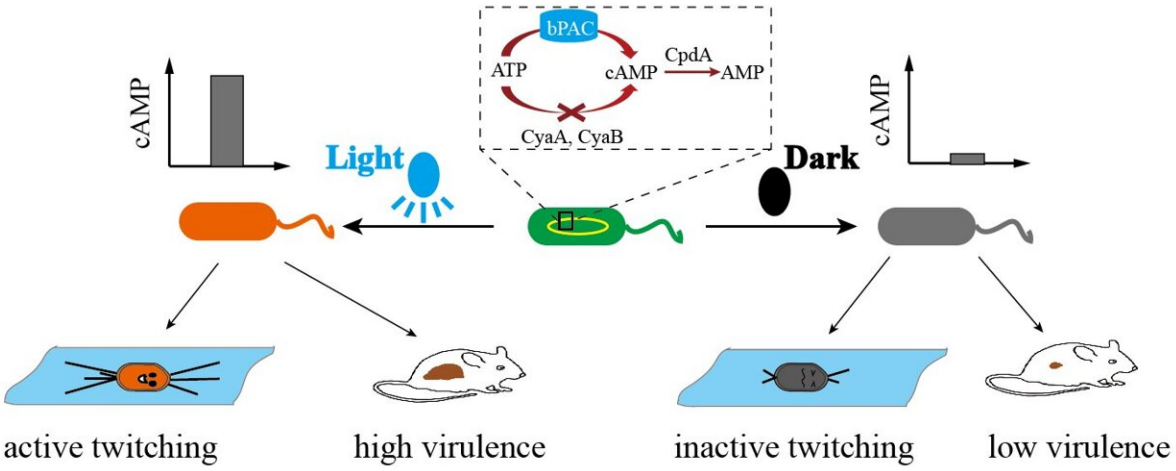
Researchers develop engineered strain to optically control bacteria's movement behavior

May 17 2021, by Li Yuan



Design principle and application diagram of the engineered strain pactm. Credit: SIAT

A research team led by Jin Fan from the Shenzhen Institute of Advanced Technology (SIAT) of the Chinese Academy of Sciences, in collaboration with Liu Zhi's group from Huazhong University of Science and Technology, designed an engineered strain based on Pseudomonas aeruginosa, which could optically control the movement behavior of the bacteria and its infection on the host.

The study was published in the journal *ACS Synthetic Biology*.

Cyclic adenosine monophosphate (cAMP) is an important secondary messenger that controls carbon metabolism, type IVa pili (TEP) biogenesis, and virulence in Pseudomonas aeruginosa.

When cAMP regulates a certain physiological function in bacteria, it usually simultaneously regulates the expression levels of multiple component proteins that affect this physiological function.

In this study, the researchers developed an engineered P. aeruginosa strain (named pactm) with light-dependent intracellular cAMP levels by introducing a photoactivated adenylate cyclase gene (bPAC) into bacteria.

The engineered strain can reversibly change its ability of twitching motility and host infection in response to illumination of blue light. Under the illumination of blue light, the expression of cAMP response promoter in pactm was increased by15-fold, and the ability of twitching motility was increased by 8-fold.

The subcutaneous infection model of nude mice showed that the skin lesion area caused by pactm infection was increased by 14-fold. Thus, this work provides a solution for the construction of a controlled infection experimental model.

In addition, the researchers guided the expansion direction of the bacterial population through the design of macroscopic illumination mode, which provided convenience for the study of the contact-dependent interactions between microorganisms.

More information: Aiguo Xia et al. Optogenetic Modification of Pseudomonas aeruginosa Enables Controllable Twitching Motility and

Host Infection, *ACS Synthetic Biology* (2021). DOI: 10.1021/acssynbio.0c00559