What's for dinner? Different Carbon Compounds Influence Host Metabolism in a Model Roseobacter-Roseophage System

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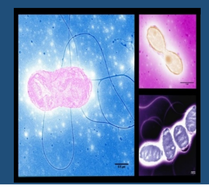
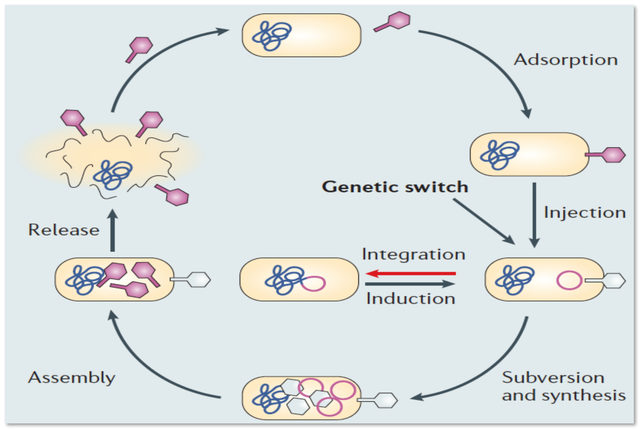


Introduction

- Bacteria get sick too!
- Viruses that infect bacteria (phage) engage in complex interactions with their hosts where they can have two life cycles: lytic or lysogenic (1).



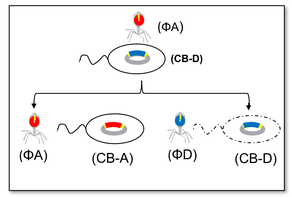
Lysogenic vs. lytic cycle. Sturino & Klaenhammer (2006) Nature Reviews Micro

- Lysogeny is widespread, with > 50% of bacterial genomes showing evidence of prophage integration. However, mechanistic study of bacteria-phage interactions are limited to a few well-studied model systems (1-3).
- The paradigm is that host cell stress prompts prophage induction (i.e. switch from lysogeny to lytic state). However, low levels of induction occurs in the absence of stress. This phenomenon is known as spontaneous prophage induction (SPI) (3).
- We have developed roseobacter-roseophage system to better understand SPI in an environmentally relevant context.

Project Objective

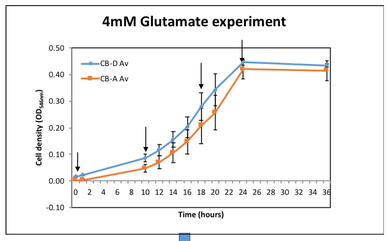
Characterize the general growth dynamics, cellular features and metabolic response of two genetically similar bacterial-phage systems with different rates of SPI.

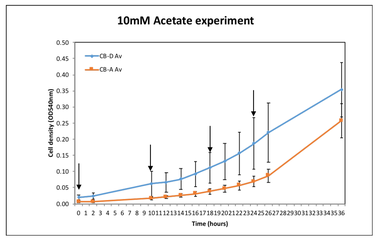
Results

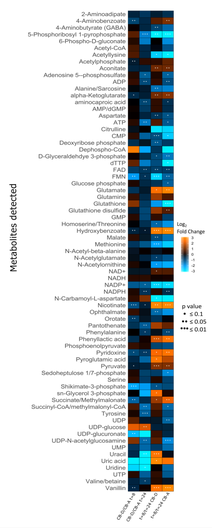


. Depiction of phage differences between strains.

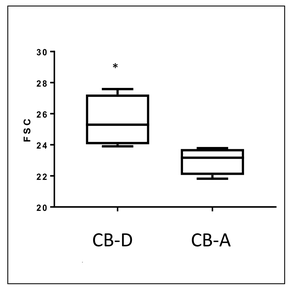
- One host, two phages. Phages share 85.65% sequence identity.
- Previous research identified significant phenotypic differences between these two bacterial strains (cell size, biofilm formation, and growth dynamics).



