

Risk Assessment – Paramecium

Background

Paramecium is a genus of unicellular ciliates, commonly studied as a representative of the ciliate group. Paramecia are widespread in freshwater, brackish and marine environments and are often very abundant in stagnant basins and ponds. Because some species are readily cultivated and easily induced to conjugate and divide, it has been widely used in classrooms and laboratories to study biological processes. Its usefulness as a model organism has caused one ciliate researcher to characterize it as the "white rat" of the phylum Ciliophora.

Species of Paramecium range in size from 50 to 330 micrometres in length. Cells are typically ovoid, elongate, foot- or cigar-shaped. The body of the cell is enclosed by a stiff but elastic membrane (pellicle), uniformly covered with simple cilia, hairlike organelles which act like tiny oars to move the organism in one direction. Nearly all species have closely spaced spindle-shaped trichocysts embedded deeply in the cellular envelope (cortex) that surrounds the organism. Typically, an anal pore (cytoproct) is located on the ventral surface, in the posterior half of the cell. In all species, there is a deep oral groove running from the anterior of the cell to its midpoint. This is lined with inconspicuous cilia which beat continuously, drawing food inside the cell. Paramecia live mainly by heterotrophy, feeding on bacteria and other small organisms. A few species are mixotrophs, deriving some nutrients from endosymbiotic algae (chlorella) carried in the cytoplasm of the cell.

Osmoregulation is carried out by contractile vacuoles, which actively expel water from the cell to compensate for fluid absorbed by osmosis from its surroundings. The number of contractile vacuoles varies from one, to many, depending on species.

Risk Considerations

(1) Paramecium is not generally considered capable of infecting vertebrate cells. As a result the risk of accidental human infection is considered negligible.

(2) Paramecium is highly sensitive to the activity of human complement so a rapid death of the micro-organism would be expected to occur in any accidental exposure of laboratory workers. In addition, the micro-organism is incapable of replication in human cells as the environment is non-permissive for paramecium replication.

Exposure risk

There is negligible risk of exposure and infection by paramecium to workers in the lab as these micro-organism cannot generally infected vertebrate cells. The micro-organism used in the lab is not very stable or robust in the environment as it is more susceptible to UV and desiccation damage. Good standard laboratory practices of appropriate lab protective equipment, containment and appropriate disinfection/disposal will prevent any accidental exposure of the human skin to the paramecium.

Decontamination/Disposal Procedures

General Level 1 good laboratory practices of decontamination of all work surfaces daily and appropriate chemical disinfection (eg. 1% hypochlorite) of all liquid cultures and laboratory glassware will successfully kill any paramecium used in the lab.

Summary

The amount of paramecium produced at any given time will be less than 1 liter of unconcentrated micro-organism. These volumes are considered to be a low and therefore low risk. There is negligible infection risk to humans. No paramecium will be used that contain mammalian promoters so the risk of accidental production of protein in mammalian cells is negligible.

Tentative Assessment: BIOSAFETY LEVEL 1