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Team discovers that skin color affects skin sensitivity to heat, mechanical stimuli

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Researchers at the Bluestone Center for Clinical Research at the New York University College of Dentistry (NYU Dentistry) have identified a novel molecular mechanism which explains why dark-skinned and light-skinned people respond differently to heat and mechanical stimulation.

In a study published in *Scientific Reports* online on August 23, 2017, the investigators demonstrate that dopamine, a small molecule produced by skin melanocytes (cells that determine skin color), contributes to differences in the skin's responsiveness to heat and mechanical stimuli. The study was led by Brian L. Schmidt, DDS, MD, PhD, director of the Bluestone Center and professor of oral and maxillofacial surgery at NYU Dentistry.

Dr. Schmidt explained how his group made the discovery. "Dr. Kentaro Ono, a visiting research scientist in my laboratory and the lead author, used publically available data to compare mechanical and heat pain sensitivity in groups of people who differed in their skin color. We sought out additional publically available data; however, this time we looked at pigmented and unpigmented rodents based on fur color. We were encouraged by our findings. We knew we had to continue to work in the laboratory to look for the mechanism that would explain why skin sensitivity would depend on color."

The group's meta-analysis in rodents, and comparison of genomic differences between mouse strains, pointed to a gene called Tyr, which controls pigmentation and dopamine synthesis in the skin. They

manipulated dopamine levels in the skin and found that dopamine causes increased expression of TRPV1 and decreased expression of Piezo2, two proteins that are responsible for heat and mechanical sensitivity, respectively.

Study coauthor Yi Ye, PhD, associate director of clinical research operations at the Bluestone Center and assistant professor of oral and maxillofacial surgery at NYU Dentistry, said: "Our skin is a sensory organ that gives us information about our environment, such as temperature and pressure. Excessive heat or pressure produces a pain signal that warns us about the dangerous input. Our environmental condition can change our skin's sensitivity to environmental stimuli under selective pressure."

She added, "Our study shows that people from different ethnic backgrounds sense temperature and pressure differently. For example, sun exposure in people who live close to the equator leads to melanin build-up, which protects them from UV damage, but also makes skin darker. The same skin cell (melanocytes) that produces melanin releases dopamine, which will increase skin's sensitivity to heat. This finding potentially means that in order to adapt to extreme weather conditions like those in the equator, this skin cell has developed a protective mechanism that warns people away from excessive sun exposure."

Dr. Schmidt speculates that differential mechanical and heat sensitivity might have implications for the clinical treatment of pain. "We know that individuals report different levels of pain following the same dental procedure or surgery. Similarly, there are differences across groups reporting pain relief once they have taken the same analgesic medication. Potentially, skin pigmentation contributes to these differences and might provide an approach for more targeted and personalized pain treatment."