Study may show the way to more effective vaccines

August 21 2015

Credit: National Cancer Institute

Scientists at the University of Bonn, together with colleagues from the USA and Japan, have shed light on an important immune mechanism. Their work shows how the body provides the important killer cells with a helper in the case of an infection. The study could point the way to better vaccines in the future. The work has been published in the renowned journal *Cell*.

It is like having a spy thriller in our immune system. The so-called killer T cells play the role of James Bond: They have a license to kill. If they come upon a cell infected by viruses, they make holes in its cell membrane until the cell bursts and dies. This prevents the virus from spreading further.

No innocent victims are to be injured in this battle. The killer cells are therefore carefully briefed prior to their deployment – similar to 007 by his superior, M. The dendritic cells of the immune system undertake the briefing: They collect evidence of an infection and hold it under the noses of the killer cells like a type of mug shot.

Wherever M and 007 are, Q cannot be far away either – the chief engineer in the service of the agency who always equips Bond with the most sophisticated weapons. The role of Q is played in the body's own defenses by the so-called helper T cells. For example, they boost the reproduction of killer T cells and give their memory a helping hand. In the event of a repeat infection with the same virus, 007 can thus remember that he already dealt with this enemy.

Conspiratorial meeting in the lymph node

The actors of the immune system and their respective roles have been known for some time. However, it has not been clear to date what type of dendritic cell M is. It was also not known how M, Q and 007 managed to meet up. It was suspected that this meeting took place in the lymph node. But a lymph node is big – it is extremely unlikely that the three key figures would find each other by chance.

The immunologists at the University of Bonn were now able to answer this question. The killer T and helper T cells are initially separated from each other after an infection, in a state of alert. In this process, they are equipped with a type of GPS receiver. "This receiver guides the two to a

so-called XCR1 cell," explains the immunologist Prof. Dr. Wolfgang Kastenmueller from the University of Bonn. "That is a dendritic cell with special properties. Helper T cells as well as killer T cells can dock onto it."

The scientists were able to visualize these processes using what is known as an intravital microscope. In this way, cellular processes can be observed in living animals – thus under real-time conditions. The results may also be of interest for the development of new vaccines. Because killer cells are activated best by living viruses or bacteria. However, a live vaccine presents risks precisely in the case of harmful pathogens which one would like to avoid. It would be better to be able to activate killer cells through harmless fragments of disease pathogens. "Over the long term, our findings could help turn this idea into reality," says Prof. Kastenmueller.

More information: "Robust Anti-viral Immunity Requires Multiple Distinct T Cell-Dendritic Cell Interactions." *Cell*; DOI: 10.1016/j.cell.2015.08.004

Provided by University of Bonn