The Gut Link between Multiple Sclerosis and Diet

The Challenge Multiple sclerosis (MS) affects nearly 3 million people worldwide. This chronic disease occurs when the body's immune system mistakenly attacks the nervous system, causing symptoms like fatigue, difficulty walking, and cognitive problems. Although there is no cure yet, exciting new research suggests that what we eat might play a much larger role in MS than we had previously thought.

The Gut-Brain Connection Scientists have discovered that our stomach, intestines, and colon – the "gut" – and our brain are constantly "talking" to each other. The trillions of bacteria living in our gut are critical in maintaining a healthy immune system. Laboratory studies with mice revealed that these gut bacteria may even help protect against autoimmune diseases like MS. In humans, clear differences were found between the gut bacteria of MS patients and healthy individuals, suggesting that gut health might affect MS development and progression.

How Diet Makes a Difference Fiber-rich foods promote the growth of healthy gut bacteria. These bacteria produce beneficial compounds which fight inflammation and regulate our immune system. In contrast, diets high in fat, sugar, and processed foods reduce good bacteria and encourage harmful bacteria to grow, leading to inflammation and compromised immune function. The dietary habits of people with MS and other autoimmune diseases (rheumatoid arthritis, inflammatory bowel disease, Type I diabetes, psoriasis) have been connected to diet, although to date, there exist **no** controlled experiments testing this intriguing hypothesis.

Our Study We propose a controlled dietary study in people with MS, that will help us to understand how diet and the gut microbiome may influence MS-related symptoms. Our study has two parts:

Part 1: MS patients and healthy participants will stay at UT Austin's AT&T Center for one week, where we will provide them with carefully controlled meals - either a typical American diet or a Mediterranean diet. During this time, we will collect breath, blood, and stool samples, which will allow us to evaluate how these different diets influence the body's health. We will also track participants' fatigue level, ability to perform tasks that require attention and concentration, anxiety levels, and pain scores

Part 2: The same participants will follow their assigned diet at home for six months using a meal delivery service. We will continue monitoring their health and collecting samples throughout this period.

What Makes This Proposal Special Our team, composed of scientists at the University of Texas at Austin (Profs. Kinney, Josephs, Melamed, Misztal, and Noble), has discovered an innovative way to track metabolism in real-time by analyzing the gases people breathe out. This breath analysis is completely non-invasive and can reveal how diet affects the complex relationship between gut bacteria, immune function, and brain health. We will use advanced computer algorithms to identify patterns that could help predict which dietary approaches work best for different people.

This experiment has the potential to create personalized dietary recommendations for people with MS, offering a new tool to help manage this challenging condition, locally and globally.