The nose Knows how to Kill MRSA Bacteria from the Human Body Produce an Antibiotic That Seems to Kill Resistant Bacteria

Anna Nowogrodzki

The human nose is no longer just a source of gross globs of mucous. A new antibiotic was right under our noses — or rather, in them. Produced by a bacterium living in the human nose, the molecule kills the potentially deadly methicillin-resistant *Staphylococcus aureus* (MRSA) in mice and rats.

Staphylococcus aureus resides in the noses of 1 in 3 people without causing a problem. MRSA — an *S. aureus* strain resistant to many antibiotics — is found in 2 in 100. In a small percentage of cases, the bacterium escapes to the bloodstream, causing infection. MRSA kills 11,000 people annually in the United States alone.

The potential new soldier in the fight against MRSA is a molecule called lugdunin produced by the bacterium *Staphylococcus lugdunensis*, report Andreas Peschel and colleagues at the University of Tübingen, Germany, on 27 July in *Nature*.

In a sampling of 187 hospital patients, people whose noses naturally contained *S. lugdunensis* were six times less likely to have *S. aureus* than people whose noses lacked *S. lugdunensis*, Peschel's team found. This suggests that *S. lugdunensis* is able to combat the growth of the problematic bacterium. That means the antibiotic produced by the bacterium could be developed as a preventive — a nasal spray, for example — to keep *S. aureus* out of people's noses in the first place. About 9% of people naturally carry *S. lugdunensis*.

A new hope

The vast majority of antibiotics are small molecules that attack bacterial enzymes, the proteins that orchestrate chemical reactions inside the cell. The researchers found that lugdunin is unusual in that it's much larger, with a mode of action involving the cellular membrane that isn't fully understood. That novel *modus operandi* could be the reason why bacterial strains of *S. aureus* were unable to evolve resistance to the antibiotic in a 30 day test tube trial. "We never found spontaneous mutants," says Peschel.

John Powers, an infectious disease clinician at George Washington University in Washington DC, is hopeful that **lugdunin might eventually become a useful antiobitic for human use**. But he would like to see how the antibiotic works in humans, as the test tube trials Peschel's team conducted cannot predict whether antibiotic resistance will develop in people.

The human microbiome has so far yielded only a few antibiotics, such as lactocillin, which comes from a vaginal bacterium. Soil bacteria are the typical source for new antibiotics.

When Peschel and his team stumbled upon lugdunin, they weren't looking

for a new antibiotic. They were studying *S. aureus* in its natural environment, the human nose. "If you want to keep the bacteria in check, you need to understand their lifestyle," he says. "And to understand that, we also looked at its competitors." They screened 90 bacteria from the human nose, and found that **only *S. lugdunensis* killed MRSA**.

When Peschel's team **infected the skin of mice with *S. aureus*, lugdunin ointment killed the infection both on the surface and in deeper layers of the skin.** *S. lugdunensis* also reduced the amount of *S. aureus* when squirted into the noses of cotton rats (*Sigmodon hispidus*).

In addition to MRSA, **lugdunin killed *S. aureus* resistant to the antibiotic glycopeptide and vancomycin resistant *Enterococcus spp*.**

It's the first time researchers have been able to definitively connect the production of an antibiotic in a bacterium with the suppresssion of a competitor in a microbiome community, says Kim Lewis, a microbiologist at Northeastern University in Boston, Massachusetts. Lewis has coauthored a commentary accompanying this study.

"It was a bit surprising," he says. "We do not usually think of antibiotics as an important tool that bacteria can use in competition in the microbiome."

Peschel says they are currently talking to companies interested in **developing lugdunin as a drug for human use.**