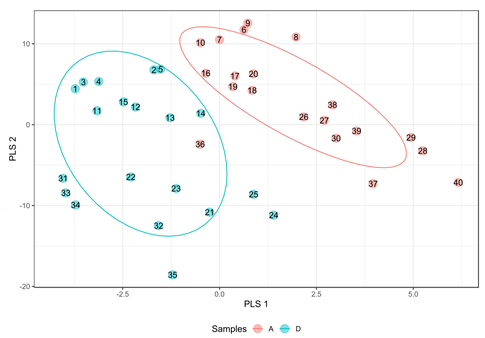




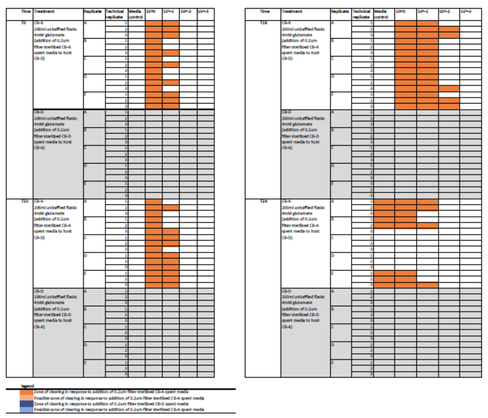
Metabolite profiles for two strains differ over 24 hour growth cycle.



Data from flow cytometry reveals CB-D cells are larger, on average, compared to CB-A cells.

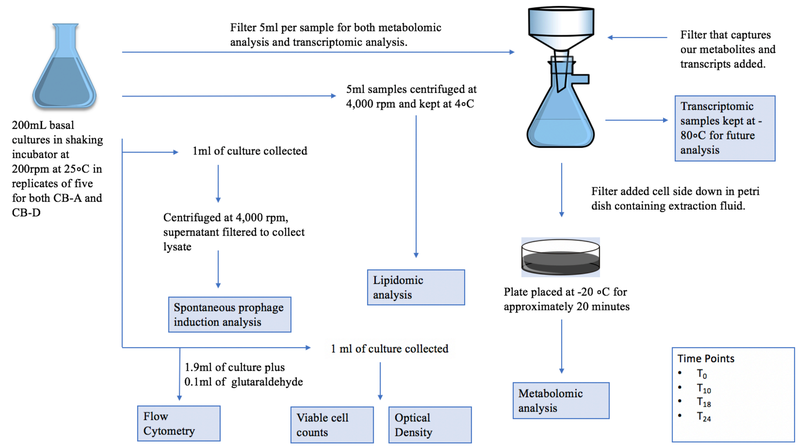


PLS plot reveals separation of the strains throughout the growth cycle in terms of metabolites.



The occurrence of SPI is higher in CB-A compared to CB-D

Work Flow



Conclusion

- The metabolite profiles of CB-D and CB-A differ throughout growth curve.
- CB-D cells are larger than CB-A cells.
- Evidence suggests CB-A has a higher rate of spontaneous prophage induction than CB-D at different stages of growth.

Future Directions

- Future research will include repeated procedures for the two strains in cultures supplemented with 10mM acetate to further identify any differences in physiology depending upon culture conditions.
- Further studies will also look to determine viral burst size for both phages under basal media conditions as well as complex media conditions through a one-step growth curve.

Acknowledgments

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Citations

1. Ankrah, Nana Yaw D et al. "Phage infection of an environmentally relevant marine bacterium alters host metabolism and lysate composition." *The ISME journal* vol. 8,5 (2013): 1089-100. doi:10.1038/ismej.2013.216
2. Wilson, William H., and Nicholas H. Mann. "Lysogenic and lytic viral production in marine microbial communities." *Aquatic Microbial Ecology* 13.1 (1997): 95-100.
3. Nanda, Arun M., Kai Thormann, and Julia Frunzke. "Impact of spontaneous prophage induction on the fitness of bacterial populations and host-microbe interactions." *Journal of bacteriology* 197.3 (2015): 410-419.