a copy of the micronucleus and the macronucleus.

Sexual reproduction has been observed in some protozoa. As in other eukaryotic organism, sexual reproduction in protozoa also involves meiotic division. Sexual union between two haploid nuclei results in diploid zygotic nucleus in which meiosis takes place.

In sporozoa (Apicomplexa), like Plasmodium (malarial parasite), a motile microgamete fuses with a non-motile macrogamete (anisogamy) to form a diploid zygote. Another mode of sexual reproduction is conjugation which generally occurs in the ciliate protozoa, like Tetrahymena and Paramecium.

Conjugation of ciliates is an elaborate process in which two individuals unite with each other by fusion of their pellicles and nuclei are exchanged. Apparently, the nuclei act as gametes. The ciliates possess two different types of nuclei, — the micronucleus and the macronucleus. Only micronuclei take part in conjugation. The organisms are normally diploid in respect of the micronuclei.

A diploid micronucleus divides meiotically to form four haploid nuclei of which three degenerate. The remaining nucleus divides mitotically to produce two haploid nuclei which are potential gametes.

One of these two is exchanged between the two partners of conjugation and fuse with the one remaining in each partner to produce the diploid zygotic nucleus in both conjugates. The zygotic nucleus then divides mitotically to form eight daughter nuclei from which a micronucleus and a macronucleus are formed.

**QNo.2Write down the name of cell components and their function present in the cell of Paramecium ?**

The contents of the paramecium is bound by a **cell membrane**, which is covered by a **pellicle,**which is a stiff but elastic membrane. The pellicle gives the paramecium a definite shape but it is flexible enough to allow small shape changes.

Following are cell parts and functions that keep the single-cell paramecium alive.

**Cell membrane:** Oxygen enters and waste carbon dioxide exits through the cell membrane. Energy is produced in mitochonria (not shown) via the **respiration reaction** represented by this equation:  
Food + Oxygen yields carbon dioxide + water + Energy

**Endoplasmic reticulum:**The endoplasmic reticulum stores food.

**Cilia:** Covering the **pellicle** (outer covering of the cell) are many tiny hair-like structures, called **cilia .**The beating of the cilia is much like the movement of boat oars, they push the paramecium so that its anterior (front) end moves forward. Paramecium have no eyes, so if they hit something solid, they back up, make changes in direction and proceed forward again as shown in the diagram.

**0ral groove:**Ingestion is taking food into the body. On the side of a paramecium about mid-way is the **oral groove** . As the paramecium moves forward, water with food, including bacteria and algae are swept into the oral groove. At the posterior end of the oral groove is the gullet where food collects.  As more food collects the end of the gullet balloons out and eventually breaks off as a food vacuole

**Food vacuole,Cytoplasm and anal pore:**Digestion is the breaking down of food into small particles that can be used by the cell. The  food vacuole breaks away from the gullet at the posterior end and moves through the cytoplasm, which is the gel-like material within the cell. As the food  vacuole moves, enzyme from the cytoplasm enter the vacuole and digest the collection of food, including bacteria, algae and/or yeast. After being digested, the nutrients moves through the membrane of the vacuole into the cytoplasm. As this process continues, the vacuole decreases in size. When the shrunken vacuole completes it journey, the vacuole and its  remaining undigested food is eliminated through the anal pore .

**Contractile vacuoles:**Along with the anal pore , which eliminates solid wastes, paramecium have contractile vacuoles , which eliminate water. Contractile vacuoles are located near the surface and at either end of the cell. Waste gas, carbon dioxide, passes through the cell membrane into the water outside the cell.

**Micronucleus (Reproduction):**Paramecium reproduce asexual by binary fission in which a fully grown organism divides into two separate daughter cells; The micronucleus contains genetic material necessary for reproduction.

**Macronucleus (Control Center):**

The **macronucleus**controls all survival functions of the organisms.

**Q No 3 : What are Parasites , Explain endo and ectoparasites, Also explain types of endoparasites ?**

**Parasite:**

Parasites are plants or animals that live on or in a host getting their nutrients from that host. A host is an organism that supports a parasite. Sometimes the host is harmed by the parasite, and sometimes the relationship is neutral. But the host never benefits from the arrangement. When the parasite does have a negative impact on the host, it doesn't often kill the host directly, but the stressors that come with having parasites can kill.

**Ectoparasites** are parasites that live outside the body. In animals, they live on the skin and can cause itching and rashes. For example, human body lice.

