When Genes and the Environment Collide

What happens when genes and the environment interact? This question is one of the complex pieces of the MS puzzle. More than 200 MS susceptibility genes have been identified, and the list of environmental factors linked to MS is slowly coming into focus. Of course, it's important to remember that not everyone who develops MS has been exposed to the identified MS risk factors, and people exposed to those factors won't necessarily develop MS. But how do genetic and environmental triggers interact to bring on MS, or make it worse? Several presentations at last week's ACTRIMS 2017 meeting addressed these important gaps in our knowledge.

Smoking has been singled out as a risk factor for getting MS and has been linked to disease progression. Dr. Thomas Olsson of the Karolinska Institute in Sweden studied whether there was any connection between smoking and the HLA genes (which are involved in immune reactions) that have long been associated with MS. In fact, his team reported a **13-fold** increase in risk of developing MS if smokers carried a specific gene (HLA-DRB1*15 gene) and lacked another (HLA-A*02 gene), compared with people who never smoked and did not have these genetic characteristics (Abstract).

Another study pinpointed a virus that seems to be associated with MS progression. Dr. Antonina Dolei of Università degli Studi di Sassari in Italy talked about studies on human "endogenous retroviruses," which at some point in the ancient past took up residence in our genes. In fact, she described these retroviruses as "aliens inside human DNA" that might be involved in triggering MS or its relapses. Results so far suggest that the DNA of people with MS has more 'copies' of these viruses than people without MS. Finding signs of the viruses in spinal fluid predicted progression years in advance. If such studies are confirmed, these retroviruses may actually be used to help track MS progression, now wholly unpredictable.

Both genetics and environmental studies require a lot of people with MS to provide samples and data. The large numbers required make collaboration among doctors and scientists key. One example of big collaborations is the large-scale “Genes & Environment in MS” (GEMS) study, in which researchers at Harvard, University of Pittsburgh, Columbia and the National Institutes of Health are analyzing the genes and backgrounds of individuals who have not reported symptoms of MS, but who have close family members with MS.

Young investigator Dr. Zongqi Xia of the University of Pittsburgh presented results from this ongoing effort. The team classified participants using the Genetic an experimental approach that incorporates genetic information and environmental exposures to identify people at higher or lower risk of developing MS. The study confirmed that people who were labeled “high-risk” were more likely to have imaging findings and vibration insensitivity that might be suggestive of MS. However, in a recent publication from this study, lead scientist Dr. Phillip De Jager pointed out that “family members should be reassured that the vast majority of family members will not develop MS.” Read more about this study.

As someone who cares deeply for people affected by MS, I am heartened at this important work by scientists and doctors around the world working to simplify the genetic and environmental complexities that lead to the development of MS and its progression. If we know how genes and potential environmental triggers interact to give rise to the disease or impact the severity of symptoms, we can hopefully better anticipate its course, stop it in its tracks and even find ways to prevent MS.