

'Hijacking' and hibernating parasite could alter brain behavior

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Researchers from Melbourne's Walter and Eliza Hall Institute have discovered how a common parasite hijacks host cells and stockpiles food so it can lie dormant for decades, possibly changing its host's behavior or personality in the process.

The findings could lead to a vaccine to protect pregnant women from *Toxoplasma* infection, which carries a serious risk of miscarriage or birth defects, as well as drugs to clear chronic infections in people with compromised

immune systems, such as cancer patients. Credit: Walter and Eliza Hall Institute

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Toxoplasma is a common parasite transmitted by cats and found in raw meat. Around 30 per cent of the population is infected. The research projects were led by Dr Chris Tonkin, Dr Justin Boddey, Dr Alex Uboldi, Mr James McCoy and Mr Michael Coffey from the Walter and Eliza Hall Institute.

Dr Tonkin said *Toxoplasma* required a human host cell - such as a brain cell (neuron) - to live in. The research team discovered how the parasite hijacks the host cell to enable its own growth and survival, hibernating for decades by creating its own food reserve.

"*Toxoplasma* infection leads to massive changes in the host cell to prevent immune attack and enable it to acquire a steady nutrient supply," Dr Tonkin said. "The parasite achieves this by sending proteins into the host cell that manipulate the host's own cellular pathways, enabling it to grow and reproduce."

Dr Boddey said some of these proteins might even influence the behaviour of the host. "There is a fascinating association between *Toxoplasma* infection and psychiatric diseases including schizophrenia

and bipolar disorder. It is now possible to test whether proteins sent from the hibernating parasite into a host neuron disrupt normal brain function and contribute to development of these diseases," he said.

Once *Toxoplasma* parasites establish infection, they can lie dormant in our bodies for the rest of our lives. In people with suppressed immune systems, such as cancer patients, the parasite can reactivate and cause neurological damage and even death.

Dr Tonkin said the teams had identified pathways that allow the parasite to establish chronic infections, unveiling potential avenues for treatment that clear the dormant parasite.

"We discovered that, similar to animals preparing for hibernation, *Toxoplasma* parasites stockpile large amounts of starch when they become dormant," he said. "By identifying and disabling the switch that drives starch storage, we found that we could kill the dormant parasites, preventing them from establishing a chronic infection."

Dr Tonkin said the finding could lead to a drug to clear chronic *Toxoplasma* infections, or even a vaccine to prevent infection in at-risk people, such as pregnant women.

"Cats are one of the primary transmitters of *Toxoplasma* parasites," Dr Tonkin said. "If the [parasites](#) are transmitted to [pregnant women](#), for example through contact with kitty litter, there is a substantial risk of miscarriage or birth defects.

"We hope to use our discoveries to develop a vaccine that stops cats transmitting the parasite, to prevent these potentially catastrophic consequences."

Dr Boddey said it had long been a mystery how the *Toxoplasma* parasite

transported proteins into the host. "Our study showed that the parasite includes a signature on the exported proteins that 'earmark' them for transport into the [host cell](#)," he said. "Blocking transport makes the parasite much less dangerous in infection models, suggesting this may also be a new way of treating *Toxoplasma* infections."

The research findings were published today in the journal *Cell Host & Microbe* and in the journal *eLife*.

Provided by Walter and Eliza Hall Institute

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