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**Subject. Microbial taxonomy.**

**Date. 24 June 2020.**

**Question no.1**

**Explain the following,,**

**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 potato spindle tuber viroid, have a rod-like secondary structure with small single stranded regions, a central conserved region, and replicate in the nucleus (illustrated; click to enlarge; [figure credit](http://commons.wikimedia.org/wiki/File%3APSTviroid.png)). The Avsunviroidae, named for avocado sunblotch viroid, have both rod-like and branched regions, but lack a central conserved region and replicate in chloroplasts. In contrast to the Pospiviroidae, the latter RNA molecules are functional ribozymes, and this activity is essential for replication.

Symptoms of viroid infection in plants include stunting of growth, deformation of leaves and fruit, stem necrosis, and death. Because viroids do not produce mRNAs, it was first proposed that disease must be a consequence of viroid RNA binding to host proteins or nucleic acids.  The discovery of RNA silencing in plants lead to the hypothesis that small interfering RNAs derived from viroid RNAs guide silencing of host genes, leading to induction of disease. In support of this hypothesis, peach latent mosaic viroid small RNAs have been identified that silence chloroplast heat shock protein 90, which correlates with disease symptoms. The different disease patterns caused by viroids in their hosts might all have in common an origin in RNA silencing.

The origin of viroids remains an enigma, but it has been proposed that they are relics from the RNA world, which is thought to have been populated only by non-coding RNA molecules that catalysed their own synthesis. Viroids have properties that make them candidates for survivors of the RNA world: small genome size (to avoid error catastrophe caused by error-prone replication), high G+C content (for greater thermodynamic stability), circular genomes (to avoid the need for mechanisms to prevent loss of information at the ends of linear genomes), no protein content, and the presence of a ribozyme, a fingerprint of the RNA world. Today’s viroids can no longer self-replicate, possibly having lost that function when they became parasites of plants. What began as a search for virus-like agents that cause disease in plants has lead to new insights into the evolution of life.

 **Prions,,,,,,,,,**

A **prion** is a type of protein that can trigger normal proteins in the brain to fold abnormally. **Prion** diseases can affect both humans and animals and are sometimes spread to humans by infected meat products. The most common form of **prion** disease that affects humans is Creutzfeldt-Jakob disease (CJD).

"'Prion' is a term first used to describe the mysterious infectious agent responsible for several neurodegenerative diseases found in mammals, including Creutzfeldt-Jakob disease (CJD) in humans. The word itself derives from 'proteinaceous infectious particle'; it refers to the initially heretical hypothesis that the infectious agent causing those diseases consists only of protein, with no nucleic acid genome. (All previously known pathogens, such as bacteria and viruses, contain nucleic acids, which enable them to reproduce.) The prion hypothesis explained why the mysterious infectious agent is resistant to ultraviolet radiation, which breaks down nucleic acids, but is susceptible to substances that disrupt proteins.

"A major breakthrough occurred when researchers discovered that the infectious agent consists primarily of a protein found in the membranes of normal cells, but in this case the protein has an altered shape, or conformation. Some scientists hypothesized that the distorted protein could bind to other proteins of the same type and induce them to change their conformation as well, producing a chain reaction that propagates the disease and generates new infectious material. Since then, the gene for this protein has been successfully cloned, and studies using transgenic mice have bolstered the prion hypothesis. The evidence in support of the hypothesis is now very strong, though not incontrovertible

large numbers of cattle in Great Britain and panicked the public, has lent new urgency to the quest for a cure--especially since the discovery that infected cows might be responsible for several new cases of CJD in humans. Finally, I and my colleagues have recently determined that a phenomenon much like prion infection exists in yeast.

"In the case of yeast, the phenomenon involves the passing of a particular genetic trait from mother cells to daughter cells, rather than the transmission of an infectious agent from one individual to another. These genetic traits had been known for many years, but their baffling patterns of inheritance (for example, they can be passed along through a cell's cytoplasm, rather than the nucleus where the DNA resides) had eluded explanation. We now know that the genetic trait is transmitted by proteins that are encoded in the nucleus but that can change their conformation in the cytoplasm. Once this change has occurred, the reconfigured proteins induce other newly made proteins of the same type to change their conformation, too. Molecular genetic research on yeast should speed up the resolution of fundamental questions about the workings of protein-folding chain reactions. And more important, it suggests that the prion mechanism is ubiquitous among living things and may be responsible for many phenomena other than neurodegenerative diseases like CJD."

Virions…….

**Virion**, 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. In some virions the capsid is further enveloped by a fatty membrane, in which case the virion can be inactivated by exposure to fat solvents such as ether and chlorofoam. Many virions are spheroidal—actually icosahedral—the capsid having 20 triangular faces, with regularly arranged units called capsomere, two to five or more along each side; and the nucleic acid is densely coiled within. Other virions have a capsid consisting of an irregular number of surface spikes and the nucleic acid loosely coiled within. Virions of most plant viruses are rod-shaped; the capsid is a naked cylinder (lacking a fatty membrane) within which lies a straight or helical rod of nucleic acid.

