Lab Science: Using poop to cure gut infections

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If all disease begins in the gut, as Hippocrates declared more than 2,000 years ago, then surely the cures for those diseases must be tied to the gut, as well. That's the basic idea behind research at Los Alamos National Laboratory that aims to make fecal transplants a thing of the past. The gut – a.k.a. the gastrointestinal tract that starts at the mouth and ends at the anus – contains trillions of bacterial cells. A majority are good bacteria that reside in the nearly 30 feet of the large and small intestines. These good bacteria are responsible for a person's overall health.But sometimes a harmful bacterium called Clostridium difficile (C. diff) infects the gut, with symptoms that range from diarrhea to inflammation of the colon. Doctors typically treat the infection with antibiotics, but spores from C. diff often linger in the gut and re-infect the patient.If the infection occurs more than twice, doctors often recommend a fecal transplant: They transplant poop from a person with a healthy gut into the gut of the infected patient. Sounds crazy, but the idea is that the healthy bacteria in the transplanted poop will fight off the C. diff infection. The process works about 95 percent of the time.

Although fecal transplants are fairly routine, not all doctors can perform them and not all hospitals are equipped to handle them. Here in New Mexico, for example, only four physicians at the University of New Mexico Hospital can perform fecal transplants.On top of that, finding a good poop donor is challenging – typically, only three out of 100 people meet the donation requirements. Even so, donor samples aren't screened for all pathogens, so although the transplant might cure a C. diff infection, it might cause another type of infection. Or the transplant might carry a behavior or condition, such as diabetes or depression, from the donor to the recipient – that's how powerful gut bacteria are.But what if scientists could identify and isolate the bacteria in a fecal sample that inhibit C. diff and then put just those bacteria into a pill or drink? That's exactly what researchers at Los Alamos are doing – pulling together bacteria into a super-powerful cocktail that washes out the infection. The work exploits the Laboratory's extensive biological research efforts developed in support of its national security mission.Working with a syringe in an anaerobic glove box, scientists extract healthy gut bacteria from a donated fecal sample. They randomly place two to five gut bacteria together with C. diff pathogen in millions of microdroplets – essentially microscopic bubbles where the gut bacteria and pathogen can interact – and then identify the microdroplets where C. diff growth is suppressed. The gut bacteria in those microdroplets are then identified through sequencing and are mixed together into a cocktail that can be taken orally.Not only is the cocktail safer than a fecal transplant, but it's a heck of a lot more comfortable (no tubes through the nose or colon) and affordable (transplants, which costs thousands of dollars, typically aren't covered by insurance).Although the cocktail is not yet in clinical testing, the Los Alamos research team hopes that one day it will be available over the counter. Then, people can take it as a precaution against C. diff or to treat an existing infection. Another precaution is a healthy diet full of colorful vegetables and unprocessed foods – Hippocrates would surely agree.

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