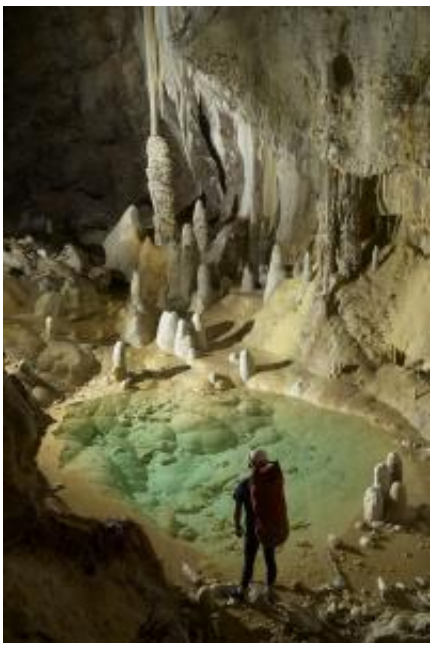
Researchers find antibiotic-resistant bacteria deep in one of the largest, unspoiled underground caves

April 11 2012



A researcher at 'Pearlsian Gulf'; background calcite formations Photo: (c) Max Wisshak

McMaster University and University of Akron researchers are leading the way in understanding the origins of antibiotic resistance, a global challenge that is creating a serious threat to the treatment of infectious diseases.

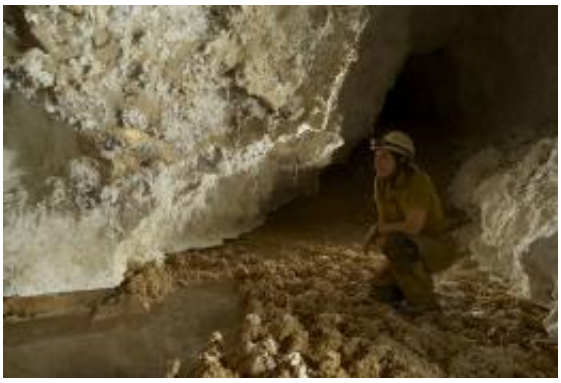
Gerry Wright, scientific director of the Michael G. DeGroote Institute for Infectious Disease Research (IIDR) at McMaster University, and Hazel Barton, associate professor of biology at the University of Akron, discovered a remarkable prevalence of antibiotic resistance bacteria isolated from Lechuguilla Cave in New Mexico, one of the deepest and largest caves in the world and a place isolated from human contact for more than four million years.

The research was published today in the Journal PLoS ONE.

"Our study shows that antibiotic resistance is hard-wired into bacteria, it could be billions of years old, but we have only been trying to understand it for the last 70 years," says Wright. "This has important clinical implications. It suggests that there are far more antibiotics in the environment that could be found and used to treat currently untreatable infections."

Amid the rare beauty of the Lechuguilla Cave, in Carlsbad Cavern National Park, researchers collected strains of bacteria from its deep and isolated recesses. They then examined these bacteria for antibiotic resistance. They found that while none of the bacteria are capable of causing human disease nor have they ever been exposed to human sources of antibiotics, almost all were resistant to at least one antibiotic, and some were resistant to as many as 14 different antibiotics. In all, resistance was found to virtually every antibiotic that doctors currently use to treat patients.

For instance, the researchers were able to identify a type of resistance that has yet to emerge in the clinic in a group of bacteria distantly related to the bacterium that causes anthrax.



A researcher looking at gypsum flowers in 'Lebarge Borehole' Photo: (c) Max Wisshak

Says Barton: "We can say to doctors, 'while this isn't a problem right now, it could be in the future so you need be aware of this pre-existing resistance and be prepared if it emerges in the clinic. Or you are going to have a problem'."

The development of antibiotic resistant bacteria is becoming an increasing health concern. With the emergence of bacteria, such as multi-drug resistant Staphylococcus and the global spread of resistance to all clinically used drugs, where and how these organisms acquire resistance is an important question, says Wright.

"Most practitioners believe that bacteria acquire antibiotic resistance in the clinic," he says. "As doctors prescribe antibiotics, they select for members of the community that are resistant to these drugs. Over time, these organisms spread and eventually the bacteria that commonly cause these infections are all resistant. In extreme cases these organisms are resistant to seven or more drugs and are untreatable using traditional treatment, and ¬ doctors must resort to surgery to remove infected tissue. The actual source of much of this resistance are harmless bacteria that live in the environment."

Because antibiotics are heavily prescribed and used in agriculture, it is difficult to find an environment where antibiotics do not exert some kind of influence, adds Barton, noting this is why Lechuguilla Cave was the perfect environment to look at the pre-existing reservoir of antibiotic resistance in nature. Discovered in 1986, access to the cave has been limited to a few expert cavers and researchers each year. It is also surrounded by an impermeable layer of rock, meaning infiltration of water into the cave can take up to 10,000 years to reach its deepest recesses, an age well beyond the discovery of antibiotics. The researchers sampled bacteria from so far deep into the cave that Barton and some other researchers involved in the study camped in the cave during the collection process.

Their findings support recent studies at McMaster that suggest antibiotic resistance has a long evolutionary past.

More information: dx.plos.org/10.1371/journal.pone.0034953

Provided by McMaster University