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Immune cells use 'bungee of death' to kill dangerous cells

Monday 8 March 2010

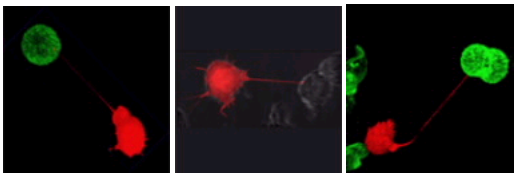
Immune cells use a bungee-like nanotube to snare dangerous cells, according to new research funded by the Medical Research Council (MRC).

The findings by researchers from Imperial College London show that natural killer (NK) cells use this bungee, called a membrane nanotube, to destroy cells that could otherwise escape them.

NK cells are the first line of defence against dangerous cells, such as tumour cells and cells infected with bacteria and viruses, and researchers are keen to understand how they help the body fight infection and stop tumours from growing. Ultimately, it may be possible to design drugs that harness the NK cells' ability to fight disease.

Prior to this study, scientists understood that NK cells can kill their target cells by attaching onto them, forming a connection called an immune synapse, which they use to pass toxic molecules into the target cell. However, sometimes the target cells move away from the NK cells to escape being destroyed.

The researchers took video footage of the cells using the bungee-like tube to keep hold of their target cells. The NK cells either pulled the target cells back into direct contact to be killed, or killed them from a distance.



See the video footage on the MRCComms YouTube channel;

- Video footage of natural killer (NK) cells (1) – YouTube, 11 seconds
- Video footage of natural killer (NK) cells (2) – YouTube, 6 seconds

Dr Kevin Moreton, Board Programme Manager for Infections and Immunity at the Medical Research Council said: "Understanding how the human immune system protects the body is critical to developing new treatments for a range of conditions from infectious diseases, autoimmune diseases, through to allergies. The MRC funded this study as part of our core strategy and ongoing commitment to researching the body's natural protection and defence mechanisms."

Professor Daniel Davis, corresponding author of the study at Imperial College London said: "Natural Killer cells are cells that are really good at killing tumours and virus-infected cells. It was thought they kill these diseased cells only by sticking to them tightly for several minutes. These new movies show that in fact they also tether cells with long membrane connections and can pull diseased cells back into contact. We think they may also use these nanotubes to kill them from a distance.

"The movies show the process vividly but the next step is difficult because we have to know where and when these processes are important in your body, and the technology to see such thin nanotubes in the body hasn't been invented yet! It's a very new research area and we need to learn how the process works precisely so that we can then think about ways to design drugs that help immune cells kill," added Professor Davis.

When a target cell moves away from an NK cell, it normally moves 'head' first, at around eight micrometres per minute. Today's research shows that when the NK cell pulls its target cell back using the nanotube bungee, it moves much faster, at around fourteen micrometres per minute. The study also showed that membrane nanotubes dramatically increase an NK cell's chance of killing its target cell from a distance. The next step will be to find out exactly how the bungee tubes help immune cells kill their target cells.

YOUTUBE

Footage of immune cells using 'bungee of death' to kill dangerous cells. MRCcomms channel

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The study “Membrane nanotubes facilitate long-distance interactions between natural killer cells and target cells” was published in the journal Proceedings of the National Academy of Sciences (PNAS) on Monday 8 March 2010 and funded by the MRC and the Association pour la Recherché sur le Cancer (ARC).