

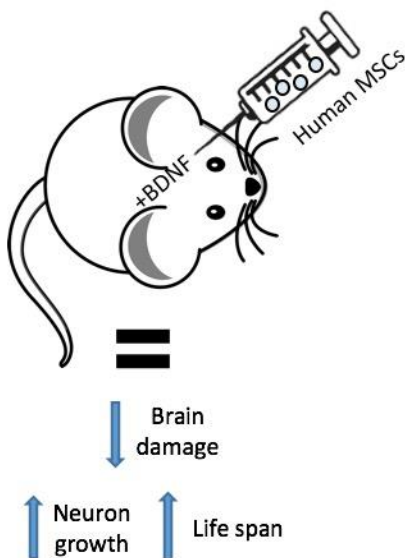
Hope for Huntington's: Enhancing the Delivery of Medicine by Stem Cells to Treat Huntington's Disease By Angelica Bachman

Imagine living your whole life knowing there is a fifty percent chance that you have inherited a genetic disease. At the age of 35 you find out that you fall into that percentage. You may have already started a family by this point in your life, and now there is a fifty percent chance your children have also inherited the disease. Within a few years, medical professionals deem you unfit to drive a car or work the job that you love. Soon, you can't work any job because you are in constant pain, slowly losing control of your body and mind. This is just a fraction of what it is like living with Huntington's disease.

Huntington's disease (HD) is a neurodegenerative genetic disorder that affects 1 in every 10,000 individuals in the United States. It is a progressive disease, meaning it gets worse as the individual gets older. HD is characterized by cognitive decline, behavioral and psychiatric changes, and jerky, involuntary movements. These symptoms are caused by a mutation in the huntingtin gene, which results in a mutated protein that eventually leads to loss of neurons in the brain. There is currently no cure for HD and very few treatment options. In fact, the treatment options available aren't able to slow the progression of the disease; they only work to improve quality of life for HD patients. HD causes death about 18 years after the onset of symptoms.

However, a more successful treatment for this devastating disease may be within reach.

Mesenchymal stem cells (MSCs) are a subtype of stem cell that can be used to deliver vital substances, like growth factors, to different parts of the body. Growth factors are substances that are required to promote cell growth. Brain derived neurotrophic factor (BDNF) is one of the growth factors that can be delivered to the damaged part of an HD brain by MSCs. BDNF is important for any healthy brain, as it mediates the survival and function of neurons. Research has shown that the mutated huntingtin protein results in a reduction of BDNF in the brain. So, the addition of BDNF becomes medicine to the HD brain. This is like giving insulin to a person with type I diabetes because their body is not producing enough on its own.



Delivery of BDNF has been shown to work in treating HD. A recent study published in 2016 found that BDNF delivered by human MSCs to a mouse with HD decreased the amount of brain damage, increased the growth of new neurons, and increased the overall lifespan of the mouse. This is a huge advancement in the treatment of HD!

This system isn't anywhere near perfect though. After a short amount of time, the mouse's immune system recognizes the human MSCs as foreign invaders. This causes

the immune system to kill all the MSCs, effectively destroying the medicine that is trying to help treat the sick brain.

I know what you're thinking: why not just use mouse MSCs so the immune system doesn't need to generate a response and kill the human cells? The simple answer is that we have to show evidence that this form of treatment is successful in a human cell type in order to use it in a clinical setting to treat patients.

For this reason, it is difficult to study the long-term safety and efficacy of this treatment option. This has led Dr. Jan Nolte's HD team at the UC Davis Institute of Regenerative Cures to begin working to create an immune deficient HD mouse model. This is a model that has been bioengineered to lack an immune system. By creating this model, we can begin to study what happens when treatment with human MSCs is continued long-term. It can also help us and other scientists to study different potential treatment therapies for HD that could be affected by the immune system.

Developing this mouse model brings us one step closer to a treatment for a HD. A treatment that may be able to slow the progression of the disease and potentially lead to an extended and easier life for HD patients. It gives us hope for Huntington's.