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A Brief Note on Protozoa

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Opinion Article

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ABOUT THE STUDY

Protozoa (plural micro-organism or protozoans) is an informal term for a group of single-celled eukaryotes which are either free-living or parasitic and feed on organic matter including certain microorganisms or organic tissues and debris. Previously, protozoans were regarded "one-celled animals" because they more often display animal-like behavioural responses such as motility and predation and lack a cell wall that these plants and many algae use. Protozoa are abundant in fresh, brackish and salt water as well as other moist environments such as soils and mosses. Some species thrive in harsh conditions such as hot springs and hyper saline lakes and lagoons. All protozoa require a moist environment however; some can survive in dry environments for long periods of time by forming resting cysts that allow them to remain dormant until conditions improve.

Protozoa that are parasitic or symbiotic live on or within other organisms such as vertebrates and invertebrates as well as plants and other single-celled organisms. Some are harmless or beneficial to their hosts while others such as babesia, malaria and toxoplasmosis can be significant pathogens. The interaction of protozoan symbionts and their hosts can be mutually beneficial. *Trichonympha* and *Pyrsonympha* are flagellated protozoa that live in the guts of termites and aid in the digestion of wood by breaking down complex sugars into smaller more easily digested molecules. A diverse array of protozoa can be found in the rumens of ruminant animals such as cattle and sheep. Flagellates such as *Trichomonas* and ciliated protozoa such as *Isotricha* and *Entodinium* are examples of these. The ciliate subclass *Astomatia* is entirely made up of mouthless symbionts that have adapted to life in the guts of annelid worms. All protozoa are heterotrophic, meaning they get their nutrients from other organisms either by ingesting them whole *via* phagocytosis or by absorbing dissolved organic matter or microparticles (osmotrophy).

Phagocytosis may involve engulfing organic particles with pseudopodia (as amoebae do) ingesting food through a specialised mouth-like aperture known as a cytosome or using stiffened ingestion organelles. Parasitic protozoa have a wide range of feeding strategies and some may switch between them at different stages of their life cycle. Plasmodium for example, feeds by pinocytosis during its immature trophozoite stage (ring phase) but develops a dedicated feeding organelle (cytosome) as it matures within a host's red blood cell.

Protozoa can also exist as mixotrophs combining a heterotrophic diet with autotrophy. Some protozoa form close relationships with symbiotic photosynthetic algae (*zoochlorellae*) which live and grow within the larger cell's membranes and provide nutrients to the host. The algae are not digested but rather reproduce and spread between division products. The organism may benefit from obtaining some of its nutrients from algal endosymbionts or from surviving anoxic conditions due to the oxygen produced by algal photosynthesis at times. Some protozoans engage in kleptoplasty which involves stealing chloroplasts from prey organisms and storing them within their own cell bodies while continuing to produce nutrients *via* photosynthesis. *Mesodinium rubrum* a ciliate retains functioning plastids from the *cryptophyte* algae on which it feeds and uses them to nourish itself *via* autotrophy. The symbionts could be passed on to dinoflagellates of the genus *"Dinophysis*," which eat *Mesodinium rubrum* but keep the enslaved plastids for themselves. These plastids can function for months within *Dinophysis*. Traditional protozoa are abundant in aqueous environments and soil occupying a variety of trophic levels. Flagellates are included in this group (which move with the help of undulating and beating flagella).Amoebae and ciliates (which move by using hair-like structures called cilia) (which move by the use of temporary extensions of cytoplasm called pseudopodia). Many protozoa including amoebic meningitis agents use both pseudopodia and flagella. Some protozoa attach to the substrate or form cysts preventing them from moving (sessile). Most sessile protozoa can move around at some point in their lives, such as after cell division. The term 'theront' refers to actively motile phases, as opposed to trophont or trophozoite which refers to feeding stages. Unlike plants, fungi and most types of algae, most protozoa lack a rigid external cell wall and are instead surrounded by elastic membrane structures that allow the cell to move. In some protozoa, such as ciliates and euglenozoans, the cell's outer membrane is supported by a cytoskeletal infrastructure known as a "pellicle." The pellicle shapes the cell, particularly during locomotion. Protozoan organisms' pellicles range from flexible and elastic to fairly rigid. The pellicle of ciliates and *Apicomplexa* contains a layer of closely packed vesicles called alveoli. The pellicle of euglenoids is made up of protein strips that are spirally arranged along the length of the body. Some protozoa have two-stage life cycles in which they alternate between proliferative stages (e.g., trophozoites) and resting cysts. Some protozoa can survive harsh conditions as cysts such as being exposed to extreme temperatures or harmful chemicals or going for long periods without nutrients, water or oxygen. Encysting allows parasitic species to survive outside of their hosts and allows them to spread from one host to the next.