Epigenetics and Breast Cancer

Speaker: Dr. Shuk-Mei Ho, Chair of the Department of Environmental Health, Director of the Center for Environmental Genetics, Director of the Microarray and Genomic Core, Associate Director of the Cincinnati Cancer Center, University of Cincinnati College of Medicine

Dr. Ho's presentation addressed the genetic and epigenetic factors involved with breast cancer risk and provided an update on the work her team at the Center for Environmental Genetics is doing.

Epigenetics and Genetics Background

While most of us think of DNA as the major factor that controls whether we get a disease and when we get it, researchers are becoming increasingly aware of the important role of epigenetics. Epigenetics, which means "outside" conventional genetics, controls when and which sets of genes are going to be turned on and off.

Epigenetics studies the changes, or marks, produced in the gene expression.
All of our genes, which together comprise our genotype, are not expressed or turned on. The genes that are expressed, our phenotype, are the traits that are observable. Our phenotype is like a birth certificate we can show people. We can also write on it. These marks can be caused by lifestyle choices and environmental factors. When these marks are added at critical periods of development such as puberty, they can turn us into a much more healthy person or a more susceptible individual.

The field of epigenetics shows how our environment and our choices can actually influence our genetic codes as well as our children's. Unlike genetic processes, which can take tens of thousands of years to make changes, epigenetic processes occur over a shorter time span, such as a single generation. These types of modifications can be passed on to our children as well as the next generations, but they do not change our DNA codes. Therefore, if someone makes a positive change, the negative epigenetics marks may be erased and a person may be able to revert back to a healthier life.

Grant Update

The initial work Dr. Ho's team undertook was an animal experiment to look at the relationship between epigenetic changes that occur due to consuming a high fat diet at a young age and the possible link to risk of breast cancer in adult life. In the experiment rats were feed different diets – a controlled diet, a normal diet and a high fat diet, which included olive oil, butter, and safflower oil. At day 50 the rats were given a DNA-damaging agent so that the rats would develop a tumor. The researchers were interested in seeing what would happen at day 100 in terms of growth in breast cancer cells. The results showed that the breast tissue of the rats on the control diet multiplied very little; the breast tissue of the rats on the high fat diet multiplied at a much higher rate.

As a part of the new Windows of Susceptibility grant Dr. Ho and her team received this year, the team will examine the effects of a high fat diet in the womb. Pregnant rats will be fed one of four diets: a control diet, a diet high in olive oil, a diet high in butter or a diet high in safflower oil. Once the pups are born, the ones that are the offspring of the rats eating the high fat diets will be weaned off those diets and they will eat the control diet. Preliminary data show that continuous exposure to high fat diets do increase breast cell multiplication and the diet causes changes in gene expression changes as early as Day 21 in the rats.

The team hopes to look at second, third and fourth generations in their lab experiments in order to identify the relationships between agents that cause gene expression changes like a high fat diet and bisphenol A, a chemical compound commonly found in consumer goods such as plastic bottles, and to identify markers.

Conclusion

Epigenetic marks can very permanent; they may last a lifetime and may be passed on from parents. They are also reversible, so getting this information out to the public is important .