The complicated biology of garlic

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Researchers today generally agree that eating garlic, used for thousands of years to treat human disease, can reduce the risk of developing certain kinds of cancers, cardiovascular disease, and type 2 diabetes. Nevertheless, in a review published April 26 in the journal *Trends in Pharmacological Sciences*, researchers in the UK argue that explaining

exactly how garlic affects human health—and getting consistent results during clinical trials—is more complex, because of the vast array of compounds garlic produces.

Garlic's unique flavor comes from sulfur compounds. Like other members of the allium family, the plant absorbs sulfate from the soil and incorporates it into amino acids and sulfur storage molecules. These sulfur storage molecules can then be broken down into approximately 50 different sulfur-containing compounds when the garlic is prepared and eaten. "These molecules give the plants an ecological advantage when they're growing out in the wild. As it happens, they're also biologically active within mammalian cells and tissues," says senior author Peter Rose, a biochemist at the University of Nottingham.

These compounds are well studied in garlic, and there is research to suggest that they are important in producing the health effects for which garlic is renowned. Understanding how they produce those effects is less clear, however, in part because how we prepare garlic affects which sulfur compounds we end up consuming. Chopping fresh garlic, fermenting garlic in alcohol, and pressing garlic for oil, for example, all yield different sulfur compounds. "Each of these preparative forms could have a different effect within mammalian systems. And that's what makes this research so complex, because we don't really understand how these compounds are metabolized in humans and it's very difficult to identify common mechanisms of action for these molecules," he says.

While there's no right or wrong way to prepare your garlic, this quirk of garlic's biochemistry could explain why studies of the plant's effects on humans have had such mixed results. "When it comes to human intervention studies, there's been quite a lot of disparity. Sometimes the consumption of and exposure to these compounds has biological effects, and other times, it does nothing. I think it needs reinvestigating, just because of the sheer complexity of the diversity of these sorts of

compounds and the different distribution of them between different garlic products," he says.

Rose and his colleagues are particularly interested in how these sulfur compounds might affect gaseous signaling molecules like nitric oxide and hydrogen sulfide, which are naturally produced by our bodies. Gaseous signaling molecules play an important role in cell communication and maintaining homeostasis, and altered levels of them are present in many diseases. Recent research in vitro has linked the kinds of sulfur compounds we get from garlic to increased production of these molecules, suggesting that this might be the common mechanism by which the different sulfur compounds affect the human body.

There's still a lot of research to be done, but Rose believes that someday we might be able to identify other plants that stimulate the production of these gases or modify garlic, onions, and other alliums to be more efficient at producing them once ingested. "There is a lot of possibility within this area for finding approaches that could reduce the risk of diseases and improve human health, but it all comes back to those fundamental questions of what actually happens to these compounds when we metabolize them. There's a whole spectrum of human work that still needs to be done to further explore some of these weird and wonderful sulfur compounds that we find within our diets," he says.

He also believes that it's important to remember that garlic isn't some kind of magic bullet. "I don't think there is one individual plant species that is a cure-all, but there are certainly plant species that are strongly associated with reducing disease risk within humans. Variety is the spice of life, but understanding the chemistry of some of your spices is probably a very advantageous thing to do."

More information: *Trends in Pharmacological Sciences*, Rose et al.: "Garlic and gaseous mediators" www.cell.com/trends/pharmacolo …

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