Hi Alice,

Why are some people born blond but turn brunette as they get older?

Answer

Human bodies go through a number of changes as people get older, and a shift in natural hair color is often one of them! Hair color is determined by melanin, or specialized pigment cells positioned at the skin's surface where the hair grows. A variety of factors — including genetics, age, and chemical exposure — influence what kind of melanin the body produces, and thus, the color of a person's hair. And while the amount, distribution, and type of melanin the body produces explains how everyone gets their unique hair color, scientists believe that genes are responsible for the natural changes in hair color people often experience during childhood (such as blond to brunette). Researchers suspect that the change in hair color may be related to puberty. Read on for more about melanin, the gene that controls its production, and how both influence hair color!

As mentioned, pigment cells called melanin (which are made up of specialized cells called melanocytes) determine a person’s hair color. There are two types of melanin: eumelanin and pheomelanin. While eumelanin contributes to black, brown, or blond hair, pheomelanin leads to red hair — and any combination of the two creates a unique shade. A variety of factors contribute to the combination of melanin any person has, such as genes, hormones, and age. Researchers are particularly interested in which genes control hair color and how exactly they do it. As it turns out, many genes likely contribute to the type and amount of melanin in hair, although little is known about most of them.

That being said, the most understood hair color gene in humans is known as MC1R. This gene provides instructions to a person’s body explaining how to make a protein called the melanocortin 1 receptor, which controls which type of melanin (eumelanin or pheomelanin) is produced by melanocytes. Put simply, the MC1R gene instructs the body to make a protein (melanocortin 1 receptor); this protein controls which kinds of melanin are produced, leading to a person’s unique hair color. Here’s where things get "hairy:" the production of melanin depends on whether the
MC1R gene is active or inactive in any given cell. Each cell expresses, or "turns on" only a fraction of its genes, and the rest of the genes are repressed, or turned off — this is a process called gene regulation. When the melanocortin 1 receptor is turned on, it triggers a series of chemical reactions inside melanocytes that stimulate these cells to make eumelanin (dark pigment). When the receptor is turned off, melanocytes make pheomelanin (light pigment). In addition to the MC1R gene, a number of other genes can affect hair color and how much melanin is produced, but the exact roles they play in affecting the color is unclear.

If you're wondering why some genes turn on and others off, you're not alone — scientists are wondering this, too! What they do know is that gene regulation is a typical and critical part of a person's development. It can occur at any point during gene expression, most commonly when signals from the environment or from other cells activate proteins called transcription factors. These proteins bind to the gene and increase or decrease whether or not the gene is copied into other cells, which is a process called transcription. By controlling the level of transcription, this process can determine the amount of protein product a gene makes at any given time. And thus, hair color may change! This may be why some people with light hair have darker hair when they get older; the genes that produced lighter hair may have been "turned on," or activated, which produces more eumelanin, making hair darker.

"Hairs" to learning more about what makes each person unique!

Alice!
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