

Chronic Stress Changes Immune Cell Genes, Leading to Inflammation

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A new study provides a better understanding of why chronic stress leads to high levels of inflammation in the body.

Researchers found that chronic stress changes gene activity of immune cells before they enter the bloodstream so that they're ready to fight infection or trauma -- even when there is no infection or trauma to fight. This then leads to increased inflammation.



This phenomenon was seen in mice, as well as in blood samples from people with poor socioeconomic statuses (a predictor of chronic stress), reported the researchers from Ohio State University, the University of California, Los Angeles, Northwestern University and the University of British Columbia.

"There is a stress-induced alteration in the bone marrow in both our mouse model and in chronically stressed humans that selects for a cell that's going to be pro-inflammatory," study researcher John Sheridan, a professor at Ohio State University and associate director of the university's Institute for Behavioral Medicine Research, said in a statement. "So what this suggests is that if you're working for a really bad boss over a long period of time, that experience may play out at the level of gene expression in your immune system."

Inflammation isn't always bad, particularly acute inflammation in response to an injury or infection. **But chronic inflammation, on the other hand, has been linked with a range of conditions such as heart disease, depression and even cancer.**

For the mouse part of this study, published in the journal Proceedings of the National Academy of Sciences, researchers induced chronic stress in mice by having a bunch of

male mice live together for a certain period of time. This time was enough for the mice to establish a hierarchy. Then, they introduced an aggressive male mouse to this group for periods of two hours to induce chronic stress in the mice.

After that, researchers looked at the immune cells circulating in the stressed mice's blood stream, and found that they had four times the frequency of immune cells in their blood and spleen, versus non-stressed mice.

Researchers completed genome-wide analysis of the immune cells taken from the stressed mice's blood. **They found that compared with the non-stressed mice, 3,000 genes in the stressed mice's immune cells were either expressed at higher or lower levels -- and 1,142 of the up-regulated genes played a role in making the immune cells become more inflammatory.**

Similar results were found in humans. The University of California, Los Angeles researchers looked at blood samples from both the stressed mice, as well as humans who came from differing socioeconomic statuses. Just like in the mouse part of the experiment, 387 genes were identified that had differences in activity between the people who came from low socioeconomic backgrounds and those who came from high socioeconomic backgrounds. And just like in the mice, the up-regulated genes in those who came from low socioeconomic backgrounds were pro-inflammatory.

In addition, a third of the genes that seemed to be affected by chronic stress were the same in both the humans and mice.

"This study provides a nice mechanism for how psychology impacts biology," study researcher Nicole Powell, a research scientist in oral biology at Ohio State University, said in a statement. **"Other studies have indicated that these cells are more inflammatory; our work shows that these cells are primed at the level of the gene, and it's directly due to the sympathetic nervous system."**

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