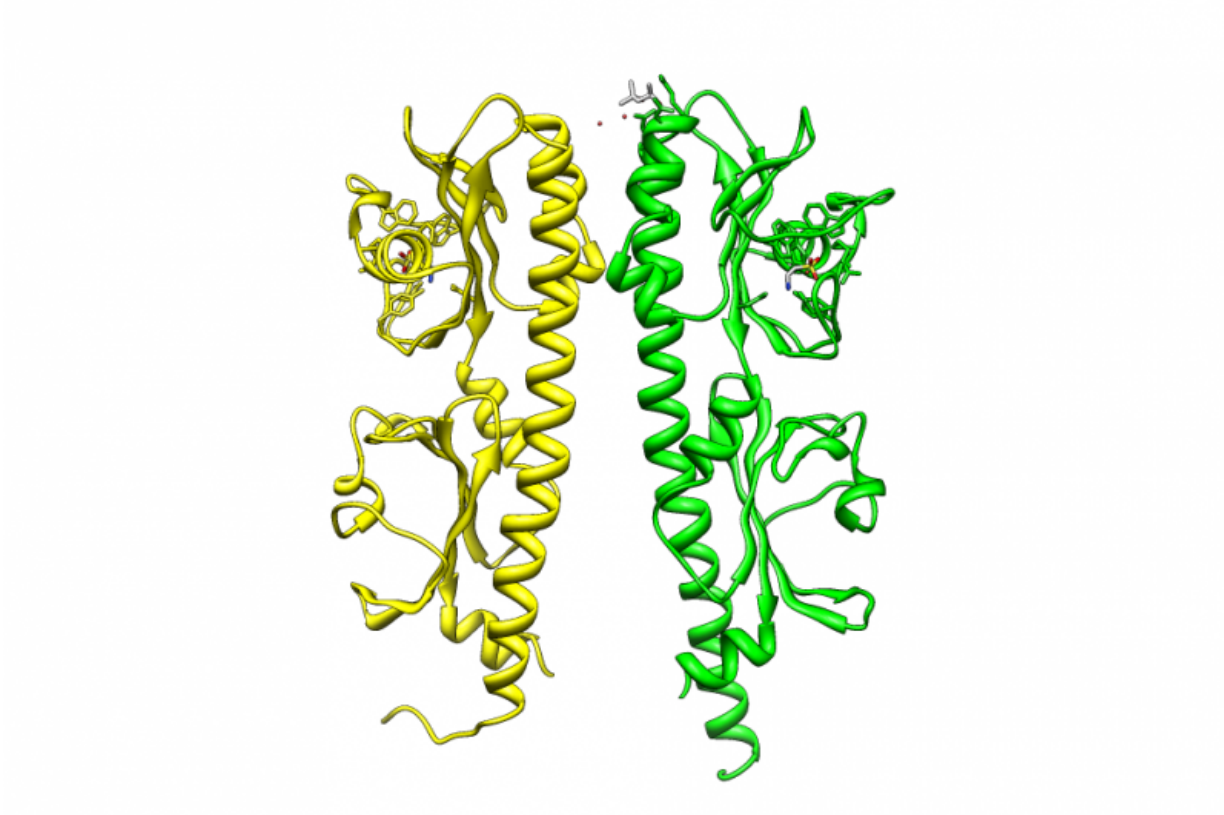
How vibrio cholera is attracted by bile revealed

April 25 2016



Molecular structure of Mlp37: Ribbon representation of Mlp37. Mlp37 forms a dimer (yellow and green). The two domains (the red circle and the black circle) are similar in structure, but only the upper domain binds taurine.

