Research highlights potential way to combat toxoplasmosis parasite

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Credit: University of Glasgow

It lives inside one third of the UK population and is a common infection in cats, however until now scientists knew little about how the toxoplasmosis parasite communicated with its host.?

New research, by the University of Glasgow's Wellcome Centre for Molecular Parasitology in collaboration with The University of Vermont, has revealed how the parasite uses a key protein to form a communication network and ultimately continue the infection process.

The paper, which is published today in eLife, has identified a key "intracellular network of protein" that allows the toxoplasmosis parasites to communicate with each other while inside the host. The research has also shown that disrupting this network leads to reduced replication of the parasite and an inability to leave the single host cell – which ultimately halts infection.

Toxoplasma gondii is a parasite that commonly infects cats, but it is also carried by other warm-blooded animals, including humans. Up to one-third of the UK population is chronically infected with the parasite, although most experience few harmful effects.

However, women who become infected during pregnancy can pass the parasite to their unborn child. This can result in serious health problems for the baby such as blindness and brain damage. People who have compromised immunity, such as individuals infected with HIV, are also at risk of serious complications owing to the reactivation of dormant parasitic cysts in the brain.

Toxoplasma parasites must actively invade host cells so they can replicate and survive. During an infection, this replication is synchronised, meaning that all parasites in the host cell replicate at the same time.

Until now it was unknown how these parasites co-ordinated this tightly regulated process. However, through experimental work, the researchers have discovered that the protein actin helps the parasite cells form an extensive network that connects individual Toxoplasma parasites. When this protein is depleted in the parasite, not only does this network collapse, but the parasites also start to replicate out of synch and are trapped inside the host cell.

Professor Markus Meissner from the University of Glasgow, one of the lead authors of this study, said: "This work greatly increases our understanding of the Toxoplasma parasite, and provides an insight into how this potentially dangerous parasitic infection can be disrupted.

"When we first saw the formation of such an extensive network, we didn't believe our eyes and the first thing we discussed was if this is just an artefact. However, at the end all our control experiments demonstrated that it is very real. The major challenge was to convince some of our colleagues who were also looking into the role of actin in these parasites."

The findings could provide clues to new treatment for other parasite diseases, including malaria, which cause substantial morbidity and mortality worldwide.

Dr Aoife Heaslip, previously of the University of Vermont who is now an Assistant Professor at the University of Connecticut, said: "We've known for many years that actin was an important protein needed for parasite entry into host cells. However our recent discover that actin forms communication channels between parasites as they grow inside host cells adds a whole new dimension to our understanding."

More information: Javier Periz et al. F-actin forms an extensive filamentous network required for material exchange and parasite maturation, *eLife* (2017). DOI: 10.7554/eLife.24119