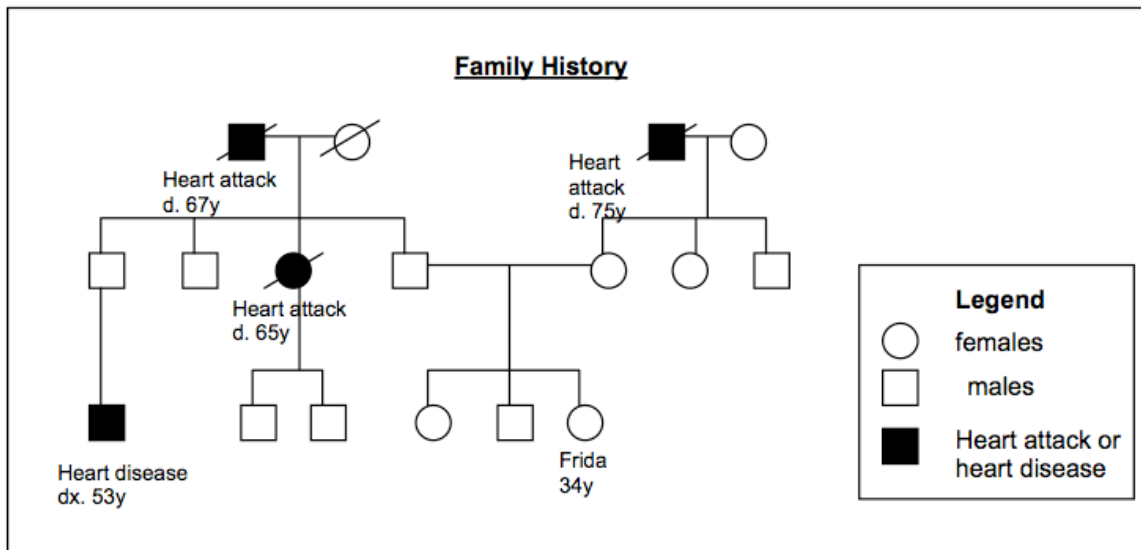


CASE: HEART DISEASE

Frida, 34 years old, has always led a healthy lifestyle by playing soccer and eating healthy foods. Frida noticed that many family members have coronary heart disease and have suffered heart attacks (diagrammed below). She always thought this must be because her family has traditionally eaten a diet full of fried foods and aren't very athletically inclined. A news program recently claimed "It may not be the lifestyle you lead but the genes that you're born with that determine if you'll get heart disease". This worried Frida – is she destined for heart disease because of her genetics, or will her healthy lifestyle offer some protection?



Multifactorial Inheritance

Many common, long-term (chronic) diseases that show up later in life are thought to be inherited in a multifactorial way. This includes conditions such as diabetes, high blood pressure (hypertension), Alzheimer's and heart disease. A person's height and weight are other examples of traits that are inherited in a multifactorial pattern.

Unlike dominant, recessive and x-linked conditions that are caused by a mutation in a single gene, multifactorial conditions are thought to result from a combination of many genes *and* many environmental factors that must reach a threshold level for the condition to occur.

Take a bucket of water for example. If some people start off with their bucket almost full of water, then they will only need to add a small amount of water for the bucket to overflow. This would be like a person born with many genetic alterations that on their own do not cause disease but if exposed to just enough negative environmental factors would cause the condition to develop (the bucket would overflow). Similarly, if a person starts off with a small amount of water in their bucket (i.e. few negative genetic factors), they would have to fill the bucket up with a lot of water (many environmental exposures) for the bucket to overflow.



QUESTIONS

1) Why are each of the following inheritance patterns NOT a good fit for the heart disease in this family? Dominant, Recessive and X-linked.

2) Why are so many people affected with heart disease in Frida's family?

3) Will Frida definitely develop heart disease?

Frida's friend Wilma is also concerned about her risk of developing heart disease. Wilma leads a healthy lifestyle and does not have a family history of heart disease.

4) Who most likely has the greater chance of developing heart disease – Frida or Wilma? Why?

5) Is it possible for Wilma to develop heart disease?

Consider the four sibling types below when answering questions 6&7. Assume each pair of siblings are being raised in the same house together.

- Identical twins (who share 100% of their DNA)
- Fraternal twins (who share 50% of their DNA)
- Regular full siblings (who share 50% of their DNA)
- Step siblings (who do not share DNA)

6) Which type of siblings are most likely to both be affected with the same multifactorial condition? Why?

7) Which type of siblings would you least expect to both be affected with the same multifactorial condition?