

Colored sunscreen protects skin from damage caused by visible light

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Study performed at one of FAPESP's research centers elucidates action mechanism of visible light on skin and questions typical use of sunscreen .
Credit: Wikimedia

Despite rising worldwide use of sunscreens, the number of cases of skin cancer continues to grow. One of the reasons may be the action of visible light, which is also harmful to skin and is not blocked by conventional sunscreens.

This is the conclusion drawn by a team at the Center for Research on Redox Processes in Biomedicine. In an article published in the *Journal of Investigative Dermatology*, the researchers describe the combined damaging effects of long-wavelength ultraviolet radiation (UVA) and [visible light](#) on the cells that produce keratin.

"We knew visible [light](#) could damage the skin, but we've gained a deeper understanding of the mechanisms by showing that UVA stimulates accumulation of a pigment called lipofuscin, which later acts as a photosensitizer to visible light in the epidermis," said Maurício Baptista, a professor at the University of São Paulo's Chemistry Institute (IQ-USP) in Brazil.

"Basically, UVA damages the skin, and visible light augments the damage," he said.

A physical barrier such as cloth or apparel, or else a colored sunscreen, is needed to protect the skin from the adverse effects of visible light. "A colored sunscreen shouldn't be just any color," Baptista said. "It should be the same hue as the individual's own skin tone. We've developed a product that protects the skin against UVA, UVB and visible light. It uses nanoparticles coated with a fine film of melanin."

Baptista highlights misconceptions about UV protection. "Vitamin D levels are steadily falling in the Brazilian population because we hardly expose ourselves to the sun at all without sunscreen. However, we don't avoid visible light, which also damages the epidermis and isn't blocked by sunscreen."

The mechanism by which visible light and UVA damage the skin is the same. Both act on the cells of the epidermis by means of photoexcitation.

UVA radiation penetrates deeper into the epidermis and causes another kind of damage, which is perceptible in the long run. "We believe the types of skin cancer characterized by exposure to UVA must also be due in large measure to the action of visible light, which has never been taken into account," Baptista said. "UVA and visible light cause similar lesions. They act together. Both the oxidative damage done by UVA and the effect of visible light cause DNA oxidation."

This is completely different from the way UVB (shortwave ultraviolet) damages the skin. UVB radiation is directly absorbed by epidermal cell DNA. The response is much faster, consisting initially of redness for people who produce less melanin, and the skin is more severely damaged. Infrared radiation heats the blood vessels and causes inflammation.

Protection against UVB is also essential. "It would be quite wrong to interpret the study as saying we don't need to use [sunscreen](#). That's not the point at all. UVB is far more toxic than UVA and visible light, but the number of cases of severe [skin cancer](#) is rising largely because people have been protecting themselves from UVB for at least 40 years, yet for a long time, there were no products to block UVA. There aren't any visible light blockers even now," he said.

Damage to keratinocytes

In a 2014 study, the team focused on finding out how melanocytes, cells that produce melanin, respond to visible light. The new study goes further by analyzing how keratinocytes, which correspond to most epidermal cells, are damaged by visible light.

According to Baptista, keratinocytes are the first victims of the damage done by UVA, which makes these cells produce lipofuscin, which acts as a visible light photosensitizer, generating reactive oxygen species and

mediating light-induced damage. "We found that not just melanocytes but also keratinocytes are damaged by visible light," he said.

Visible light has fewer damaging effects on the skin than other kinds of solar radiation, but the response in the epidermis is augmented when the skin is no longer healthy owing to [damage](#) by UVA. Moreover, visible light accounts for 45 percent of the solar radiation that reaches the [skin](#), while UV accounts for only 5percent.

More information: Paulo Newton Tonolli et al, Lipofuscin Generated by UVA Turns Keratinocytes Photosensitive to Visible Light, *Journal of Investigative Dermatology* (2017). [DOI: 10.1016/j.jid.2017.06.018](https://doi.org/10.1016/j.jid.2017.06.018)

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