

Lung inflammation from childhood asthma linked with later anxiety

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Persistent lung inflammation may be one possible explanation for why having asthma during childhood increases your risk for developing anxiety later in life, according to Penn State researchers.

In a study with [mice](#), researchers found that childhood exposure to allergens was linked with persistent [lung inflammation](#). It was also connected to changes in [gene expression](#) related to stress and serotonin function.

Additionally, the study—recently published in *Frontiers in Behavioral Neuroscience*—found that episodes of labored breathing were associated with short-term [anxiety](#).

"The idea of studying this link between asthma and anxiety is a pretty new area, and right now we don't know what the connection is," said Sonia Cavigelli, associate professor of biobehavioral health. "What we saw in the mice was that attacks of labored breathing may cause short-term anxiety, but that [long-term effects](#) may be due to lasting lung [inflammation](#)."

Previous research has shown that about 10 percent of children and adolescents have asthma, which is associated with a two to three times higher chance of developing an internalizing disorder like anxiety or depression.

The researchers said that finding the root cause of this connection is difficult because in addition to the biological aspects of asthma, there are many social and environmental factors that could lead to anxiety in humans. For example, air pollution or a parent's anxiety about their child's asthma could also influence the child's risk for anxiety.

"With the mice, we can look at the different components of asthma, like the lung inflammation or the airway constriction," said Jasmine Caulfield, graduate student in neuroscience and lead author on the study. "A person who's having an asthma attack may have inflammation in their lungs and labored breathing at the same time, so you can't separate which is contributing to later outcomes. But in mice, we can isolate these

variables and try to see what is causing these [anxiety symptoms](#)."

To help tease apart these possible causes, the researchers studied four groups of mice: one with [airway inflammation](#) due to dust mite exposure; one that experienced episodes of labored breathing; one that experienced both conditions; and one that experienced neither, as a control. A total of 98 mice were used in the study.

The researchers found that three months after being exposed to the allergen, mice still had lung inflammation and mucus, suggesting that even when allergy triggers are removed, there are lasting effects in the lungs long into adulthood.

"We originally thought that once the allergen was removed, the lungs would clear themselves of inflammation relatively quickly," Cavigelli said. "If this translates to humans, it may suggest that if you grow up exposed to an allergen that you're reacting to, even if you get over that, you might still have these subtle, long-term changes in lung inflammation."

Additionally, they found that the mice that were exposed to the allergen and developed these changes in [lung](#) function also had changes in gene expression in brain areas that help regulate stress and serotonin.

"It makes sense to us because while labored breathing events may be scary and cause anxiety in the short term, it's the inflammation in the airways that persists into adulthood," Caulfield said. "So, it would make sense that long-term anxiety is linked with this long-term physical symptom."

The researchers also found differences in the results between male and female mice.

"In this study, the [female mice](#) had more inflammation in their lungs than the male mice three months after exposure to the allergen," Caulfield said. "In humans, girls are more likely to have persistent asthma while boys are more likely to outgrow it, so our animal model seems to map onto what we see in humans."

In the future, the researchers will continue to explore different possibilities for what causes the link between asthma and anxiety. For example, Caulfield and Cavigelli are working on a study in mice that examines whether a common class of daily [asthma](#) medication—corticosteroids—has long-term effects on anxiety.

More information: Jasmine I. Caulfield et al, Asthma Induction During Development and Adult Lung Function, Behavior and Brain Gene Expression, *Frontiers in Behavioral Neuroscience* (2018). [DOI: 10.3389/fnbeh.2018.00188](https://doi.org/10.3389/fnbeh.2018.00188)

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