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Rejuvenating the Old Immune System

Jan. 27, 2010 — Thanks to the progress in health care and improved living conditions, we live longer. The price we pay: Our immune system loses functionality as we age and the susceptibility to infections increases. Members of the infection immunology research group at the Helmholtz Center for Infection Research in Braunschweig, Germany, are investigating this aspect of aging using a mouse model that mimics the susceptibility to infection observed in elderly humans.

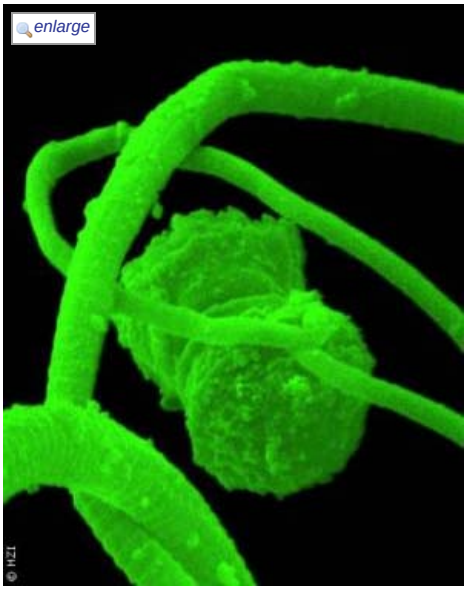
By comparing the immune responses of both young and old mice to bacterial infection, the researchers found that the number of macrophages -- one of the major cell populations involved in the elimination of infecting bacteria -- decreases rapidly in aged mice. This decline in the number of fighters and the associated weakness of the immune defense may be responsible for the age-associated increase in susceptibility to infections.

The HZI researchers have succeeded to enhance the resistance to an infection in aged mice by treating them with a macrophage-specific growth factor. This treatment increases the amount of macrophages in aged mice and improves their capacity to fight the infection. This study has been published in the current issue of the scientific magazine *Journal of Pathology*.

The main task of the immune system is to protect the body against invading pathogens. For this purpose, a variety of different cell types and molecular factors work together in a complex network. Together, they compose a highly effective defense front line. As we are getting older, our immune system changes: infections are more frequent and more severe, some immune cell types lose certain properties and their functionality declines -- in short: the immune system grows old. "Since the immune system protects our body against infections, to keep the immune system young and functional is a crucial factor for a healthy aging," says Eva Medina, head of the HZI infection immunology research group.

Much research effort is now focused on identifying age-related changes in the immune function in the hope of developing intervention strategies. "These therapies aim to strength the resistance of the elderly against infectious pathogens," says Eva Medina. The researchers from the HZI have used young mice, age two to three months, and aged animals, older than 20 months (this is the equivalent of 70 to 80 human years) to investigate specific deficiencies in the immune function that lead to the age-related increased in susceptibility to infection with the bacterium Streptococcus pyogenes. This pathogen is an important cause of severe, life-threatening infections among the elderly population. While the young animals were able to combat the infection successfully, the old mice died even if they were infected with fewer bacteria.

Afterwards, the researchers investigated the immune mechanisms involved in the control of the infection that are functional in young mice but impaired in the aged animals. They focused their studies on macrophages because these cells are the first line of defense for combating bacterial infections. The scientists found that the amount of this cell type is highly reduced in the tissue of aged mice compared to young animals. As the amount of macrophages in the organs depends



Streptococcus pyogenes (Credit: Image courtesy of Helmholtz Association of German Research Centres)

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on the production of a specific growth factor, the researchers evaluated if treatment with this growth factor could induce repopulation of resident tissue macrophages in aged mice and increase their resistance during infection.

"The treatment made aged mice much more resistant and they could fight much better the infection. The results of our study indicate that repeated prophylactic administration of this growth factor can help to maintain the macrophage compartment in the elderly and the fitness of the immune system," says Oliver Goldmann, scientist in the HZI research group. "Understanding the changes occurring within an ageing immunes system that increase the susceptibility to infection is essential for developing new strategies to to improve the capacity of the elderly immune system to fight and defeat pathogens."

Story Source:

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1. Goldmann et al. Age-related susceptibility to Streptococcus pyogenes infection in mice: underlying immune dysfunction and strategy to enhance immunity. *The Journal of Pathology*, 2009; DOI: 10.1002/path.2664

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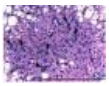

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