New technique can help understand neurodegenerative diseases

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Cell biologists at Utrecht University have successfully moved selected parts of a neuron to another specific location within the cell. This allows them to accurately study which role the position of a cell component performs in the cell's function. This is vital in order to understand the origins of neurodegenerative diseases such as Alzheimer's disease and ALS. The researchers' research will be published in the 7 January 2015 issue of *Nature*.

The technique they have developed is interesting for research into all cells, but especially for the hundred billion nerve cells that we use to think, feel, move and observe the world around us. Unlike other cells, damaged nerve cells, or neurons, are seldom replaced by new cells. This means that the growth and repair of damaged cells is crucial for a healthy nervous system. Diseases such as Alzheimer's and ALS result from malfunctions in this process, which can be caused by defects in the proper transport of cellular components. "With our technique, we can now study whether improving this transport process can contribute to the rehabilitation of neural damage. Five years ago, I wouldn't have dreamt that we would be able to study this process in such detail", according to Utrecht University research leader Dr. Lukas Kapitein.

Selective and local control

The proper function of cells requires specialised components, such as mitochondria, which provide the energy the cell needs. "We have

evidence that the proper position of these components is essential for the proper functioning of the cell", explains Kapitein. "Unfortunately, until now it has been impossible to move a specific cell component to a specific location or remove it entirely. With our technique, we can finally selectively and locally control the cell's transportation system."

Blue laser light

The cell biologists from Utrecht control the components that they wish to study using blue laser light. In the part of the cell that is illuminated using laser light, the selected components bind to 'motor proteins'. These molecular motors can travel throughout the cell's structure in order to transport components. Each type of motor protein has its own destination. By linking and unlinking to the proper motor protein, the researchers can steer the components they wish to study to the desired location in the cell.

Controlled outgrowth

In the publication in Nature, the cell biologists from Utrecht show the effect that the position of a specific type of transport vesicle has on the growth of the axon. An axon is an appendage of a neuron that sends signals to other neurons, and can reach lengths of up to a meter. The tip of the axon has a feature called a growth cone. "By varying the position of the vesicles, we were able to prove that their presence in the growth cone contributes to the growth of the axon. If they are in a different location, then they do not support cell growth", explains Kapitein.

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