

Probing Question: Do sisters share a closer genetic proximity than other siblings?

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If '70s pop star Marie Osmond had a sister, would she have been closer to her than her six singing brothers are to each other? While Osmond may have had more in common with a fictional sister in the makeup and hairstyle department, their genetic proximity would be the same as the bond the famous brothers share with each other.

Sisters, said Ken Weiss, Evan Pugh professor of anthropology and genetics at Penn State, are no more genetically similar than brothers, although same-sex sibling sets are closer than brother and sister sets.

Weiss offered a lesson in basic biology: Get a piece of paper and a pen. Draw a circle for the mother and a square for the father. Populate the circle with "XX" for the female sex chromosome and the square with "XY" for the male chromosome. Draw two more circles under the symbols for the parents to represent two sisters.

"The two daughters below them are going to inherit an X from their mother, one or the other. Each one gets an independent choice," said Weiss. "But if they're daughters, they have to be XX, which means they must both inherit the same X from their father, since he only has one to give them. Everything else is scrambled equally between the two sisters from the two parents. They have one X that they share, and one X that they may or may not share, depending on the luck of the draw from the mother."

Now, if you were to draw two squares for brothers under the parents,

you would pull one or the other X from the mother and the Y from the father, because to be a son you must be XY and the Y can only come from Dad.

Humans have 46 chromosomes, inheriting 22 non-sex chromosomes, and one sex chromosome, from each parent. What they inherit from the other chromosomes is similar regardless of sex, which overall makes the child 50 percent related to each other and to each parent. In this sense, Weiss said, "Two brothers are as equally close to each other as two sisters. A brother and a sister are not as closely related as two brothers or two sisters. They're a bit more distantly related." This is because one will have an X and the other a Y from their father, whereas two brothers must share the same Y, and two sisters the same X, from him.

Fraternal twins bear the same genetic similarity to each other as do a regular brother and sister, although Weiss said the fact that they gestated together may provide further commonalities. Identical twins, of course, swim in exactly the same gene pool and are the most closely related people on the planet, unless, said Weiss, we one day are able to clone ourselves. Clones, also, would carry carbon-copy genes.

Source: By Gigi Marino, Research Penn State

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