

Bitter food but good medicine from cucumber genetics

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High-tech genomics and traditional Chinese medicine come together as researchers identify the genes responsible for the intense bitter taste of wild cucumbers. Taming this bitterness made cucumber, pumpkin and their relatives into popular foods, but the same compounds also have potential to treat cancer and diabetes.

"You don't eat wild cucumber, unless you want to use it as a purgative," said William Lucas, professor of plant biology at the University of California, Davis and coauthor on the paper to be published Nov. 28 in the journal *Science*.

That bitter flavor in wild cucurbits—the family that includes cucumber, pumpkin, melon, watermelon and squash—is due to compounds called cucurbitacins. The [bitter taste](#) protects wild plants against predators.

The fruit and leaves of wild cucurbits have been used in Indian and Chinese medicine for thousands of years, as emetics and purgatives and to treat liver disease. More recently, researchers have shown that cucurbitacins can kill or suppress growth of cancer cells.

Bitterness is known to be controlled by two genetic traits, "Bi" which confers [bitterness](#) on the whole plant and "Bt", which leads to bitter fruit. In the new

work, Lucas, Sanwen Huang at the Chinese Academy of Agricultural Sciences and colleagues employed the latest in DNA sequencing technology to identify the exact changes in DNA associated with bitterness.

They also tasted a great many cucumbers. "Luckily this is an easy trait to test for," Lucas said. "You just chomp on a cucumber leaf or fruit and your tongue gives you the readout!"

They were able to identify nine genes involved in making cucurbitacin, and show that the trait can be traced to two transcription factors that switch on these nine genes, in either leaves or the fruit, to produce cucurbitacin.

The new research shows how domestication tweaked [cucumber](#) genetics to make the [fruit](#) more edible. Understanding that process might open up approaches to developing other food crops based on plants that are naturally either inedible or poor in nutrition, Lucas said.

It could also make it much easier to produce cucurbitacins in large enough quantities to use in clinical trials and potentially in medicine, Lucas said. For example the anti-malarial drug artemisinin, originally derived from traditional Chinese medicine, is now being produced either as a precursor molecule in yeast or through synthetic biology systems.

More information: "Biosynthesis, regulation, and domestication of bitterness in cucumber," by Y. Shang et al. *Science*, www.sciencemag.org/lookup/doi/10.1126/science.1259215

Provided by UC Davis

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