

Micro 201:

Bernhardt Lecture 4 - Peptidoglycan and cell shape determination

February 7, 2019

Overview:

In this lecture we will cover the structure of the peptidoglycan (PG) layer and how it is assembled. In recent years this topic has garnered a lot of interest because it has become clear that PG assembly is directed by cytoskeletal elements: actin (MreB), tubulin (FtsZ), and intermediate filaments (CreS). The lecture will focus on the structure of PG, the synthetic enzymes needed to produce it, and the control of PG assembly by MreB and FtsZ. Both of the reviews give a nice overview of the topic with the older review by Höltje providing a lot of nice detailed view of many foundational papers.

While the majority of the steps in PG biogenesis have been characterized, one of the missing links has been the identification of the “flippase” that translocates/flips the lipid-linked PG precursor, lipid II, from the cytoplasmic side of the membrane to the periplasmic side. The two papers we will discuss each claim to have identified the flippase. Focus on the methods used to for “flippase” identification and characterization. Do you think we have a complete picture? Who’s right? The debate surprisingly continues to this day.

Papers for discussion:

1) Natividad Ruiz. **Bioinformatics identification of MurJ (MviN) as the peptidoglycan lipid II flippase in Escherichia coli.** Proc Natl Acad Sci USA (2008) 105:15553-15557

2) Tamimount Mohammadi et al. **Identification of FtsW as a transporter of lipid-linked cell wall precursors across the membrane.** EMBO J. (2011) 30: 1425-1432

General Reviews:

1) Athanasios Typas, Manuel Banzhaf, Carol A Gross, and Waldemar Vollmer. **From the regulation of peptidoglycan synthesis to bacterial growth and morphology.** *Nat Rev Microbiol* (2012) 10:123-136

2) Heng Zhao, Vaidehi Patel, John Helmann, and Tobias Dorr. **Don’t let sleeping dogmas lie: new views of peptidoglycan synthesis and its regulation.** *Mol Microbiol* (2017) 106: 847-860