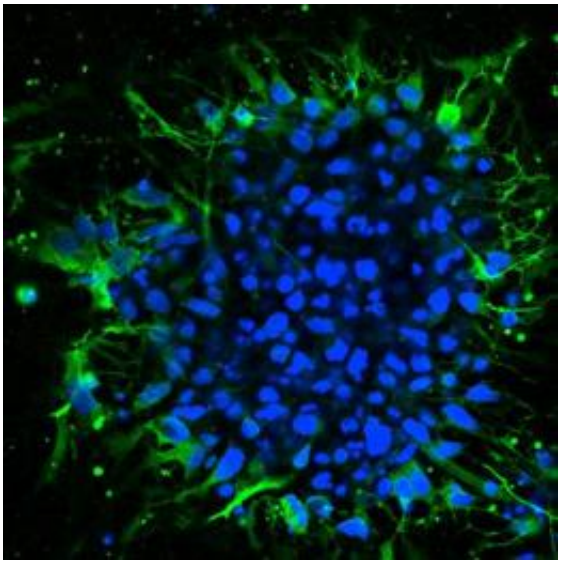
Researchers develop stem cell-based models for studying mitochondrial disorders

September 23 2011, By Sathya Achia Abraham



Neurons generated from human neural progenitors transfected with pathogenic mitochondrial DNA. Shown in green are neuronal extensions and nucleus in blue. Image courtesy of Khaled Alsayegh from the laboratory of Raj Rao, Ph.D./VCU.

(Medical Xpress) -- Virginia Commonwealth University researchers from the Center for the Study of Biological Complexity, the School of Engineering and the School of Medicine have developed a novel approach for generating stem cell-derived cell models to study neurodegenerative disorders that have defects in their mitochondrial genome and physiology such as Leber's hereditary optic neuropathy, Leigh's syndrome, Alzheimer's disease and Parkinson's disease.

These findings offer researchers the ability to have the right model systems in place to study the path of a disease and use it to discover new potential drugs or other therapies.

In this approach, according to the study's principal investigator, Raj R. Rao, associate professor in the Department of Chemical and Life Science Engineering in the VCU School of Engineering, pathogenic mitochondrial DNA was introduced and stably expressed in human neural progenitor stem cells, which still maintained 'stemness' and could be successfully differentiated to neuronal lineages. The study was published online Sept. 15 in the Nature Publishing Group journal, Gene Therapy.

Rao; Shilpa Iyer, research scientist at VCU Center for the Study of Biological Complexity and VCU Life Sciences; and colleagues reported the methodology for establishment of stem cell-derived cell lines with mitochondrial disorders. Defective mitochondria have been found to be the culprit in a wide variety of clinical disorders, many of which impact the nervous system in early mammalian development, and also in age-related disorders such as Alzheimer's and Parkinson's disease.

According to Rao, while this specific cell line can be predicted to have broad usage, the technique itself can be adopted for establishing similar stem cell-based disease models for a host of other diseases with defects in mitochondrial genome.

"We think that these results will aid in the development of customized cell lines for studying the effects of pathogenic mitochondrial DNA on the severity of disease during neuronal development," said Iyer.

According to Rao, future studies will focus on establishing several customized disease lines that will assist in studying the effects of mitochondrial defects on disease progression.