How immune cells 'sniff out' bacteria

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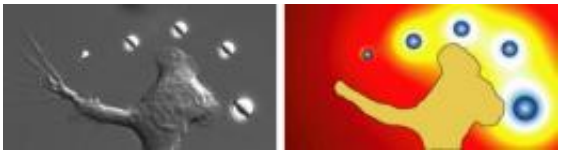

Biophysicists at Yale created a method to stimulate single living cells with light and microparticles. Left side: The five particles pictured are trapped with laser tweezers and release a chemical which attracts the cell. Right side: The cell encounters a larger chemical concentration close to the particles (white-yellow region) than further away from the particles (red-black region). Credit: Holger Kress and Eric Dufresne

Scientists are learning how our immune system senses and tracks down infection in the body by responding to chemical "scents" emitted by bacteria. Studying how immune cells manipulate their movement in response to external signals could shed light not only on how our immune system functions but also how cancer cells spread through the body and even how the brain wires itself.

Speaking at the Society for General Microbiology's spring meeting in Edinburgh, Dr Holger Kress describes a new technique pioneered by himself and Professor Eric Dufresne at Yale University in the US that uses sponge-like micro-particles to mimic bacteria.

The micro-particles slowly release a characteristic bacterial "scent" that is picked up by immune cells, causing them to actively move towards the

source of the chemical in an attempt to hunt down the model microbes. These micro-particles can be trapped and manipulated three-dimensionally using 'optical tweezers' - highly focussed laser beams that are able to precisely control the movement of the particles to within a millionth of a millimetre. "By controlling the shape of the chemical signals, we were able to control the movements of immune cells and study how they respond to the signals," said Dr Kress.

The scientists found that a single chemical-releasing micro-particle was enough to encourage neutrophils (a type of immune cell) to migrate towards it. Within less than one minute's exposure to the micro-particle, the neutrophils were able to polarize the growth of their internal 'skeleton' in the direction of the chemical.

Dr Kress explained that although researchers had successfully identified the types of chemical signals that stimulate immune cells, it is still a challenge to work out the exact details of the immune cell response. "This new technique allows us to measure systematically how cells respond to various stimuli over minute gradients in time and space."

Dr Kress believes his technique could be applied across a wide range of research fields. "Cell migration along chemical gradients of this kind plays a key role in wound healing and the wiring of the brain. It is also an essential feature of many diseases - particularly metastatic cancers," he said.

Provided by Society for General Microbiology

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