

Raw sewage: Home to millions of undescribed viruses

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Biologists have described only a few thousand different viruses so far, but a new study reveals a vast world of unseen viral diversity that exists right under our noses. A paper to be published Tuesday, October 4 in the online journal *mBio* explores ordinary raw sewage and finds that it is home to thousands of novel, undiscovered viruses, some of which could relate to human health.

Viruses are everywhere: every moment of every day, humans are exposed to viruses on surfaces, in foods, and in water. However, our knowledge of the viral universe is limited to a tiny fraction of the viruses that likely exist. There are roughly 1.8 million species of organisms on planet Earth, and each one is host to untold numbers of unique viruses, but only about 3,000 have been identified to date.

To explore this diversity and to better gauge the numbers of unknown viruses that are out there, researchers looked for the genetic signatures of viruses present in [raw sewage](#) from North America, Europe, and Africa.

They detected signatures from 234 known viruses that represent 26 different "families", or types, of viruses. This makes raw sewage home to the most diverse array of viruses ever found.

Known viruses included [human pathogens](#) like [Human papillomavirus](#) and [norovirus](#), which causes stomach flu. Also present were several viruses belonging to those familiar denizens of sewers everywhere:

rodents and [cockroaches](#). Bacteria are also present in sewage, so it was not surprising that the viruses that prey on bacteria dominated the known genetic signatures. Finally, a large number of the known viruses found in raw sewage came from plants, probably owing to the fact that humans eat plants and plant viruses outnumber other types of viruses in human stool.

Raw sewage contains more mysteries than answers, however: the vast majority of viral genetic signatures belong to unknown viruses. This fact is significant, says the study's editor, Michael Imperiale of the University of Michigan. Unknown viruses like those found in sewage probably play many roles in human health and environmental processes that we simply do not appreciate yet, he says.

Of the unknown sewage viruses that come from humans, some of them may be opportunists that lie in wait for the human host's immune system to break down and provide an opening, he says.

Other viruses may be benign or even helpful. "There's a theory out there that we may be infected with viruses that don't cause any disease and may have beneficial effects," says Imperiale. There are examples of animal viruses that bear this out, he says, including a herpes virus in mice that makes them somewhat resistant to bacterial infections.

The study's authors plan to follow up their examination of sewage viruses with studies of other environments around the world where viruses are likely to thrive.

Michael Imperiale expects more discoveries to come. "I think this is going to be the tip of the iceberg of how many [viruses](#) are out there," he says. "I think the ocean is going to top raw sewage by orders of magnitude," although they won't be found in such densities as they are in sewage, he concedes.

More information: mbio.asm.org/

Provided by American Society for Microbiology

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