 **Question no.2**

**Write down the names of cell components and their function in the cell of paramecium?**

**Answer…**

# **Paramecium….**

**Paramecium**, genus of microscopic, single-celled, and free-living protozoan. Most species can be [cultivated](https://www.merriam-webster.com/dictionary/cultivated) easily in the laboratory, making them ideal model organisms, well suited for biological study. Paramecium vary in length from about 0.05 to 0.32 mm (0.002 to 0.013 inch). Their basic shape is an elongated oval with rounded or pointed ends, such as in p.caudatum. The term paramecium is also used to refer to individual organisms in a Paramecium species. Paramecium is the only genus in the family Parameciidae, which resides within the phylum ciliaphora.

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Paramecia are completely covered with cilia (fine hairlike filaments) that beat rhythmically to propel them and to direct bacteria and other food particles into their mouths. On the ventral surface an oral groove runs diagonally posterior to the mouth and gullet. Within the gullet, food particles are transformed into food vacoules, and digestion takes place within each food vacuole; waste material is excreted through the anus.

A thin layer of ectoplasm (clear, firm cytoplasm) lies directly beneath the pellicle (a flexible body membrane) and encloses the endoplasm (the inner, more fluid portion of the cytoplasm). The endoplasm contains granules, food vacuoles, and crystals of different sizes. Embedded in the ectoplasm are trichocyst (spindle-shaped bodies) that may be released by chemical, electrical, or mechanical means. The precise function of trichocysts is unclear; they may be extruded as a reaction to injury, or they may be used as an anchoring device, as a mechanism of defense, or as a means of capturing prey.

Depending on the species, a paramecium has from one to several contractile vacoule located close to the surface near the ends of the cell. Contractile vacuoles function in regulating the water content within the cell and may also be considered excretory structures, since the expelled water contains metabolic wastes. Paramecia have two kinds of nuclei: a large ellipsoidal nucleus called a macronuclues and at least one small nucleus called a micronucleus. Both types of nuclei contain the full complement of genes that bear the hereditary information of the organism. The organism cannot survive without the macronucleus; it cannot reproduce without the micronucleus. The macronucleus is the centre of all metabolic activities of the organism. The micronucleus is a storage site for the germline genetic material of the organism. It gives rise to the macronucleus and is responsible for the genetic reorganization that occurs during conjugation (cross-fertilization).

Strictly speaking, the only type of reproduction in Paramecium is asexual binary fission in which a fully grown organism divides into two daughter cells. Paramecium also exhibits several types of sexual processes. conjugation consists of the temporary union of two organisms and the exchange of micronuclear elements. Without the rejuvenating effects of conjugation, a paramecium ages and dies. Only opposite mating types, or genetically compatible organisms, can unite in conjugation. Zp.aurelia has multiple hereditary mating types that form distinct mating groups; once known as syngens, these distinct groups are now considered separate species within the so-called P. aurelia complex. autogamy (self-fertilization) is a similar process that occurs in one organism. In cytogamy, another type of self-fertilization, two organisms join together but do not undergo nuclear exchange.

Functions…….

**Paramecia** feed on microorganisms like bacteria, algae, and yeasts. To gather food, the **Paramecium** makes movements with cilia to sweep prey organisms, along with some water, through the oral groove (vestibulum, or vestibule), and into the cell.

 **Question no 3…….**

**Classify protozoa into four types on the basis of mortality and reproduction?**

**Answer……….**

Protozoans are microscopic unicellular eukaryotic organisms with heterotrophic mode of nutrition. Their nutrition may be holozoic, saprobic, or parasitic. These are divided into four major groups.

(1) Amoeboid protozoans or sarcodines

They are unicellular, jelly-like protozoa found in fresh or sea water and in moist soil. Their body lacks a periplast. Therefore, they may be naked or covered by a calcareous shell. They usually lack flagella and have temporary protoplasmic outgrowths called pseudopodia for locomotion. These pseudopodia or false feet help in movement and capturing prey. They include free living forms such as Amoeba or parasitic forms such as Entamoeba.

(2) Flagellated protozoans or zooflagellates

They are free living, non-photosynthetic flagellates without a cell wall. They possess flagella for locomotion and capturing prey. They include parasitic forms such as Trypanosoma, which causes sleeping sickness in human beings and free living forms such as Noctiluca.

(3) Ciliated protozoans or ciliates

They are aquatic individuals that form a large group of protozoa. Their characteristic features are the presence of numerous cilia on the entire body surface and the presence of two types of nuclei. All the cilia beat in the same direction to move the water laden food inside a cavity called gullet. They include organisms such as Paramaecium, Vorticella etc.

