Cell manipulation could lead to the better treatment of disease

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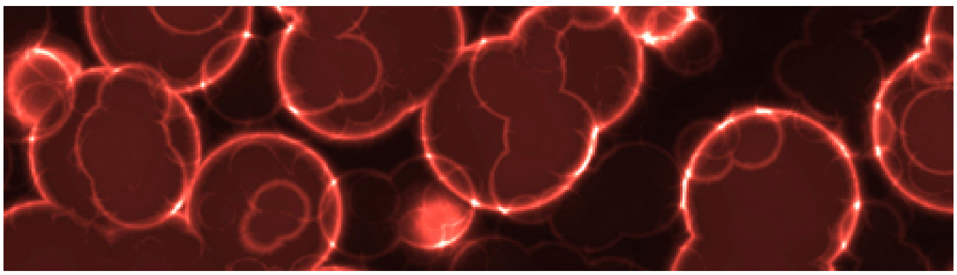

A new laboratory tool which will allow scientists to build and move microscopic cells could lead to the development of better treatments for disease.

In a new study, published in *Scientific Reports* and led by researchers at The University of Nottingham, scientists have discovered how microscopic cells can be manipulated and studied more closely in 3D using a high intensity infrared light.

The accurate study of cells has previously been limited by technologies that were only capable of studying cells on a macro scale. This latest development will enable scientists, in the laboratory, to rebuild the tiny worlds where cells live and in turn understand how they grow and function.

Optical tweezers

Scientists have discovered how to use laser energy in a technique called 'Holographic Optical Tweezers' to 'grip' tiny cells. This enables them to move these cells around on a microscope in 3D, building them together into whatever arrangement they want.

Professor Kevin Shakesheff's team from the School of Pharmacy at the University have developed this technology in conjunction with colleagues at the University of Glasgow.

Dr Glen Kirkham, the lead author of the study, said "The basis of the human body is the cells that make it up. The problem is how do we manipulate the tiny little worlds cells live and grow within? If we can do that we can better understand how cells work and potentially work out what can go wrong and develop new medicines.

"Within your body, you have stem cells that exist in your bone marrow. These stem cells provide all of your blood cells and they also provide cells to heal and repair a broken bone – for example. They exist in a tiny world called the stem cell niche, basically a little environment that the cells live in, grow and function. We don't know a lot about it and we don't know what makes it tick because we can't rebuild it within the laboratory."

Building blocks

The team is now looking to use this technique to try and rebuild cell structures in a way that replicates how they would be built in the human body. By doing this, they can learn how cells are organised, how they communicate with each other and how all the various signals get sent between them.

"This is the basis of all biological functions, so if we can better understand this, then it will mean we can manipulate biology more accurately and in turn, make better medicines. Potentially we may one day be able to rebuild cells and tissues exactly as they would be in the human body, which could have huge implications for tissue regeneration," adds Dr Kirkham.

In the short term, the team are looking at testing new drugs and treatments for infectious diseases. They will study the microscopic cells to see how certain bacteria disrupt cells at this level, and to find out what the mechanisms are. They are also looking at this as a possible replacement for the use of animals in testing.

"A tool like this has never been created before, and previously scientists have used physical manipulation to study cells," continues Dr Kirkham. "The problem with this method is you potentially have huge objects banging against them and it's very limiting as you can only move a few cells at a time. With this new method, we are able to move lots of cells at the same time and the laser energy we are using doesn't damage the biology."

More information: "Precision Assembly of Complex Cellular Microenvironments using Holographic Optical Tweezers" *Scientific Reports* 5, Article number: 8577 DOI: 10.1038/srep08577

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