

Mechanisms of Bacterial Spore Germination and its Heterogeneity

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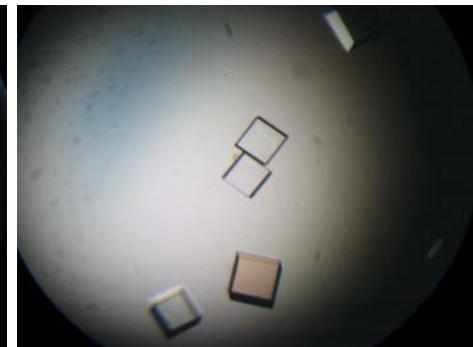
Objectives: Determine the mechanism(s) of bacterial spore germination, determine what causes heterogeneity in germination of individual spores in a population, and develop and evaluate a predictive computational model of bacterial spore germination.

Approaches: Using spores of several *Bacillus* species and *Clostridium perfringens* determine: 1) germinant receptor numbers and locations; 2) factors that contribute to spore germination heterogeneity and superdormancy; and 3) structures of germination proteins. Concurrently, generate a predictive mathematical model of spore germination.

Technical Successes: Preliminary data indicate that: 1) a number of germination proteins are clustered in spores; and 2) we have isolated mutants in potential germination signal integrators. Further, we have isolated crystals of a number of germination proteins, and to date crystals of at least two diffract to $\sim 2.5\text{\AA}$.



B. subtilis GerD



B. subtilis GerBC

Crystals of germination proteins

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Application / Outcome:

- No papers yet; project just started
- Collaborating with U of Pittsburgh, Oregon State U, and East Carolina U
- Plans and results shared with Natick Soldier Center research personnel
- Preliminary results described under technical successes

Payoff: Understanding the mechanism(s) of bacterial spore germination and its heterogeneity may allow rational development of methods to more readily eradicate spores, thereby mitigating dangers posed by super-dormant spores in both the food industry and in spore-borne diseases such as anthrax.

Follow on successes: The project was just initiated in July 2009; it's too early to have follow on successes.

Remaining technology gaps: Instrumentation to accurately measure the germination of ~500 individual spores over 2-5 hour periods even at low levels of spore germination (3-15% of total spores) is under development.