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DIVERSITY OF HUMAN SKIN BACTERIA REVEALED

First large-scale skin microbes inventory charts types, locales of bacteria

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PHILADELPHIA — Most people think of rain forests as hot spots for biological diversity, but new research suggests that belly buttons are also rich ecosystems. That's one finding from the first attempt to take a large-scale inventory of microbes on human skin.

In recent years scientists have come to appreciate that people are super organisms, composed not just of human tissue, but also of microbes galore. Human skin is covered by a wide variety of bacteria, viruses, fungi and mites, says Elizabeth Grice, a genomics researcher at the National Human Genome Research Institute in Bethesda, Md. Most of the time, people and their microbes live in harmony, but people with skin conditions such as eczema often also struggle with skin infections.

"The skin is two square meters of ecosystem," Grice said November 13 in Philadelphia at a meeting of the American Society of Human Genetics.

Grice presented work she and her colleagues have done to catalog the diversity of bacteria living on human skin. The findings could help doctors and scientists better understand why some people develop skin conditions such as eczema and psoriasis while other people with similar genetic backgrounds do not.

"We know there is a genetic component" to eczema, says Kimberly Chapman, a clinical geneticist at the Children's Hospital of Philadelphia who was not involved in the research. Some people with eczema have a defect in filaggrin, a protein that helps form the skin's protective barrier. But not everyone who has filaggrin variations associated with eczema will get the skin condition. The new inventory of bacteria could help researchers determine whether people with eczema have an unbalanced immune response to bacteria living on their skin, says Chapman.

In the new study, dermatologists collected skin scrapings from 21 places on the bodies of 10 healthy volunteers. The participants were asked to wash only with Dove soap for a week, because the soap is mild and doesn't contain antibacterial chemicals. For 24 hours before the samples were collected the volunteers weren't allowed to shower or wash their hands.

Grice and her colleagues examined genetic diversity in the 16S ribosomal RNA gene in bacteria in the samples. The gene encodes an RNA used in the protein-building machinery in bacterial cells. Some parts of the gene contain many variations that scientists can use to distinguish one type of bacteria from another. This technique has been used to sample bacteria living in a wide

variety of ecosystems, including oceans, human and mouse intestines, and even on shower curtains and toothbrushes.

Some parts of the body contain an abundance of bacterial species. Among the most diverse spots were the belly button, inner forearm, buttocks, the skin between the fingers and the gluteal crease (also known as the plumber's crack). Other body parts have a relative dearth of bacterial diversity. Among the skin's diversity, cold spots are the greasy spot just behind the ear, the crease on the side of the nose, the toe webs and the sternum.

In some spots on some volunteers the researchers found up to 300 different species of bacteria, Grice says. Other areas contained as few as three different types of bacteria. The amount of diversity varied greatly not only from body part to body part but also from person to person.

Oily spots tended to have an abundance of Propionibacteria, which can break down fatty acids in the oil for food. Corynebacteria, Staphylococcus and Propionibacteria were often found on moist skin, while dry skin, like the heel, had more Staphylococcus. There are many varieties of Staphylococcus bacteria present on the skin, not just *Staphylococcus aureus*, a type of bacteria often linked to skin infections.

The researchers plan to test the healthy volunteers again six months after collecting the first samples to see whether bacteria on the skin change over time. Grice and her colleagues are also recruiting volunteers with eczema to see if people with skin conditions have different types of bacteria on their skin.