

A Gut Reaction to Intestinal Stem Cells

by Angelo Niosi

Have you ever heard someone say they “knew it in their gut”? It may seem absurd to “know” something in your gut and it seems obvious that we know things with our brain, right? Well, researchers have recently discovered that our guts and brains are more connected than we realize. An exciting area of research making this gut-brain connection is the investigation into the cause of gastrointestinal disorders and their overlap with brain disorders.

Gastrointestinal (GI) disorders are disorders of the digestive system. The digestive system includes the GI tract, which can be further divided into the stomach, the small intestine, and the large intestine. GI disorders include irritable bowel syndrome, ulcerative colitis, Crohn’s disease, and many more. There are 60 to 70 million Americans diagnosed with a GI disorder, and many of them suffer from chronic pain and malnutrition.[3][4] For this reason, it is important that we unravel the causes of these disorders to find potential treatments.

One area of GI disorder research involves stem cells. Stem cells are unspecialized cells that have the potential to become other more specialized cells. Similar to how the raw materials of metal, plastic, and rubber have the potential to become specialized products like a car or a computer. Stem cells may be involved in the cause of many GI disorders and stem cell therapy may even be used to treat some of these disorders.

Stem cells as a cause of GI disorders

In healthy GI tracts, many of the cells are constantly replaced by a process which involves intestinal stem cells (ISCs) dividing to make new cells. These ISCs are highly regulated and much of this regulation is due to genetics. Furthermore, genetic mutations have been shown to be involved in some GI disorders.[1][3] In fact, we’re discovering more and more genes that are potentially involved in ISC regulation. Interestingly, some of these same genes are also involved in brain development and brain disorders, also called neurological disorders.[1][3][6] Some of these neurological disorders include Autism Spectrum Disorder (ASD), depression, and migraines.[1][3][5][7] Mutations in genes that are involved in both neurological disorders and ISC regulation could explain why many neurological disorders often have co-occurring GI disorders. And guess what? Learning about GI disorders could actually help us better understand the cause of some of these neurological disorders! Angelina Tupikova

of how GI disorders could cause neurological disorders is impaired ISC regulation in the GI tract causing malnourishment, which can consequently impact brain development and healthy brain function. Another way GI disorders could cause neurological disorders has to do with the bacteria that live in our guts.

It's thought that ISCs interact with the bacteria that live in our intestines.[13] Bacteria are a type of microorganism and there are many microorganisms that live in our intestines.

The microorganisms that live in our intestines are collectively referred to as the gut microbiome. We know that the make-up of our gut microbiome is important for nutrient absorption, immune system regulation, and protection from disease.[8] Furthermore, the bacteria in our gut microbiome are sensitive to changes in diet, medications, and environmental factors like industrial chemicals.[11]

Recently, we have learned that the interplay between the gut microbiome and ISCs are important for a healthy GI tract. Imbalances in the gut microbiome may impair the function of ISCs and, as a result, this impairment could lead to GI disorders.

Additionally, studies have shown that people with ASD and depression have different gut microbiomes than people without these disorders.[12][2] As mentioned previously, many genes involved in ISC regulation are also associated with neurological disorders. So, these shared genetic components influence brain health and the structure and function of the gut. Consequently, this influences which microbes can make a living there.

A better understanding of this fascinating and complex interplay between genetics, ISCs, bacteria, and the brain, as seen in figure 1, could help sharpen the picture of the relationship between GI disorders and neurological disorders.

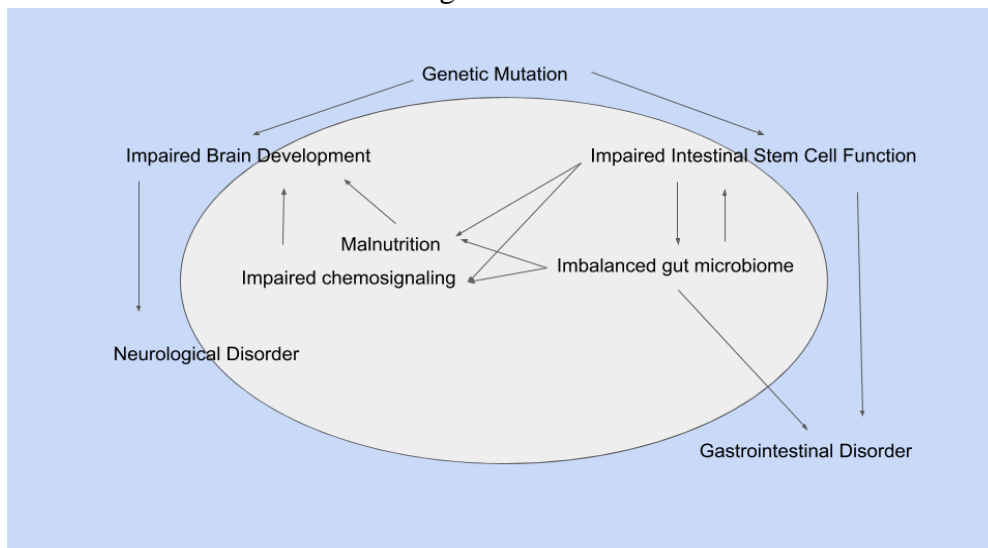


Figure 1. The complex relationship between GI disorders and neurological disorders.

Stem cells as potential treatments for disorders of the gut and brain

Though stem cells like ISCs might play a role in the cause of gut and brain disorders, another type of stem cell, called mesenchymal stem cells (MSCs), might hold promise as a treatment for

these disorders. MSCs can be derived from different human tissues, including adipose, bone marrow, peripheral blood, and umbilical cord blood, and easily grown in the lab. These cells have unique healing and anti-inflammatory properties, which could be incredibly valuable in the treatment of GI disorders. Many GI disorders cause damage to the intestine leading to pain and malnourishment. Some preliminary studies have demonstrated that injections of MSCs to injured areas of the intestine can help with tissue repair and symptom alleviation.[9] While more research is needed in this area, it is beginning to look as if stem cells may hold the answer for both the cause and treatment of GI disorders...and perhaps neurological disorders, too. Given the deficit of effective treatments for neurological disorders—which are extremely prevalent and often debilitating—an MSC-based treatment would represent a significant and exciting advancement in the field.

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