

Ella & Olivia's Story

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Paul has adopted Asian identical twin daughters; Ella and Olivia from his first marriage to an African-Canadian woman. The girls were 5 years old when they divorced. Since that time, Paul has seen the girls sporadically. Ella is in her first year of university, away from home. She is on the bus heading to her mom's to spend Thanksgiving and reading week with her Mom and sister. She is planning on a quick visit with her Dad and his new family while she is home.

Ella and Olivia used to have so much fun together, but things had changed recently. Ella was worried about Olivia and the serious health troubles she had been having for over a year and a half. Ella can't help but wonder if these same troubles are heading her way?

The Diagnosis

Ella stared out the bus window as it travelled down the highway. She recalled last June when her mother shared the fateful news about Olivia. "Olivia has been diagnosed with schizophrenia", was what her mother had said.

She had known that something was wrong with her sister. Over a year ago, Ella had started to notice changes in Olivia's behaviour. Olivia had quit a job that she loved. She seemed withdrawn and unmotivated, and had also unexpectedly decided not to attend university despite Ella's and her mother's efforts to convince her otherwise. But Ella had left in the summer for university and had not seen the worst of Olivia's behaviours. Olivia had begun having hallucinations and could not seem to carry on a coherent conversation with her mother or sister.

Ella had done some research about schizophrenia after hearing of her sister's diagnosis. She did not like what she found out. Apparently, schizophrenia has a tendency to run in families. In fact, studies indicate that a sibling of a schizophrenic has a 10-times higher risk of developing schizophrenia over the general population. Ella began to worry about her own mental health. She decided to further investigate the disease during her reading week.

Just how "identical" are we?

Ella has been home from university for a couple of days and she is still preoccupied with Olivia's diagnosis and her own potential risk for mental illness. Ella expressed her anxiety and concerns to her mother one night after dinner. "Ella," her mother said, "your concerns are perfectly valid and you have every reason to want to get more information. Why don't we make an appointment to consult with a psychiatrist?" Ella made the appointment the next day.

Ella left Dr. Jacobson's office feeling that some of the weight had been lifted from her shoulders. On the car ride home, she thought about the things that Dr. Jacobson had said to her during their consultation.

"It was good of you to come in to see me, Ella. You are absolutely right to have concerns for yourself when your identical twin has been diagnosed with schizophrenia. Research shows that schizophrenia is almost 50% heritable, and since you share nearly identical DNA with your sister, that puts you at a higher risk for developing this disease as well."

"Fifty percent may sound like a scary number, but remember that schizophrenia is a very complex disease, and 50% of what causes schizophrenia is due to things other than your DNA."

"Like what? What else could be contributing to Olivia's schizophrenia that wouldn't necessarily affect me?" Ella asked.

Dr. Jacobson replied, "There are many, many environmental influences that seem to play a role in the development of this disease, such as increased stress and anxiety, or difficult relationships with other people. Interestingly, there is some groundbreaking research that is going on that suggests that the *environment* itself might even play a role at influencing one's DNA at the *molecular level*. It's a concept called *epigenetics*. An example of epigenetics in nature is the calico cat. Each calico cat has a unique orange and black fur colour pattern because of alterations, called epigenetic changes, which occur within the cells that produce coat colour during the cat's development. Research in the field of epigenetics suggests that individuals with schizophrenia appear to have some of these epigenetic changes to their DNA that are due to environmental influences, and that these alterations could be contributing to their development of mental illness."

"But wouldn't I also have these 'epigenetic alterations' in my DNA?" Ella asked.

"Not necessarily, because you and Olivia have not experienced completely identical environments throughout your lives. For example, you and Olivia have had different teachers and jobs throughout high school. And I also understand that you spent many childhood summers with a friend and her family out in the Rocky Mountains, while your sister was off at swim camps. If you are interested, I can give you some literature to read about this subject."

Ella was definitely interested. She took the articles and headed home.

What really is "epigenetics"?

Ella felt like she was back in school. The more she read about the topic of epigenetics, the more fascinated she became, and she found herself spending most of her days on the Internet doing research. Ella had learned about genetics in her general biology class and thought she had a pretty good idea of how the Laws of Mendel worked, but this whole field of epigenetics seemed to take the idea of inheritance to another level. She was particularly fascinated by an article that Dr. Jacobson had given her regarding epigenetic differences between identical twins. The article suggested that during one's lifetime epigenetic changes occur to one's DNA that can affect gene expression, and therefore whether or not one will express a certain trait. These epigenetic changes are influenced by one's environment and behaviors, so despite having identical DNA,

identical twins will not always have the same epigenetic changes, and therefore, will not always express the same traits.