INL News Release
November 12, 2007

Media Contact: Rachel Courtland, (208) 526-4595

FOR IMMEDIATE RELEASE

Yellowstone viruses 'jump' between hot pools

A population study of microbes in Yellowstone National Park hot pools suggests viruses might be buoyed by steam to distant pools. The result, to be published online next week in the Proceedings of the National Academy of Sciences, could help to answer some fundamental questions about how microbes, and the viruses that infect them, impact their environment.

Researchers at Montana State University and Idaho National Laboratory embarked on one of the first comprehensive, long-term characterizations of hot pool ecosystems in Yellowstone National Park. The results help shed light on how viruses survive in hostile surroundings, migrate from pool to pool, and may help control hot pool environments.

A big question for biologists is how much microbes and their predators contribute to creating the acidic, mineral-heavy environment in geothermal features. In the laboratory, microbes like sulfur-eating Sulfolobus, which is found in hot pools around the world, will lower the acidity of the surrounding water to their comfort level. Viruses that infect hot pool microbes may have a similar effect on their environment by keeping certain populations in check.

To investigate the impact of viruses on their ecosystems, researchers at the Montana State University Thermal Biology Institute, with the help of Idaho National Laboratory, sampled three distinct Yellowstone hot pools over the course of two years. Initially, the team looked for a relationship between pool conditions and microbe population. But while the populations of different viruses fluctuated wildly, pool conditions stayed the same. Instead, the researchers found something surprising - changes in Sulfolobus virus populations suggested the viruses were migrating from pool to pool. The researchers set out to determine how migration to pools miles away might occur. Since subterranean water temperatures are so high, underground migration seemed unlikely. Following a hunch, the researchers found viruses in the air column above pools, suggesting the viruses might be buoyed from pool to pool in droplets of steam.

Strangely, viruses thrived in pools even if their chosen hosts were relatively rare. Sulfolobus viruses are not hearty. Most survive only a few hours in the acidic water outside a host. If Sulfolobus is a common microbe in a hot pool, a virus' next victim might be too far away to reach. Still, the study suggests the viruses are successful in infecting microbes, even if new hosts are rare and separated by hostile waters. The viruses might also be capable of infecting a wider range of microbes than researchers now know. "It's really a mystery how these viruses could have evolved if they can't survive in hot pools by themselves," says Idaho National Laboratory microbiologist Frank Roberto, who sequenced and analyzed the virus DNA. "To reproduce, these viruses need to leave their hosts. Then they're entering a really hostile environment."

Learning how viruses interact with their thermoacidophilic hosts may become increasingly important as microbes are adapted for a number of large-scale energy applications, from cleaning coal plant smokestacks to processing cellulose for ethanol.

A greater understanding of the significance of viruses in Yellowstone thermal features is still on the horizon, Roberto says. "We're in uncharted territory in terms of understanding how these viruses impact the ecosystem of these pools," he says. When viruses leave their hosts, they sometimes carry bits of host DNA with them. Roberto speculates Yellowstone viruses may transport genetic information from one pool to another, impacting the evolution of microbes across the park.

For more information:
http://www.inl.gov/featurestories/2007-10-23.shtml
http://tbi.montana.edu/

-INL-07-028-

News Release Archive