

Low-dose penicillin in early life induces long-term behavioral changes

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Credit: martha sexton/public domain

In a landmark study, researchers at St. Joseph's Healthcare Hamilton and McMaster University have found that providing clinical (low) doses of

penicillin to pregnant mice and their offspring results in long-term behavioural changes.

These changes include elevated levels of aggression and lower levels of anxiety, accompanied by characteristic neurochemical changes in the brain and an imbalance in their gut microbes. Giving these mice a lactobacillus strain of bacteria helped to prevent these effects.

The study was published in *Nature Communications* and was funded by the United States Office of Naval Research.

"In this paper, we report that low-dose [penicillin](#) taken late in pregnancy and in [early life](#) of mice offspring, changes behaviour and the balance of microbes in the gut. While these studies have been performed in mice, they point to popular increasing concerns about the long-term effects of [antibiotics](#)," says Dr. John Bienenstock, Director of the Brain-Body Institute at St. Joseph's Healthcare Hamilton and Distinguished Professor at McMaster University.

"Furthermore, our results suggest that a probiotic might be effective in preventing the detrimental effects of the penicillin."

Other studies have shown that large doses of [broad-spectrum antibiotics](#) in adult animals can affect behaviour. But there haven't been previous studies that have tested the effects of clinical doses of a commonly-used, narrow-spectrum antibiotic such as penicillin on gut bacteria and behaviour.

"There are almost no babies in North America that haven't received a course of antibiotics in their first year of life," says Dr. Bienenstock. "Antibiotics aren't only prescribed, but they're also found in meat and dairy products. If mothers are passing along the effects of these drugs to their as yet unborn children or children after birth, this raises further

questions about the [long-term effects](#) of our society's consumption of antibiotics."

A previous study in 2014 raised similar concerns after finding that giving clinical doses of penicillin to mice in late pregnancy and early life led to a state of vulnerability to dietary induction of obesity.

The research team will follow up their studies by analyzing the effects of penicillin on the offspring, if given only to the pregnant mothers. They also plan on investigating the efficacy of different types of potentially-beneficial bacteria in protecting offspring against the behavioural changes that result from antibiotic usage.

More information: *Nature Communications* (2017).
[nature.com/articles/doi:10.1038/ncomms15062](https://doi.org/10.1038/ncomms15062)

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