EP0201
ePoster Session
A potpourri of microbes

Modulation of Staphylococcus aureus spreading by water

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Background: Bacterial motility is often associated with pathogenesis. *Staphylococcus aureus* is known to form giant colonies and spread rapidly on the surface of soft agar medium and animal tissues by a process called colony spreading. So far, the mechanism underlying its spreading is not understood. The speed of colony spreading often parallels to that of swarming and a spreading colony may form tendrils that are frequently observed in colonies formed by many swarming bacteria. However, one major difference in spreading is that *S. aureus* lacks flagellum or a surface apparatus that would power the movement of organism on agar surface, like those swarming bacteria do. Earlier study demonstrated that *S. aureus* spreading requires the synthesis of biosurfactants, phenol-soluble modulins (PSMs), and the Agr quorum sensing system that activates the transcription of the PSM genes.

Material/methods: This study investigates the spreading phenomenon by culturing *S. aureus* HG001 and its mutant derivatives on TSA medium that is made of agarose. The colonies formed on soft agar plates were observed under a phase contrast microscope and confocal laser-scanning microscope. The presences of water in colonies was demonstrated by cultured bacteria on tiled plates. Green fluorescence gene transcribed from the *psmα* promoter was used to demonstrate that the quorum sensing system was activated in a spreading colony.

Results: We found that *S. aureus* extracted water from TSA medium. Water started to accumulate, which could be observed by phase contrast microscopy after 2.5 h of inoculation. Additionally, the bacteria were found to be floating, drifting, and moving with the water flow. This study also found that as the density of bacteria in a colony increases, a quorum sensing response was triggered, resulting in the synthesis of biosurfactants, PSMs. As the water is being extracted from the medium continuously from the medium, PSMs weakens the water surface tension of the colony, allowing water to flood the agar surface, which carries the bacteria to move rapidly on agar surface.

Conclusions: This study reveals a mechanism, which explains how an organism lacking a motor is capable of moving rapidly on medium surface, which is important to the understanding of how this pathogen moves in human tissues to cause diseases.