Articles of Significant Interest Selected from This Issue by the Editors

Shields Up! Epithelial Microvilli Establish an Electrostatic Barrier to Microbial Adhesion

Polarized epithelial cells throughout the body display densely packed apical microvilli, resembling a plush carpet. Nutrient absorption might be one role for this increased surface area, but other functions are likely. Interestingly, M cells, epithelial cells specialized for immune surveillance, lack microvilli and are efficient in particle capture. Bennett et al. (p. 2860–2871) engineer intestinal epithelial cells to block microvilli formation and find that bacterial particles show increased adhesion. Preference for “microvillus-minus” cells is related to particle surface charge, suggesting that microvilli generate an electrostatic repulsion field. This repulsion field may be an important innate barrier to microbial invasion.

Chlamydia trachomatis Polymorphic Membrane Protein D Functions in Early Host Cell Interactions

The Chlamydia trachomatis polymorphic membrane protein D (PmpD) is a highly conserved autotransporter and target of pan-neutralizing antibodies. To understand the function of PmpD, Kari et al. (p. 2756–2762) employ a reverse genetic approach to generate a pmpD null mutant. They show that the pmpD null mutant is not attenuated using mouse infection assays. However, the mutant is attenuated for infection of macaque eyes and cultured human conjunctival and cervical endothelial cells. This host-specific infection deficiency involves a decreased ability of chlamydiae to attach to or enter host cells.

Phosphate Acquisition and Storage Influence Cryptococcosis

Cryptococcus neoformans causes an estimated 1 million cases of life-threatening meningitis in the HIV/AIDS population each year. Functions for nutrient sensing and acquisition are potential therapeutic targets to combat cryptococcal disease. In this context, Kretschmer et al. (p. 2697–2712) demonstrate that loss of the high-affinity system for phosphate uptake in C. neoformans perturbs the formation of virulence factors (capsule and melanin), reduces survival in macrophages, and attenuates virulence in mice. Nutrient sensing functions such as the iron regulator Cir1 and cyclic AMP-dependent protein kinase A regulate the elaboration of the virulence factors and also control phosphate acquisition and storage.

Carbon Metabolism Pathways Influence Growth of Shigella flexneri in the Intracellular Environment

Shigella spp. grow in the cytoplasm of host cells, but the physiology of the bacteria growing intracellularly is poorly understood. Waligora et al. (p. 2746–2755) analyze mutants blocked in metabolic pathways and show that Shigella flexneri uses glycolysis, primarily through the Embden-Meyerhof-Parnas pathway, and mixed acid fermentation during intracellular replication. S. flexneri is stimulated by pyruvate, both in vitro and in host cells, suggesting that pyruvate is a preferred carbon source. Knowledge of the specific metabolic pathways used by intracellular Shigella may lead to strategies for limiting its replication in host cells.

Life Is Stressful without Resistance-Nodulation-Division (RND)-Mediated Efflux: Reciprocal Regulation of RND Efflux Systems and the Cpx Stress Response

Resistance-nodulation-division (RND) efflux systems function in antimicrobial resistance, whereas the Cpx stress response system functions in alleviating envelope stress. Taylor et al. (p. 2980–2991) demonstrate that the Vibrio cholerae Cpx system positively regulates expression of two RND family multidrug efflux systems. Inactivation of either RND efflux system induces the Cpx response, revealing reciprocal regulation of the Cpx response and the RND efflux systems. Their findings suggest that the Cpx and RND efflux systems mitigate stress resulting from the accumulation of toxic metabolic products and highlight the intertwined role of RND-mediated efflux and the Cpx stress response in adaptation and survival in noxious environments.