Social Stress May Enhance The Immune Response To Influenza Virus

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(PhysOrg.com) -- A new study using mice suggests that a repeated stressful situation that triggers the animals' natural “fight-or-flight” response may actually enhance their ability to fight disease when re-exposed to the same pathogen.

The study showed that the stressed mice had a 10-fold increase in their resistance to an influenza infection, and that this protection lasted at least up to three months after the stressful episodes.

While appearing to clash with years of findings that showed stressful situations can lower an individual’s immune response, the new work actually does not. Instead, it offers new insight into the fine balance the immune system maintains to protect against disease.

The report, carried in the current issue of the Journal of Immunology, describes new work emerging from Ohio State University’s Institute for Behavioral Medicine Research.

“Not all stress suppresses the immune system,” explained John Sheridan, professor of oral biology and associate director of the IBMR. “Some stressors actually give rise to enhanced immune responses.”

Led by former doctoral student Jacqueline Mays, now a postdoctoral fellow at the National Institute of Allergy and Infectious Diseases, the research capitalized on the natural pecking order that evolves when mice are housed together. Normally, a group of mice will develop a hierarchy

with the more aggressive mice being dominant and the less aggressive, more submissive.

In the experiment, Mays and Sheridan placed groups of five mice in cages and allowed them to establish dominance within those groups for six days. Then they added a sixth, highly aggressive mouse to the group for two hours for each of the next six days.

The more aggressive mouse would fight and defeat each of the others in the group establishing dominance and disrupting the current hierarchy, Sheridan said.

“There is a phenomenon called learned helplessness which is associated with depression. The repeated defeats each of the mice experienced actually modeled this learned helplessness and led to behavioral changes,” Sheridan explained.

“In humans who are depressed, we see elevated levels of cytokines like interleukin-6 and we see the same thing in this mouse model.”

One day after the aggressive mice were removed from the groups, the remaining mice were infected with a strain of influenza virus. Blood and tissue samples from the mice were assayed routinely, and antibody responses, T-cell populations and other measures of immune function were monitored over the next six weeks.

At the end of this period, Sheridan said, the mice had substantially higher-than-expected populations of specific T-cells -- key players in the immune response - and provided the animals with enhanced “immune memory” to better resist subsequent infections by the same pathogen.

“We believe the social stressor the mice experienced led to an increase in the frequency of the virus-specific T-cells needed to ward off the

disease," he said.

Flu vaccines routinely generate an immune response to surface proteins on the virus and those proteins can change from year to year, Mays said. A vaccine keyed to a T-cell response - such as the response shown in this research - might potentially confer a broader immunity against more types of the same virus, something that might be effective for more than just one year.

While the findings from animal studies may not always translate into progress for humans, Mays says she can see a parallel for humans to what the mice faced in this research.

"These mice essentially lost their place in their social hierarchy. The dominant individuals were no longer dominant, they didn't know who was in charge or what was going on" she said.

She pointed to a similar situation for humans in the workplace when the hierarchy shifts and workers can feel intense short-term stress.

Mays explained that humans interpret their environment at a different level than do rodents, so it doesn't take as aggressive of an interaction for humans to activate some of the same stress responses that these mice were experiencing. Mays said a similar intense, short-term stressful situation might face military recruits who began their basic training.

More information: Journal: www.jimmunol.org/

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