IN BRIEF

BACTERIAL PHYSIOLOGY

Multiple redundant stress resistance mechanisms are induced in *Salmonella enterica* serovar Typhimurium in response to alteration of the intracellular environment via TLR4 signalling

Wright, A. J. *et al. Microbiology* **155**, 2919–2929 (2009)

Detection of *Salmonella enterica* subsp. *enterica* serovar Typhimurium by Toll-like receptor 4 activates several downstream signalling cascades in the host cell, but the effects of signalling on the pathogen are not well understood. By comparing the gene expression profiles of intracellular *S.* Typhimurium from wild-type and *Tlr4*$^{-/-}$ mice, the authors identified 15 genes with upregulated expression following detection of the bacterium by TLR4. Several of these have a role in protecting the bacterium from oxidative damage and are also induced by NADPH oxidase, which links TLR signalling with the induction of oxidative stress. Finally, with one exception, the growth of *S.* Typhimurium mutants lacking individual oxidative stress response genes was not attenuated in a mouse infection model, suggesting considerable redundancy.

PHAGE BIOLOGY

Photosystem I gene cassettes are present in marine virus genomes

Sharon, I. *et al. Nature* 26 Aug 2009 (doi:10.1038/nature08284)

Sharon *et al.* show that marine cyanophages carry genes encoding proteins of the PSI photosystem, which, along with PSII, is used by cyanobacteria for photosynthesis. The PSI gene *psaA* was identified in a genomic dataset obtained from global ocean sampling and was confirmed to be of viral origin. In addition to *psaA*, the viral genomes contained *psaB*, *psaC*, *psaD*, *psaE*, *psaK* and a unique *psaJ–psaF* fusion. These genes were linked and, together with *nrdB*, formed a photosynthetic cluster. Comparison of the potential structures of the cyanophage PSI and the *Thermosynechococcus elongatus* PSI indicates that the fusion protein encoded by *psaJ–psaF* might allow less selective electron donation, potentially enabling the use of reducing power generated by respiration.

BIOTECHNOLOGY

Creating bacterial strains from genomes that have been cloned and engineered in yeast

Lartigue, C. *et al. Science* 20 Aug 2009 (doi:10.1126/science.1173759)

In this study the authors describe a technique to genetically modify medically or industrially important microorganisms that cannot be manipulated by conventional methods. The genome of *Mycoplasma mycoides* was cloned as a yeast centromere and then transferred into a yeast cell, where it was stably maintained through cell division. The genome was then modified using genetic tools that are available for yeast but not for these bacteria. The modified genome was subsequently transplanted into the cytoplasm of a *Mycoplasma capricolum* cell using a polyethylene glycol-based approach. To avoid degradation by *M. capricolum* restriction enzymes, the genome was either methylated *in vitro* or transplanted into bacteria in which restriction enzymes had been genetically inactivated. The successful transplantation yielded a new strain of *M. mycoides*, the genome of which had successfully incorporated the genomic alterations made in the yeast cells but was otherwise intact.