How Maggots Heal Wounds

sciencemag.org/news/2012/12/how-maggots-heal-wounds

By Paul GabrielsenDec. 6, 2012 , 1:20 PM

Yes, maggots are creepy, crawly, and slimy. But that slime is a remarkable healing balm, used by battlefield surgeons for centuries to close wounds. Now, researchers say they've figured out how the fly larvae work their magic: They suppress our immune system.

Maggots are efficient consumers of dead tissue. They munch on rotting flesh, leaving healthy tissue practically unscathed. Physicians in Napoleon's army used the larvae to clean wounds. In World War I, American surgeon William Baer noticed that soldiers with maggot-infested gashes didn't have the expected infection or swelling seen in other patients. The rise of penicillin in the 1940s made clinical maggots less useful, but they bounced back in the 1990s when antibiotic-resistant bacteria created a new demand for alternative treatments. In 2004, the U.S. Food and Drug Administration approved maggot therapy as a prescription treatment.

Although anecdotal reports suggested that maggots curb inflammation, no one had scientifically tested the idea. So a team led by surgical resident Gwendolyn Cazander of Leiden University Medical Center in the Netherlands siphoned samples of maggot secretions from disinfected maggots in the lab and added them to donated blood samples from four healthy adults. The researchers then measured the levels of so-called complement proteins, which are involved in the body's inflammatory response.

Every blood sample treated with maggot secretions showed lower levels of complement proteins than did control samples—99.9% less in the best case, the team reports in the current

issue of *Wound Repair and Regeneration*. Looking closer, the researchers found the broken-down remnants of two complement proteins—C3 and C4—in the secretion-treated samples, suggesting that the secretions had ripped the proteins apart. When the team tested blood samples from postoperative patients, whose wounded bodies were already scrambling to heal, they found that maggot secretions reduced the levels of complement proteins by 19% to 55%.

For good measure, the team tested the maggot secretions again after a day, a week, and a month to determine their shelf life. They also boiled some. To their surprise, the secretions were more effective after boiling and lost no potency after sitting on the shelf for a month.

It's not surprising that maggot secretions would suppress the immune system, Cazander says. Otherwise, the larvae would probably be attacked by the body. She says she hasn't yet seen such a reaction, even in patients treated with maggots for more than a year.

Cazander's team is now working to isolate the complement-inhibiting compounds. A clinical drug featuring maggot secretions may be several years away—but if you can't wait, the maggots themselves are available now.

The research team's conclusions are spot-on, says Ronald Sherman, pathologist, pioneering maggot researcher, and board chair of the BioTherapeutics, Education and Research Foundation in Irvine, California. Sherman's nonprofit foundation connects patients with doctors willing to handle the crawly critters. Faster wound healing probably arises from several combined maggot effects, he says, such as increasing oxygen concentrations in the wound and enhancing cellular growth. "This research advances our understanding of how and why maggot therapy helps wounds heal faster."