

## **The role of staphylococcal pathogenicity islands (SaPIs) in the adaptation and virulence of *Staphylococcus aureus***

*Staphylococcus aureus* (*S. aureus*) is a gram-positive bacterium, about 30% people carry it in their noses and it can infect almost any tissue in human body. *S. aureus* secretes as many as 50 different pathogenic proteins involved in host adaptation, virulence and immune evasion. It is a rapidly evolving pathogen and can acquire almost any foreign gene through horizontal gene transfer. *S. aureus* can carry different mobile genetic elements (MGEs), including plasmids, transposons, staphylococcal cassette chromosome (SCC), bacteriophages and staphylococcal pathogenicity islands (SaPIs), which contribute to their virulence, broad host range and antibiotic resistance.

SaPIs are accessory chromosomal segments containing virulence genes. SaPIs are induced, excised, replicated and finally packaged into small capsids by certain staphylococcal temperate phages. This results in high frequency SaPI transfer. SaPIs also interfere with helper phage reproduction, blocking plaque formation, sharply reducing burst size and enhancing the survival of host cells following phage infection. Recently, we have demonstrated that SaPIs use several different strategies for phage interference, presumably the result of convergent evolution. SaPIs are also able to mediate generalized transduction, using SaPI packaging (*pac*) site homologs in host DNA. By interfering with helper phage reproduction, the SaPIs would thus promote horizontal transfer of a wide variety of host genes in addition to their own transfer.

SaPIs move readily between strains, often carry unique toxin genes, allowing the pathogen to adapt rapidly to a changing environment. We propose that the versatility, adaptability and potency of *S. aureus* depend greatly on these unusual small chromosomal islands. The focus of my work is these incredible islands. An understanding of their biology and capabilities will enable us to modify the SaPI and consequently reduce the severity and spread of staphylococcal infection.