Brain parasite directly alters brain chemistry

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A research group from the University of Leeds has shown that infection by the brain parasite *Toxoplasma gondii*, found in 10-20 per cent of the UK's population, directly affects the production of dopamine, a key chemical messenger in the brain.

Their findings are the first to demonstrate that a parasite found in the brain of mammals can affect dopamine levels.

Whilst the work has been carried out with rodents, lead investigator Dr Glenn McConkey of the University's Faculty of Biological Sciences, believes that the findings could ultimately shed new light on treating human neurological disorders that are dopamine-related such as schizophrenia, attention deficit hyperactivity disorder, and Parkinson's disease.

This research may explain how these parasites, remarkably, manipulate rodents' behaviour for their own advantage. Infected mice and rats lose their innate fear of cats, increasing the chances of being caught and eaten, which enables the parasite to return to its main host to complete its life cycle.

In this study, funded by the Stanley Medical Research Institute and Dunhill Medical Trust, the research team found that the parasite causes production and release of many times the normal amount of dopamine in infected brain cells.

Dopamine is a natural chemical which relays messages in the brain

controlling aspects of movement, cognition and behaviour. It helps control the brain's reward and pleasure centres and regulates emotional responses such as fear. The presence of a certain kind of dopamine receptor is also associated with sensation-seeking, whereas dopamine deficiency in humans results in Parkinson's disease.

These findings build on earlier studies in which Dr McConkey's group found that the parasite actually encodes the enzyme for producing dopamine in its genome.

"Based on these analyses, it was clear that *T. gondii* can orchestrate a significant increase in dopamine production in neural cells," says Dr McConkey.

"Humans are accidental hosts to *T. gondii* and the parasite could end up anywhere in the brain, so human symptoms of toxoplasmosis infection may depend on where parasite ends up. This may explain the observed statistical link between incidences of schizophrenia and toxoplasmosis infection."

Dr McConkey says his next experiments will investigate how the parasite enzyme triggers dopamine production and how this may change behaviour.

Provided by University of Leeds