

## Science News

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### How common 'cat parasite' gets into human brain and influences human behavior

*Date:* December 6, 2012

*Source:* Karolinska Institutet

*Summary:* Toxoplasma is a common 'cat parasite', and has previously been in the spotlight owing to its observed effect on risk-taking and other human behaviors. To some extent, it has also been associated with mental illness. A study led by researchers in Sweden now demonstrates for the first time how the parasite enters the brain to influence its host.

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Toxoplasma is a common 'cat parasite', and has previously been in the spotlight owing to its observed effect on risk-taking and other human behaviours. To some extent, it has also been associated with mental illness. A study led by researchers from Karolinska Institutet in Sweden now demonstrates for the first time how the parasite enters the brain to influence its host.

"We believe that this knowledge may be important for the further understanding of complex interactions in some major public health issues, that modern science still hasn't been able to explain fully," says Antonio Barragan, researcher at the Center for Infectious Medicine at Karolinska Institutet and the Swedish Institute for Communicable Disease Control. "At the same time, it's important to emphasize that humans have lived with this parasite for many millennia, so today's carriers of Toxoplasma need not be particularly worried."

The current study, which is published in the scientific journal *PLoS Pathogens*, was led by Dr Barragan and conducted together with researchers at Uppsala University.

Toxoplasmosis is caused by the extremely common *Toxoplasma gondii* parasite. Between 30 and 50 per cent of the global population is thought to be infected, and an estimated twenty per cent or so of people in Sweden. The infection is also found in animals, especially domestic cats. People contract the parasite mostly by eating the poorly cooked flesh of infected animals or through contact with cat faeces. The infection causes mild flu-like symptoms in adults and otherwise healthy people before entering a chronic and dormant phase, which has previously been regarded as symptom-free. It is, however, known that toxoplasmosis in the brain can be fatal in people with depleted immune defence and in fetuses, which can be infected through the mother. Because of this risk, pregnant women are recommended to avoid contact with cat litter trays.

A number of studies have been presented in recent years showing that the toxoplasmosis parasite affects its host even during the dormant phase. It has, for example, already been observed that rats become unafraid of cats and even attracted by their scent, which makes them easy prey. This has been interpreted as the parasite assuring its survival and propagation, since the consumed rat then infects the cat, which through its faeces can infect the food that other rats might then proceed to eat. A number of studies also confirm that mental diseases

like schizophrenia, depression and anxiety syndrome are more common in people with toxoplasmosis, while others suggest that toxoplasmosis can influence how extroverted, aggressive or risk-inclined an individual's behaviour is.

"We've not looked at behavioural changes in people infected with toxoplasma, as that's been dealt with by previous studies," says Dr Barragan. "Instead, we've shown for the first time how the parasite behaves in the body of its host, by which I mean how it enters the brain and manipulates the host by taking over one of the brain's neurotransmitters."

In one laboratory experiment, human dendritic cells were infected with toxoplasma. After infection, the cells, which are a key component of the immune defence, started secreting the signal substance GABA. In another experiment on live mice, the team was able to trace the movement of infected dendritic cells in the body after introducing the parasite into the brain, from where it spread and continued to affect the GABA system.

GABA is a signal substance that, amongst other effects, inhibits the sensation of fear and anxiety. Disturbances of the GABA system are seen in people with depression, schizophrenia, bipolar diseases, anxiety syndrome and other mental diseases.

"For toxoplasma to make cells in the immune defence secrete GABA was as surprising as it was unexpected, and is very clever of the parasite," says Dr Barragan. "It would now be worth studying the links that exist between toxoplasmosis, the GABA systems and major public health threats."

The study was financed with a grant from the Swedish Research Council.

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### Story Source:

[Materials](#) provided by [Karolinska Institutet](#). *Note: Content may be edited for style and length.*

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### Journal Reference:

1. Jonas M. Fuks, Romanico B. G. Arrighi, Jessica M. Weidner, Suresh Kumar Mendu, Zhe Jin, Robert P. A. Wallin, Bence Rethi, Bryndis Birnir, Antonio Barragan. **GABAergic Signaling Is Linked to a Hypermigratory Phenotype in Dendritic Cells Infected by Toxoplasma gondii.** *PLoS Pathogens*, 2012; 8 (12): e1003051 DOI: [10.1371/journal.ppat.1003051](https://doi.org/10.1371/journal.ppat.1003051)