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Modern life may cause sun exposure, skin pigmentation mismatch

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As people move more often and become more urbanized, skin color—an adaptation that took hundreds of thousands of years to develop in humans—may lose some of its evolutionary advantage, according to a Penn State anthropologist.

About 2 million years ago, permanent dark skin color imparted by the pigment—melanin—began to evolve in humans to regulate the body's reaction to ultraviolet rays from the sun, said Nina Jablonski, Distinguished Professor of Anthropology.

Melanin helped humans maintain the delicate balance between too much sunlight and not enough sunlight. The pigment allowed enough ultraviolet radiation to produce vitamin D, a vitamin that helps the body absorb calcium, while protecting the skin from the intense ultraviolet radiation in the equator. Too much sunlight can cause the destruction of folate, which is also critical to cell division.

As some humans moved away from the equator to places where the sun's rays are not nearly as intense, they lost pigmentation, said Jablonski, who reports on her research at the annual meeting of the American Association for the Advancement of Science in Boston.

Unlike their ancestors, modern humans are more mobile. A person with darker skin may move to regions with less intense sunlight, and those with less pigmentation may move to areas that are closer to the equator.

"We move around a lot now," said Jablonski. "People can move across 90 degrees of latitude in a single day whereas early humans generally only went a few kilometers in the same time."

In addition to moving regularly, most people now live in cities with limited exposure to the sun. Nearly 60 percent of the people in the world live in cities now, said Jablonski.

Most people who live in cities also work indoors, further reducing their ability to make enough vitamin D in their skin.

"Think about a farmer who lived in northern England and worked outside," said Jablonski. "In the past, that farmer had the right amount of light pigmentation to make it possible for him to produce enough vitamin D in his skin in the summer to satisfy most of his yearly needs."

However, Jablonski said a typical worker who lives in England today is rarely exposed to that amount of sun, Jablonski said.

"Now, a person in England is not getting very much sun at all, except maybe when he travels to Spain on vacation for a few weeks," the researcher said.

Health problems are compounded when people do not receive enough sunlight, or when they have a mismatch between their skin pigmentation and ultraviolet radiation. "This can lead to a vitamin D catastrophe for many people," Jablonski said.

Jablonski said that there are ways to increase vitamin D without increasing the risk of skin cancer through exposure to the sun. "By far, the safest way and the cheapest way is to use vitamin D supplements, which are widely available in stores," said Jablonski.

In earlier studies, researchers found that early humans had pinkish skin that was covered with black fur, much like today's chimpanzees. The fur acted as a sunscreen. However, following the loss of body hair—which helped the early humans stay active without overheating—permanent dark pigmentation became a crucial evolutionary tool to manage exposure to ultraviolet rays, according to Jablonski.

By studying patterns of pigmentation and the amount of ultraviolet rays, Jablonski found that skin color was an example of natural selection at work to protect the skin from the sun.

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