**Endoparasites**are parasites that live inside the body. For instance, they may live in the blood system, muscles, liver, brain, or digestive systems of animals. For example, Plasmodium.

Parasites are not one-size-fits-all. There are several main categories of parasites that can affect animals and plants. Probably the most-studied parasites are the ones that affect humans. Broadly grouped, they include protozoa, helminths, and arthropods. More familiar, less mysterious names are lice, ticks, mites, bed bugs, flukes, and tapeworms.

Parasitic infections can be caused by three types of organisms:

* protozoa
* helminths
* ectoparasites

Protozoa are single-celled organisms that can live and multiply inside your body. Some infections caused by protozoa include giardiasis. This is a serious infection that you can contract from drinking water infected with Giardia protozoa.

Helminths are multi-celled organisms that can live in or outside of your body. They’re more commonly known as worms. They include flatworms, tapeworms, thorny-headed worms,and roundworms.

Ectoparasites are multicelled organisms that live on or feed off your skin. They include some insects and arachnids, such as mosquitos, fleas, ticks, and mites.

Parasitic infections can be spread in a number of ways. For example, protozoa and helminths can be spread through contaminated water, food, waste, soil, and blood. Some can be passed through sexual contact. Some parasites are spread by insects that act as a vector, or carrier, of the disease. For example, malaria is caused by parasitic protozoa that are transmitted by mosquitos when they feed on humans.

Endoparasites are of two forms:

**(1)Intercellular parasites (2)Intracellular parasites:**

Intercellular parasites are those that inhabit the spaces of the body of the host. Intercellular parasites are endoparasites that live within the [cell](https://www.biologyonline.com/dictionary/cell) of the host. Examples of intercellular parasites are [nematode](https://www.biologyonline.com/dictionary/nematode)s, [tapeworm](https://www.biologyonline.com/dictionary/tapeworm)s, and other [helminth](https://www.biologyonline.com/dictionary/helminth)es. Helminthes live in the gut of their [host](https://www.biologyonline.com/dictionary/host)s. Examples of intracellular parasites are the [protozoan](https://www.biologyonline.com/dictionary/protozoan) *Plasmodium*, the causative agent of [malaria](https://www.biologyonline.com/dictionary/malaria). They thrive inside the cells of their human host. *Plasmodium* species have different stages in their life cycle. Within the [definitive host](https://www.biologyonline.com/dictionary/definitive-host) (human), the sporozoite stage of *Plasmodium* species occurs within the [liver cell](https://www.biologyonline.com/dictionary/liver-cell)s where the [sporozoite](https://www.biologyonline.com/dictionary/sporozoite) gives rise to a [merozoite](https://www.biologyonline.com/dictionary/merozoite) or to a [hyponozoite](https://www.biologyonline.com/dictionary/hyponozoite), which then infects the [red blood cell](https://www.biologyonline.com/dictionary/red-blood-cell) of the [host](https://www.biologyonline.com/dictionary/host).

**Q No 4 : Explain in detail the differences and similarity between fungus and actinomycetes ?**The key difference between actinomycetes and fungi is given below:

**Difference Between Actinomycetes and Fungi**

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| **Actinomycetes vs Fungi** | |
| Actinomycetes are non-motile filamentous gram positive bacteria belonging to the genus of the Actinobacteria class of bacteria. | Fungi are a group of microorganism which includes single cell and complex multicellular organisms such as yeast, mushrooms, moulds, etc. |
| **Cellular Organization** | |
| Actinomycetes are prokaryotic organisms. | Fungi are eukaryotic organisms. |
| **Cell Wall Composition** | |
| Actinomycetes contain peptidoglycan in their cell walls. | Fungi contain chitin in their cell walls |
| **Cell Size under Microscope** | |
| Actinomycetes filaments are smaller. | Fungal filaments are bigger. |
| **GC Content in DNA** | |
| GC content in actinomycetes DNA is less than fungi. | Fungi have more GC bases in DNA. |

**Similarities Between Actinomycetes and Fungi?**

* Actinomycetes and fungi are filamentous.
* Both produce [spores](https://www.differencebetween.com/difference-between-spore-and-vs-endospore/).
* Both types are good decomposers.
* Both groups include antibiotic producing species.

