IN BRIEF

BACTERIAL PATHOGENESIS

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Two subpopulations can be identified within populations of *Salmonella enterica* subsp. *enterica* serovar Typhimurium: a slow-growing one that promotes inflammation to outcompete the gut microbiota through expression of type III secretion system 1 (T3SS1); and a fast-growing one that does not express T3SS1 and is phenotypically avirulent. Here, the authors observed that, in addition, genetically avirulent mutants that do not contribute to inflammation ('defectors') arise during infection. Importantly, the defector subpopulation increased in size more rapidly when the phenotypically avirulent subpopulation was absent, leading to reduced inflammation and the decline of the whole *S.* Typhimurium population in the gut. This indicates that the phenotypically avirulent subpopulation protects the slow-growing virulent subpopulation from being taken over by defectors. Thus, *S.* Typhimurium subpopulations exhibit cooperative behaviour, in this case through bistable expression of virulence genes to stabilize virulence.

ORIGINAL RESEARCH PAPER Diard, M. *et al.* Stabilization of cooperative virulence by the expression of an avirulent phenotype. *Nature* **494**, 353–358 (2013)

MICROBIOME

Diet and oral microbiota go hand in hand

In this study, the authors assessed whether changes in diet during human evolution affected the oral microbiota. By analysing samples of calcified dental plaque from 34 prehistoric European skeletons, they found that the transition from a hunter–gatherer diet to one based on farming was associated with a shift in the oral microbiota, with hunter–gatherers having fewer taxa that are associated with tooth decay (cariogenic bacteria) and periodontal disease. This shift was potentially due to an increased consumption of soft carbohydrate foods. This composition of the oral microbiota remained stable through medieval times. However, comparison with the modern oral microbiota revealed an additional shift such that the modern oral microbiota became dominated by cariogenic bacteria and less diverse than historic populations; this probably coincided with the Industrial Revolution.

ORIGINAL RESEARCH PAPER Adler, C. J. *et al.* Sequencing ancient calcified dental plaque shows changes in oral microbiota with dietary shifts of the Neolithic and Industrial revolutions. *Nature Genet.* 17 Feb 2013 (doi:10.1038/ng.2536)

ANTIMICROBIALS

Protective effect for Cpx

It has been suggested that bactericidal compounds, including aminoglycoside antibiotics and hydroxyurea, kill bacteria through activation of the Cpx system and subsequent formation of reactive oxygen species. The two-component Cpx system involves the kinase–phosphatase CpxA sensing and tranducing stress signals to its regulator, CpxR, through phosphorylation, leading to transcriptional activation; the response is inactivated by CpxA-mediated dephosphorylation of CpxR. Here, the authors show that Cpx can actually protect bacteria from aminoglycosides and hydroxyurea. Bacteria carrying a mutant CpxA that lacks phosphatase activity (and thus constitutively activates the Cpx response) were protected from aminoglycosides and hydroxyurea. However, these bacteria did not show enhanced resistance to fluoroquinolones and β-lactams, indicating that not all bactericidal antibiotics kill by the same mechanism.

ORIGINAL RESEARCH PAPER Mahoney, T. F. & Silhavy, T. J. The Cpx stress response confers resistance to some, but not all bactericidal antibiotics. *J. Bacteriol.* 18 Jan 2013 (doi:10.1128/JB.02197-12)

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