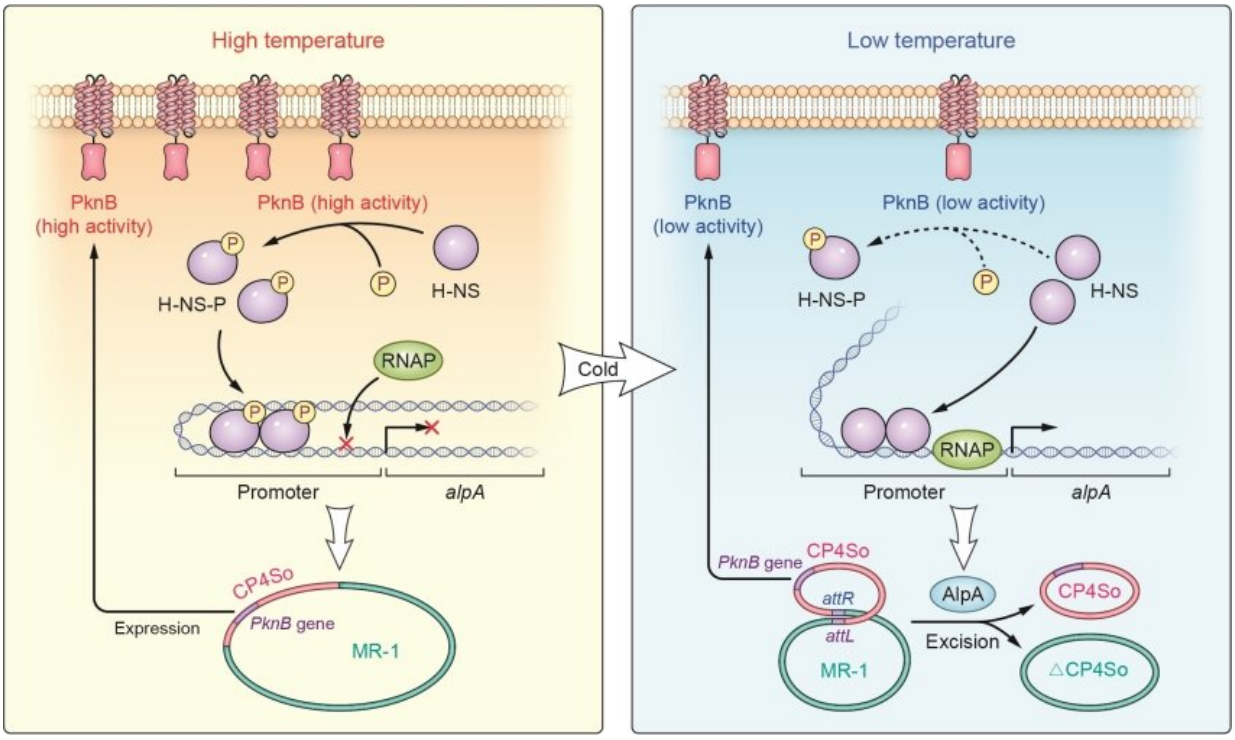
Scientists reveal new mechanism of xenogeneic silencing in bacteria

March 16 2021, by Li Yuan



A proposed mechanism of xenogeneic silencing by H-NS. Credit: LIU Xiaoxiao, SCSIO

Lateral gene transfer (LGT) plays a prominent role in the genome evolution and environmental adaptation of prokaryotes.

Xenogeneic silencing proteins can selectively silence the newly acquired

DNA molecules to protect cells from the detrimental effects of LGT genes. H-NS, a nucleoid-associated DNA-binding protein, is an important xenogeneic silencer.

Recently, Dr. Liu Xiaoxiao and other researchers in Dr. Wang Xiaoxue's group from the South China Sea Institute of Oceanology (SCSIO) of the Chinese Academy of Sciences found a key process of xenogeneic silencing by studying Shewanella. The silencing of prophage relied on a temperature-dependent posttranslational modification of the host H-NS in S. oneidensis.

This work was published in *Nucleic Acids Research* on March 8. It is the first to show that posttranslational modification of H-NS can function as a regulatory switch to regulate the prophage activity in host genomes.

Researchers from Wang's group showed that H-NS "silenced" the prophage by recognizing the excisionase of the prophage. At room temperature, most of the H-NS protein in the cell was phosphorylated. Phosphorylated H-NS could silence the expression of cytotoxic genes on the prophage.

However, low temperature promoted the dephosphorylation of H-NS and changed the binding of H-NS to DNA, which relieved these genes expression. By this way, the H-NS silenced the specific prophage and helped Shewanella to adapt to the low temperature environment.

Specifically, phosphorylation of H-NS at Ser42 was critical for silencing the cold-inducible genes including the excisionase of CP4So prophage, a cold shock protein, and a stress-related chemosensory system. By contrast, nonphosphorylated H-NS derepressed the promoter activity of these genes/operons to enable their expression at cold temperatures.

The results of the study illustrate a new way of decision-making for

xenogeneic silencing in response to temperature shifts in bacteria and provide new insights for our understanding of how bacteria silence and activate the LGT genes in response to environmental changes.

More information: Xiaoxiao Liu et al. Xenogeneic silencing relies on temperature-dependent phosphorylation of the host H-NS protein in Shewanella, *Nucleic Acids Research* (2021). DOI: 10.1093/nar/gkab137

Provided by Chinese Academy of Sciences