Could Honeybee Venom Lead to a Breast Cancer Drug?

The honeybee's sting contains a compound that kills hard-to-treat breast cancer cells quickly.

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Since ancient times, people in countries as far-flung as China, Russia, Egypt and Greece have incorporated honeybee body parts and venom into treatments for arthritis, rheumatism and a range of other ailments. Known as "apitherapy," the practice has frequently been written off as quackery.

But in a study that examined the effects of bee venom on breast cancer cell survival and proliferation, scientists at the Harry Perkins Institute of Medical Research in Western Australia identified a specific, quantifiable positive effect. There is a big difference between a lab result and an actual treatment, of course, but the new findings are of particular interest because they pertain to some of the most difficult-to-treat forms of breast cancer.

Breast cancer, the most common cause of cancer-related mortality in women worldwide, kills over 600,000 people annually. Not all types are created equal, however. Some, such as triple-negative breast cancer (TNBC) and HER2-enriched breast cancer—the focus of the Australian study—are particularly aggressive and account for a disproportionate number of breast cancer deaths. Others, such as luminal A breast cancer, are much more slow-growing.

The scientists collected venom from several populations of honeybees and bumblebees in Australia and the United Kingdom. In total, they collected venom from 312 individual bees. Back in the lab, they cultured the venom and injected small amounts into healthy cells as well as several different types of breast cancer cells, including TNBC cells, HER2-enriched breast cancer cells and luminal A breast cancer cells.

Honeybee venom, they found, far outperformed bumblebee venom at targeting, attacking and killing breast cancer cells, though the intensity of its effects varied between cell types. It was most active in the TNBC and HER2-enriched breast cancer cells, followed by the luminal A breast cancer cells, and least active in the normal cells. The results suggest it may be a powerful "anticancer agent," the scientists wrote in the journal Nature Precision Oncology.

Honeybee venom likely owes its anticancer properties to its major component, the molecule melittin, which bumblebee venom does not possess. The scientists found that melittin isolated

from honeybee venom had similar effects on breast cancer cell lines as honeybee venom itself: It induced apoptosis (cell death) in breast cancer cells within 60 minutes. It also shut down the signaling pathways that transmit the chemical messages that incite cell growth and division within 20 minutes. The bumblebee venom, meanwhile, had a negligible impact on breast cancer cell numbers even in high doses. The national origin of the venom did not appear to affect its potency.

Peter Klinken, the chief scientist of the Harry Perkins Institute, described the study results as "incredibly exciting" in an interview with the BBC last week. "Significantly, this study demonstrates how melittin interferes with signaling pathways within breast cancer cells to reduce cell replication," said Klinken. "It provides another wonderful example of where compounds in nature can be used to treat human diseases."

However, Ciara Duffy, PhD, the study's chief investigator, cautioned that it will be years, if not decades, before such a treatment becomes available. "There's a long way to go in terms of how we would deliver it in the body and, you know, looking at toxicities and maximum tolerated doses before it ever went further," she told ABC News.

Scientists began experimenting with using bee venom to shrink or kill tumors as far back as 1950. However, Duffy noted in a press release, it is only in the past 20 years that they have dedicated significant amounts of time, energy and money to researching honeybee venom's potential medical applications. This study was the first to assess the effects of honeybee venom on breast cancer cells of every type as well as normal cells.

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