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Stem cell research aims to tackle Parkinson's disease

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Scientists in Sweden are developing new ways to grow brain cells in the laboratory that could one day be used to treat patients with Parkinson's disease, an international conference of biologists organised by the European Science Foundation (ESF) was told last week.

Professor Ernest Arenas of the Karolinska Institute in Stockholm presented his research to the EuroSTELLS "Stem Cell Niches" conference in Barcelona on January 11. Stem cell therapy hold the promise of treating disease by growing new tissues and organs from stem cells – 'blank' cells that have the potential to develop into fully mature or 'differentiated' cells. The EuroSTELLS is an ESF EURCORES programme, managed by the European Medical Research Councils (EMRC), that aims to develop a stem cell 'toolbox' by generating fundamental knowledge on stem cell biology.

Parkinson's disease affects around three in a hundred of people aged over 65. The condition can cause muscles to become rigid and limbs to tremble uncontrollably. Parkinson's disease results from the loss of a particular type of brain cell called dopaminergic (DA) neurons in the part of the brain called the substantia nigra.

Among the various approaches that are currently being discussed from an ethical perspective, is the possible approach of taking stem cells, growing them into new brain cells and transplanting these into the patient. "The idea is to start with stem cells and induce them to become neurons," said Professor Arenas, whose research is carried out as part of

a EuroSTELLS collaboration. “These could then be transplanted into the brain of the patient. Also, such cells could be ideal for developing and testing new drugs to treat brain disease.”

However, to create such cells that function efficiently and safely is a major challenge. Early efforts at growing DA neurons from embryonic stem cells produced cells which, when transplanted into animal models, had a tendency to form tumours or clumps, or die without an obvious reason.

Professor Arenas’s team studied the development of DA neurons in animals to determine the important biological molecules in the brain that were necessary for the cells to grow and function efficiently. The scientists identified one particular molecule that seemed to be key, a protein called Wnt5a. They showed that when this molecule, together with a second protein called noggin, was included in cultures of stem cells, far more DA neurons were produced than when these ingredients were not present.

The team then carried out a series of molecular, chemical and electrophysiological tests on the newly grown neurons to check their proficiency, which was shown to be good.

Crucially the team also moved away from embryonic stem cells – which can be induced to grow into a wide variety of different cells. Instead they used neural stem cells – which are programmed to develop only into nerve cells.

When the researchers transplanted the cells into laboratory animals whose substantia nigra region of the brain was damaged, the results were promising. “We reversed almost completely the behavioural abnormalities, and neurons differentiated, survived and re-innervated the relevant part of the brain better” Professor Arenas said. “Furthermore

we do not see the kind of proliferation of the cells that has occurred in the past and we get very little clustering when the cells are treated with Wnt5a. The cells are safer than embryonic stem cells and more efficient than fetal tissue."

Verification of this approach with human cells is ongoing and if the study is successful, it may lead to a clinical trial. Experts in the field have recently identified this approach as the next step in cell replacement therapy for Parkinson's disease and the hope is that this may, ultimately, lead to cells suitable for transplant into human patients.

Source: European Science Foundation