

Good earth: Chemists show origin of soil-scented geosmin

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Brown University chemists have found the origins of an odor – the sweet smell of fresh dirt. In *Nature Chemical Biology*, the Brown team shows that the protein that makes geosmin – source of the good earth scent – has two similar but distinct halves, each playing a critical role in making this organic compound.

“Everyone is familiar with the wonderful smell of warm earth,” said David Cane, professor of chemistry at Brown who oversaw the research. “Now we know precisely how it is made.”

Geosmin, which literally translates to “earth smell,” was scientifically identified more than 100 years ago. In soil, bacteria produce the chemical compound. In water, blue-green algae make it. Along with the pleasant scent of warm, moist soil, geosmin is also responsible for the muddy “off” taste in some drinking water. That is why the substance is of interest to water purification experts and even vintners, who want to keep the benign but pungent substance out of their wine.

Until recently, scientists knew little about how geosmin is made. Then, a few years ago, Cane found the gene responsible for geosmin formation in *Streptomyces coelicolor*, a strain of plant-munching bacteria found in soil. Last year, the team discovered that a single protein converts farnesyl diphosphate to geosmin.

In their new work, Cane and his lab team found that this protein, called germacradienol/geosmin synthase, folds into two distinct but connected

parts, similar to a dumbbell. One piece is responsible for the first half of the reaction, cranking out a chemical that wafts over to the companion bit of protein, which then produces geosmin.

“We found that geosmin is created by this bifunctional enzyme,” Cane said. “The two steps of the process that forms geosmin are metabolically related. This finding was a real surprise. This is the first bifunctional enzyme found for this type of terpene, the class of chemicals geosmin belongs to.”

Jiaoyang Jiang, a Brown graduate student in the Department of Chemistry and lead author of the journal article, said microbiologists working in water purification plants will be most interested in knowing the origins of geosmin. By understanding precisely how the substance is synthesized, Jiang said, these experts may find a way to block it – avoiding the foul taste that keeps people away from the tap.

“Geosmin may smell good in the garden, but not in the glass,” she said.

Source: Brown University

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