(4) Sporozoans

They include disease causing endoparasites and other pathogens. They are uninucleate and their body is covered by a pellicle. They do not possess cilia or flagella. They include the malaria causing parasite

**Structure…….**

Protozoa are microscopic unicellular eukaryotes that have a relatively complex internal structure and carry out complex metabolic activities. Some protozoa have structures for propulsion or other types of movement.

**Reproduction…….**

Binary fission, the most common form of reproduction, is asexual; multiple asexual division occurs in some forms. Both sexual and asexual reproduction occur in the Apicomplexa.

The most common type of asexual multiplication is binary fission, in which the organelles are duplicated and the protozoan then divides into two complete organisms. Division is longitudinal in the flagellates and transverse in the ciliates; amebas have no apparent anterior-posterior axis. Endodyogeny is a form of asexual division seen in *Toxoplasma* and some related organisms. Two daughter cells form within the parent cell, which then ruptures, releasing the smaller progeny which grow to full size before repeating the process. In schizogony, a common form of asexual division in the Apicomplexa, the nucleus divides a number of times, and then the cytoplasm divides into smaller uninucleate merozoites. In *Plasmodium, Toxoplasma*, and other apicomplexans, the sexual cycle involves the production of gametes (gamogony), fertilization to form the zygote, encystation of the zygote to form an oocyst, and the formation of infective sporozoites (sporogony) within the oocyst.

Some protozoa have complex life cycles requiring two different host species; others require only a single host to complete the life cycle. A single infective protozoan entering a susceptible host has the potential to produce an immense population. However, reproduction is limited by events such as death of the host or by the host's defense mechanisms, which may either eliminate the parasite or balance parasite reproduction to yield a chronic infection. For example, malaria can result when only a few sporozoites of *Plasmodium falciparum*—perhaps ten or fewer in rare instances—are introduced by a feeding *Anopheles* mosquito into a person with no immunity. Repeated cycles of schizogony in the bloodstream can result in the infection of 10 percent or more of the erythrocytes—about 400 million parasites per milliliter of blood.

**Nutrition……**

Protozoa have metabolic pathways similar to those of higher animals and require the same types of organic and inorganic compounds. In recent years, significant advances have been made in devising chemically defined media for the in vitro cultivation of parasitic protozoa. The resulting organisms are free of various substances that are present in organisms grown in complex media or isolated from a host and which can interfere with immunologic or biochemical studies. Research on the metabolism of parasites is of immediate interest because pathways that are essential for the parasite but not the host are potential targets for antiprotozoal compounds that would block that pathway but be safe for humans. Many antiprotozoal drugs were used empirically long before their mechanism of action was known. The sulfa drugs, which block folate synthesis in malaria parasites, are one example.

**Mortality…….**

Since **protozoa** are relatively large micro- organisms, they are easier to filter out than bacteria and viruses. Drinking water is disinfected to **destroy** or inactivate the micro-organisms that are not filtered out. Chlorine is the most common disinfectant in the world.

 **Question 4…**

**What is a parasite? Explain Endo and ecto parasite also explain types of endoparasites?.**

**Answer….**

**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. **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.

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.

 Types of endoparasites……

Endoparasites are of two forms: intercellular parasites and 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 of the host. Examples of intercellular parasites are nematodes, tapeworms, and other helminthes. Helminthes live in the gut of their hosts. Examples of intracellular parasites are the protozoa Plasmodium, the causative agent of malaria. They thrive inside the cells of their human host. Plasmodium species have different stages in their life cycle. Within the definitive host (human), the sporozoite stage of Plasmodium species occurs within the liver cells where the sporozoite gives rise to a merozoites or to a hyponozoite, which then infects the red blood cells of the host.

**Examples** of Parasites

**Some examples of endoparasites** include Giardia lamblia , an anaerobic protozoan parasite which reproduces via binary fission. It affects humans, cats, **and** dogs, among other wild animals. Another **endoparasite** is **the** hookworm, either Ancylostoma duodenale or Necator americanus, which infects humans.

 **Question no.. 5**

## What are Actinomycetes?

Actinomycetes are a phylum of gram positive bacteria. They are prokaryotic organisms with a primitive unicellular organization. Actinomycetes are anearobi microorganismsic. They show filamentous and branching growth pattern on solid substrates resembling fungi mycelia. Their colonies are extensive like mycelium. Aerial hypae are found in many genera of actinomycetes. Some actinomycetes genera are motile and have flagella. Actinomycetes are responsible for the musty odor ( the smell of freshly ploughed soils) which comes after rain.

## What are Fungi?

Fungi are a group of microorganisms which includes yeast, moulds, mushrooms and filamentous fungi. Fungi can be single celled or multi-celled. They show eukaryotic cellular organization. Fungi are found in almost all habitats. But most of them are found in lands, mainly in soil or on plant material. Fungi are heterotrophs, and they obtain foods by absorbing molecules which were digested using their digestive enzymes. One characteristic feature of fungi is the presence of chitin in their cell walls. Chitin is unique to fungi.

## What are the 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.

## What is the Difference Between Actinomycetes and 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.