Dear Alice,

My husband and I both have brown eyes but our new baby has blue eyes. How come?

Answer

Dear Reader,

Before your husband starts eyeing the milkman suspiciously, it may be helpful to know that most babies are born with blue eyes, regardless of the eye colors of their parents. The iris (the eye structure that surrounds the pupil) gets its pigment from melanin, which is the same pigment that produces skin and hair color. In the early stages of life, newborns haven’t yet begun to make melanin. This means as their bodies start producing more, the eye color may change. Similar to skin tone, the more melanin that’s present, the darker the eye color. Furthermore, eye color isn’t a simple genetic trait, but rather is determined by several genes that may come in different variations. Therefore, it’s entirely possible for two brown-eyed parents to have a blue-eyed child and vice versa.

Now, to take a dive into the specifics: as a physical trait, eye color ranges from a very light blue (almost grey) to dark brown (almost black) depending on the concentrations of melanin found in the front layers of the iris. It was previously thought that a single gene pair following dominant and recessive inheritance patterns was responsible for eye color. Based on that assumption, it wouldn’t be possible for parents with blue eyes to have a child with brown eyes. However, this does happen. Therefore, subsequent studies disproved this model showing that it was too simplistic, and that two or more genes are likely responsible for eye color, making it a polygenic trait.

Given that eye color is a direct result of the amount of melanin in the iris, it makes sense that most of the genes involved are related to the production, transport, or storage of melanin. Two genes that play a major role in determining eye color are OCA2 and HERC2, which are both located on chromosome 15. Without getting too technical, OCA2 encodes the sequence necessary to produce the P protein, which plays a key role in the production and storage of melanin. The less active or functional the OCA2 gene is, the less P protein your body produces, which means there’s less melanin in the iris, resulting in an eye color that’s closer to blue than
brown. HERC2 comes into play by regulating the activity of OCA2 in either direction depending on the sequence of DNA inherited from your parents. HERC2 can either increase OCA2 expression, leading to browner eyes, or decrease OCA2 expression, leading to bluer eyes. To complicate this even more, over 16 other genes are involved in eye color, affecting factors such as hue and saturation (intensity of color). This highlights two key points when it comes to eye color: first, the mechanisms behind eye color aren’t very well understood. Second, looking at the parent’s eye color or following a simple genetic inheritance pattern can’t always predict the color of a newborn’s eyes.

In closing, your child’s eye color may change over the next few months as more melanin is produced or they may remain a blue-eyed baby. Either way, rest assured that you and your husband’s brown eyes can produce a blue-eyed baby. As much as is understood about the incredibly complex workings of the human body, there are some details that remain elusively beyond 20/20 vision.

Alice!
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