

Study shows how aging impairs immune response

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Researchers at Albert Einstein College of Medicine of Yeshiva University have uncovered one of the mechanisms by which aging may compromise the ability of the immune system to fight infections and respond to vaccines. The study, conducted in aging mice, shows that administering antioxidants may help reverse this loss of immune function. The findings were published online this month in the journal *Cell Reports*.

"Aging is known to affect [immune function](#), a phenomenon known as immunosenescence, but how this happens is not clear," said study leader Laura Santambrogio, M.D., Ph.D. , associate professor of [pathology](#) and of [microbiology](#) & immunology at Einstein. "Our study has uncovered several ways in which aging can worsen the body's overall ability to mount an effective immune response."

All cells generate chemicals called free radicals as a normal part of metabolism. These highly reactive, unstable molecules can readily damage proteins, lipids and other cellular components through oxidation (the reaction between oxygen and substances it comes in contact with). Cells keep "oxidative stress" in check by producing several enzymes that are scavengers of free radicals. But in aging, increased production of free radicals coupled with cells' decreased production of antioxidant enzymes cause a buildup of damaged proteins and other molecules that can be toxic to cells.

The current study is the first to examine whether age-related oxidative

stress compromises the function of a type of immune cell called dendritic cells. "Dendritic cells are known as the 'sentinels of the [immune system](#)' and alert the rest of the immune system to the presence of microbial invaders," explained Dr. Santambrogio. "When you are exposed to viruses or bacteria, these cells engulf the pathogens and present them to the immune system, saying in effect, 'There's an infection going on, and here is the culprit—go get it.'"

Dr. Santambrogio, in collaboration with Einstein colleagues Fernando Macian-Juan, M.D., Ph.D. , and Ana Maria Cuervo, M.D., Ph.D. , isolated dendritic cells from aging [mice](#) and found that oxidation-damaged proteins had accumulated in those cells and had caused harmful effects. For example, oxidatively modified proteins hampered the function of endosomes, the cell's organelle where pathogens are inactivated.

When the mice were injected with a potent antioxidant in the abdominal cavity daily for two weeks, some of the effects of oxidative stress were reversed. This finding has implications for designing vaccines or therapies for humans, especially the elderly, whose weakened immune systems increase their susceptibility to infections and cancer, and reduces [vaccine](#) effectiveness. "Many elderly people respond very poorly to vaccination, so perhaps a cycle of therapy with [antioxidants](#) before vaccination might improve their immune response to vaccines," Dr. Santambrogio noted.

More information: The paper is titled "Age-related Oxidative Stress Compromises Endosomal Proteostasis."

Provided by Albert Einstein College of Medicine

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