**Q No 5 : Explain the following ?Virions, Viroids ,Prions**

V[irions](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/virion):A virion is an entire virus particle consisting of an outer protein shell called a capsid and an inner core of nucleic acid (either ribonucleic or deoxyribonucleic acid—RNA or DNA). The core confers infectivity, and the capsid provides specificity to the virus.

V[irions](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/virion) are bacilliform, non-enveloped and lack prominent surface projections. Typically, [virions](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/virion) are 19×50 nm, but range between 18 and 20 nm in width and 48 and 53 nm in length . [Optical diffraction](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/diffraction) patterns of the virions resemble those of virions of [Alfalfa mosaic virus](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/alfalfa-mosaic-virus), suggesting a morphological subunit diameter of about 10 nm and a T=1 icosahedral symmetry.Virions are stable between pH 6 and 8 and ionic strength of 0.01 to 0.1M phosphate, and are insensitive to chloroform.

**Nucleic acid**

Virions contain a single linear molecule of a positive sense ssRNA, 4.0 kb in size. The complete 4009 nt sequence of mushroom bacilliform virus (MBV) is available. The RNA has a linked VPg and appears to lack a poly(A) tail. RNA constitutes about 20% of virion weight.

**Proteins**

Virions contain a single major CP of 21.9 kDa. There are probably 240 molecules in each capsid.

Viroids: Viroids, the smallest known pathogens, are naked, circular, single-stranded RNA molecules that do not encode protein yet replicate autonomously when introduced into host plants. Potato spindle tuber viroid, discovered in 1971, is the prototype; 29 other viroids have since been discovered ranging in length from 120 to 475 nucleotides. Viroids only infect plants; some cause economically important diseases of crop plants, while others appear to be benign. Two examples of economically important viroids are coconut cadang-cadang viroid (which causes a lethal infection of coconut palms) and apple scar skin viroid (which causes an infection that results in visually unappealing apples).

The 30 known viroids have been classified in two families. Members of the *Pospiviroidae*, named for *po*tato *spi*ndle tuber viroid, have a rod-like secondary structure with small single stranded regions, a central conserved region, and replicate in the nucleus

There is no evidence that viroids encode proteins or mRNA. Unlike viruses, which are parasites of host translation machinery, viroids are parasites of cellular transcription proteins: they depend on cellular RNA polymerase for replication. Such polymerases normally recognize DNA templates, but can copy viroid RNAs.

The hepatitis D viroid can only enter a human liver cell if it is enclosed in a capsid that contains a binding protein. It obtains this from the hepatitis B virus. The delta agent then enters the blood stream and can be transmitted via blood or serum transfusions.

Prions: Prions are infectious agents composed exclusively of a single sialoglycoprotein called PrP 27-30. They contain no nucleic acid. PrP 27-30 has a mass of 27,000 - 30,000 daltons and is composed of 145 amino acids with glycosylation at or near amino acids 181 and 197. The carboxy terminus contains a phosphatidylinositol glycolipid whose components are ethanolamine, phosphate, myo-inositol and stearic acid. This protein polymerizes into rods possessing the ultrastructural and histochemical characteristics of amyloid. Amyloid is a generic term referring to any optically homogenous, waxy, translucent glycoprotein; it is deposited intercellularly and/or intracellularly in many human diseases such as:

* Alzheimer's disease
* Creutzfeldt-Jakob disease
* Down's syndrome
* Fatal familial insomnia
* Gerstmann-Straussler syndrome
* Kuru Leprosy

The prion is a product of a human gene, termed the PrP gene, found on chromosome 20. This gene contains two exons separated by a single intron. Exon I and Exon II are transcribed and the two RNAs ligated into a single mRNA. This mRNA contains an open reading frame (ORF) or protein coding region which is translated into the PrP protein. The PrP protein is a precursor of the prion protein. It is termed PrP 33-35.

Spread of the disease is via horizontal transmission, i.e., transmission from one person to another, either directly or by fomites or by ingestion of contaminated meat.

In the past, diagnosis of prion disease was made through examination of brain biopsies taken from patients in advanced stages of the disease or, more commonly, after they had died.  In January of 1999 it was found that the prion protein accumulated in the tonsils and could be detected by an immunofluorescence test on tonsilar biopsies.  A second test was simultaneously developed which was based on a Western blot.  Later that year a third test was developed that had the high sensitivity necessary to detect the prion protein in blood.  This test is based on capillary electrophoresis with laser-induced fluorescence.  It detects as little as 10-18 mole.