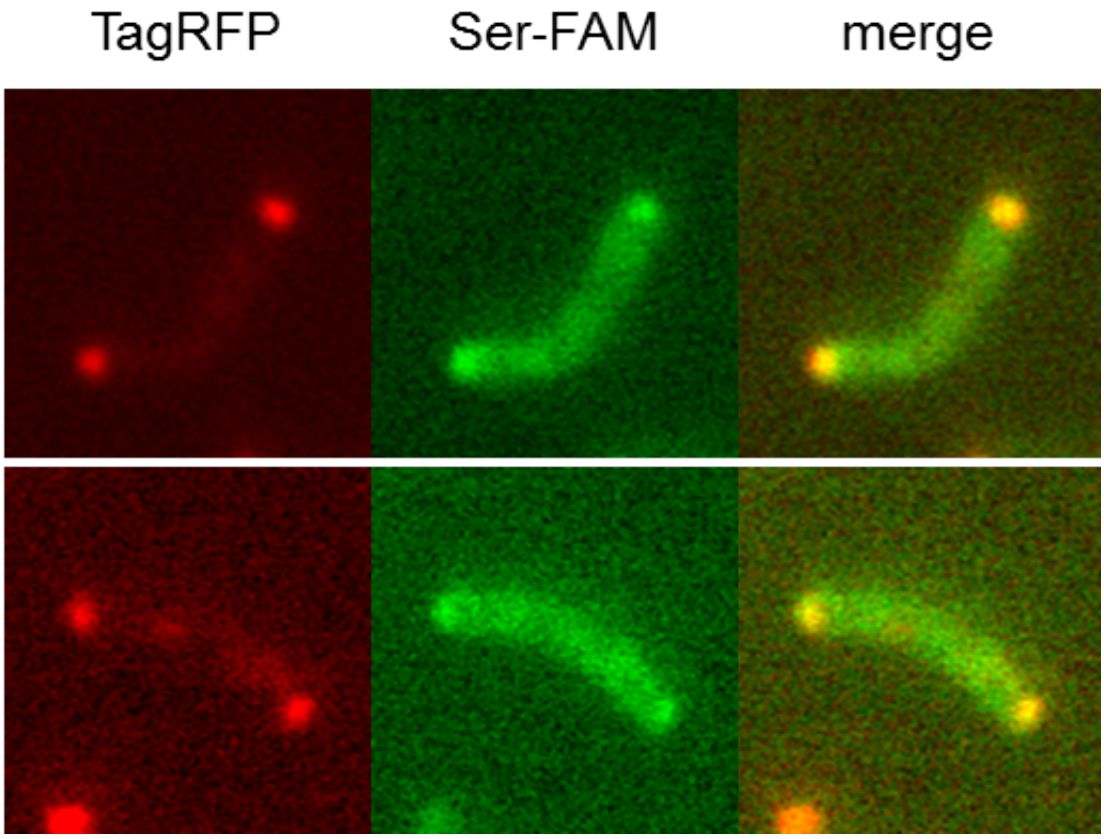
A group of researchers from Osaka University, Hosei University, and

Nagoya University have revealed the molecular mechanism that Vibrio cholerae, the etiological agent of cholera, is attracted by bile. This group has also successfully detected the ligand binding to the bacteria chemoreceptor in vivo for the first time. These results may significantly advance research on mechanism and control of V. cholerae.

Cholera, an acute diarrheal disease caused by the infection of the Gram-negative bacterium Vibrio cholerae, remains a global threat to public health. V. cholerae does not produce toxins in nutrient-poor aquatic environments. However, in a nutrient-rich environment, such as the lumen of the human small intestine, it begins to form colonies and expresses pathogenic proteins that cause the serious diarrheal disease. Thus, sensing environmental chemicals is crucial for the pathogenicity of V. cholerae.

Katsumi Imada, Professor, and Yohei Takahashi, a graduate student at Osaka Univeresity together with Ikuro Kawagishi, Professor, and Kentaro Yamamoto, a graduate student at Hosei University, and Michio Homma, Professor at Nagoya University found that V. cholerae is actually attracted by taurine, a bile component, and that taurine is recognized by a chemotaxis receptor protein, Mlp37.

The structural study of the Mlp37 sensor domain in complex with taurine and serine revealed that the ligands bind to the same pocket and that taurine is recognized essentially in the same way as serine. The sensor domain of the ligand complex had a small opening, which would accommodate a larger side chain group, accounting for the broad ligand specificity of Mlp37.



Visualization of the serine binding to Mlp37 in V. cholerae V. cholerae that produces Mlp37 labeled with RFP (red fluorescent protein) binds serine.

This group has also successfully visualized the ligand binding to the bacterial chemoreceptor as fluorescent spots. This is the first example of the direct detection of the ligand binding to the bacteria chemoreceptor in vivo.

The finding of taurine taxis sheds new light on the survival of V. cholerae in the host intestine as well as its pathogenicity. Inhibition of taurine taxis might lead to prevention of infection and pathogenesis of V. cholerae. The structural basis of taurine recognition by the

chemoreceptor Mlp37 provides a great contribution to the development of new drugs for cholera. Moreover, this group's fluorescent labeling technique provides a powerful cell biological tool to study bacterial chemotactic behavior, which is essential for bacterial survival and infection.

More information: So-ichiro Nishiyama et al. Identification of a Vibrio cholerae chemoreceptor that senses taurine and amino acids as attractants, *Scientific Reports* (2016). DOI: 10.1038/srep20866

Provided by Osaka University