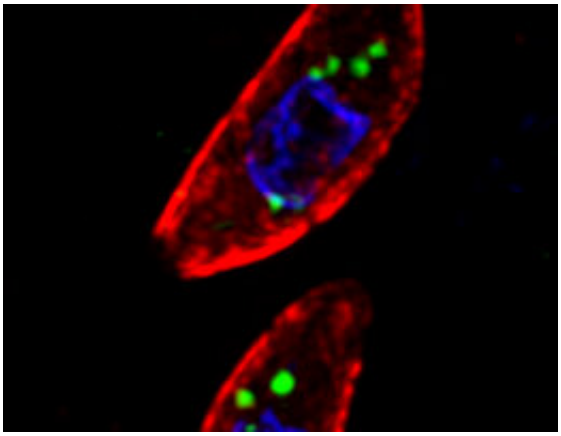
Toxoplasma gondii utilizes at least two modes of locomotion during its infection cycle

July 2 2019



Micrograph showing uptake of fluorescently labelled molecules by the unicellular parasite T. gondii. Credit: Meissner/LMU

Microbiologists at LMU have shown that *Toxoplasma gondii*, the parasite that is responsible for toxoplasmosis, utilizes at least two modes of locomotion during its infection cycle.

Toxoplasma gondii—the microorganism that causes toxoplasmosis—is a highly successful parasite, which can invade and establish a persistent infection in most cell types found in mammals. As a rule, this cosmopolitan parasite causes relatively innocuous infections in humans. But in immunocompromised individuals the infection can become chronic, while in pregnant women the organism can induce miscarriage or malformation of the fetus. "Up to now, the general consensus among

researchers was that the parasite's motility is dependent on the actomyosin cytoskeleton, which is made up of actin filaments with which myosins interact as motor proteins to generate force," explains Markus Meissner, professor of experimental parasitology at LMU. In a study carried out together with colleagues at the Wellcome Centre for Integrative Parasitology at the University of Glasgow, which appears in the online journal *PLoS Biology*, Meissner's group now describes a previously unrecognized mode of motility in T. gondii.

T. gondii belongs to the Apicomplexa, the group of obligate intracellular pathogens to which the causative agents of malaria belong. The infectious form, or tachyzoite, is a teardrop-like cell, which changes its morphology following successful invasion of host cells. The new study was prompted by the observation that the parasite is capable of infecting cells even when the motor proteins of its specialized "glideosome" have been disabled. The LMU-UoG team went on to show that the extracellular *T. gondii* tachyzoite are capable of recycling material secreted from its apical tip into the membrane at its posterior pole. The researchers made use of this observation to study the motility of the unicellular parasites with the aid of fluorescently labeled molecules. "We demonstrated that *T. gondii* secretes membrane material as vesicles at the apical pole of the cell, which are then reincorporated into the cell membrane at the posterior pole by a process called endocytosis. This secretion-endocytosis cycle generates a fountain-like flow of membrane material, which contributes to propel the parasite along the substrate. "The endocytic uptake mechanism appears to be fundamentally different from that found in other eukaryotic cells, including the parasite's host cells," says Meissner. The next step will be to elucidate the mechanisms that underlie this type of motility and identify possible points of attack for potential therapies that can effectively prevent chronic infections.

More information: Simon Gras et al. An endocytic-secretory cycle participates in Toxoplasma gondii in motility, *PLOS Biology* (2019).

DOI: 10.1371/journal.pbio.3000060

Provided by Ludwig Maximilian University of Munich