We created a blog that allowed “experts” to interact with an individual who has contracted systemic lupus. The blog posts consists of three experts responding the various questions proposed by a woman who cannot understand how she and her twin have different phenotypes but are identical.

http://epigeneticlupus.blogspot.com/

Main Post One (Lindsey): Hey guys! My name is Lucy Johnson. I am a 40 year old female living in New York City. I have an identical twin sister, Linda, who lives in Florida. Linda and I were very similar growing up, but we moved apart from each other when we were 18 years old to follow different career opportunities. Recently I fell ill and had symptoms of severe joint pain, fever, rashes, and I was tired all the time. I went to several doctors and found out I have systemic lupus. Is this a viral or bacterial disease? I’m looking for any information about the disease.

Expert 1 Comment (Kate): Hi Lucy! My name is Dr. Capitano and I have a doctorate in chronic autoimmunity. First off, systemic lupus erythematosus is a chronic autoimmune disease, meaning your own immune cells have come to attack your body’s own healthy cells as if they are foreign invading cells. This happens when your white blood cells, the cells tasked with fighting off foreign invaders, produce antibodies that attach to your own body tissues instead of the antigens. This causes your white blood cells to attack and destroy healthy tissues from various organs, causing multiple symptoms.

Main Post Two (Lindsey): How could I be diagnosed with this disease and not my identical twin sister? Since we are identical twins, don’t we have the same DNA?

Expert 2 Comment (Adwoa): Good point, Lucy! However, more factors than DNA sequence contribute to the expression of genes. I’m Dr. Baffoe-Bonnie, an epigenetic researcher for the Mayo Clinic. Epigenetics isn’t a difference in the nucleotide sequence of DNA, but how genes are expressed. Factors like histone acetylation and DNA methylation contribute to changes in gene expression and transcription of certain proteins. In a sense, epigenetic factors have the ability to “turn off” or “turn on” certain genes. This explains why your phenotypic expression of lupus differs from your sister’s.

Kate: To further explain the mechanisms behind this change in gene expression, expert one included a video to aid Lucy’s understanding.

Video Script: DNA methylation can occur on genes that were originally meant to be expressed. This occurs when a methyl group attaches to a nucleotide base pair, in this case cytosine. This
can occur due to environmental factors such as cigarette smoke and silica. Then, during transcription, the methylated cytosine can be on the coding strand of the DNA. This makes it so that the RNA polymerase is unable to transcribe that specific base pair. Another method mentioned as a possible epigenetic cause for lupus is acetylation. Acetylation is when an acetyl group is attached to the amino acid of a histone, allowing the DNA to be wrap less tightly around the histones which exposes the genes to transcription.

Main Post Three (Lindsey): Epigenetics? I thought that had to do with heritability over generations. I read an article about epigenetics and it talked about how a grandmother who smoked while pregnant negatively affected her offspring’s reproductive cells and the grandchildren’s phenotype. I still don’t understand how epigenetic changes to my genome still aren’t the same as my sister’s epigenome! How can epigenetics change the expression of genes in my own lifetime?

Expert 2 Comment (Adwoa): That is one component epigenetics. In your case, rather than epigenetic changes to DNA being inherited, changes can also arise by various environmental and lifestyle factors. These environmental conditions and lifestyle choices can cause specific sequences of DNA to become methylated.

Expert Comment (Kate): It is possible that both you and your sister inherited the SLE gene, which only predisposes you to develop the disease, but certain environmental factors acted on your gene to allow the expression of that gene.

Expert Comment (Carlie): While we are discussing changes that occurred in your lifetime that lead to the expression of lupus, epigenetics also encompasses heritability patterns over generations. An interesting example of this phenomenon in humans was examined through the study of the harvest data of a Swedish town. Researchers identifies a connection between how much food a generation had available to them in a given harvest season and the occurrence of heart disease and diabetes in subsequent generations. The amount of food consumed was proven to have influenced the epigenome of earlier generations. This scenario is an example of epigenetic inheritance, because food availability acted as an external environmental factor that altered how genes related to heart disease and diabetes were expressed in later generations.

Main Post Four (Lindsey): Are there any specific environmental factors or lifestyle choices specifically related to lupus?

Expert 3 Comment (Carlie): Hi Lucy! That’s a great question. I’m Dr. Vasquez and I’m an expert on lupus and its relation to epigenetics. A variety of factors can contribute to the epigenetic expression of lupus. Exposure to silica, a compound found in soil, concrete, rock,
granite, sand, tile, and other materials was determined as confident by researchers in the causation of SLE. Cigarette smoking has also been shown as a likely cause of the disease expression. Other factors including Epstein-Barr virus and some dietary deficiencies have shown positive correlations with SLE.

Main Post 5 (Lindsey): Wow! I am interior designer and work with tile a lot in kitchens and bathrooms. My sister is an accountant and rarely leaves a cubicle. Also, I have never smoked before, but living in New York City has exposed me to a lot of secondhand smoke. My sister lives near a national park in Florida where cigarette smoking is heavily policed. No wonder I got the disease and my sister didn’t. We’ve been living in such different environments for over 20 years. Does having lupus put my offspring at risk for expressing the disease as well?

Expert 2 Comment (Adwoa): Unfortunately Lucy, DNA methylation can be inherited by offspring. There is a significantly larger risk of your offspring inheriting lupus due to epigenetic changes to your genome.

Expert 1 Comment (Kate) : Methylation can also contribute to the heritability factor of SLE. When methylation occurs, it can be passed on the subsequent cells past the first mitotic division. This is considered part of the heritability of epigenetics.

Main Post 6: Is lupus very common in the United States? I’ve never met anyone else with the disease prior to my diagnosis.

Expert 3 Comment (Carlie): Lupus affects nearly 1.5 million people in the United States alone and the disease is much more prevalent in women. Selena Gomez is a famous individual with lupus.

<Insert Video>

https://youtu.be/ztrcUl-LcG4