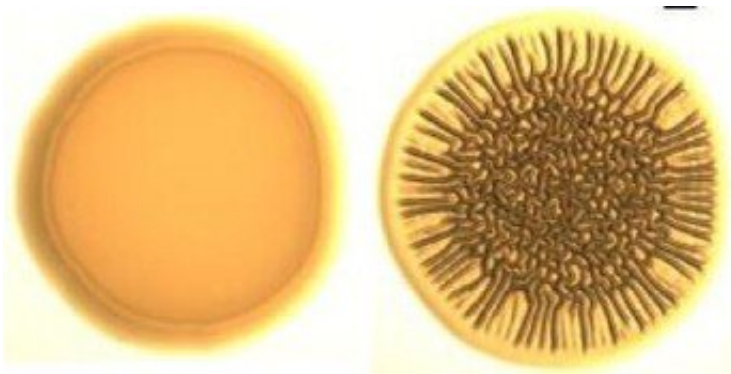


Secret to how cholera adapts to temperature revealed

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This image shows a smooth colony of *Vibrio cholerae* (left) next to a rough colony formed at 37C (right). Credit: Santos et al. CC BY 4.0

Scientists have discovered an essential protein in cholera-causing bacteria that allows them to adapt to changes in temperature, according to a study published today in *eLife*.

The protein, BipA, is conserved across [bacterial species](#), which suggests it could hold the key to how other types of bacteria change their biology and growth to survive at suboptimal temperatures.

Vibrio [cholerae](#) (*V. cholerae*) is the bacteria responsible for the severe diarrhoeal disease cholera. As with other species, *V. cholerae* forms biofilms—communities of bacteria enclosed in a structure made up of sugars and proteins—to protect against predators and stress conditions.

V. cholerae forms these biofilms both in their aquatic environment and in the human intestine. There is evidence to suggest that [biofilm](#) formation is crucial to *V. cholerae*'s ability to colonize in the intestine and might enhance its infectivity.

"*V. cholerae* experiences a wide range of temperatures, and adapting to them is not only important for survival in the environment but also for the infection process," explains lead author Teresa del Peso Santos, a postdoctoral researcher at the Laboratory for Molecular Infection Medicine Sweden (MIMS), Umeå University, Sweden. "We know that at 37 degrees Celsius, *V. cholerae* grows as rough colonies that form a biofilm. However, at [lower temperatures](#) these colonies are completely smooth. We wanted to understand how it does this."

The researchers screened the microbes for genes known to be linked with biofilm formation. They found a marked increase in the expression of biofilm-related genes in colonies grown at 37C compared with 22C.

To find out how these biofilm genes are controlled at lower temperatures, they generated random mutations in *V. cholerae* and then identified which mutants developed rough instead of smooth colonies at 22C. They then isolated the colonies to determine which genes are essential for switching off biofilm genes at low temperatures.

The most common gene they found is associated with a [protein](#) called BipA. As anticipated, when they intentionally deleted BipA from *V. cholerae*, the resulting microbes formed rough colonies typical of biofilms rather than smooth colonies. This confirmed BipA's role in controlling biofilm formation at lower temperatures.

To explore how BipA achieves this, the researchers compared the proteins produced by normal *V. cholerae* with those produced by microbes lacking BipA, at 22 and 37 degrees Celsius. They found that

BipA alters the levels of more than 300 proteins in *V. cholerae* grown at suboptimal temperatures, increasing the levels of 250 proteins including virtually all known biofilm-related proteins. They also showed that at 37 degrees Celsius, BipA adopts a conformation that may make it more likely to be degraded. In BipA's absence, the production of key biofilm regulatory proteins increases, leading to the expression of genes responsible for [biofilm formation](#).

These results provide new insights into how *V. cholerae* adapts to [temperature](#) and will help understand—and ideally prevent—its survival in different environments and transmission into humans.

"We have shown that BipA is critical for temperature-dependent changes in the production of biofilm components and alters [colony](#) shape in some *V. cholerae* strains," concludes senior author Felipe Cava, Associate Professor at the Department of Molecular Biology, and MIMS Group Leader and Wallenberg Academy Fellow, Umeå University. "Future research will address the effect of temperature- and BipA-dependent regulation on *V. cholerae* during host infection and the consequences for cholera transmission and outbreaks."

More information: Teresa del Peso Santos et al, BipA exerts temperature-dependent translational control of biofilm-associated colony morphology in *Vibrio cholerae*, *eLife* (2021). [DOI: 10.7554/eLife.60607](https://doi.org/10.7554/eLife.60607)

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