IN BRIEF

BACTERIAL TRANSCRIPTION

Promoter melting by alternative sigma factors

Alternative sigma factors direct transcription to a specific subset of regulons in response to environmental signals and exhibit stringent promoter specificity. A crucial step in transcription initiation is the melting of the double-stranded promoter DNA by the bound RNA polymerase holoenzyme. Conserved amino acids in primary sigma factors initiate strand separation within the –10 region in target promoters; however, alternative sigma factors do not contain these key residues. The authors of this study investigated the mechanism of promoter melting by the *Escherichia coli* alternative sigma factor σ^E and solved the structure of the complex that is formed between σ^E and its cognate –10 promoter. They identified specific intramolecular contacts and found that σ^E induced strand separation by flipping out a single nucleotide from the non-template strand. Sequence-specific recognition of this nucleotide was mediated by a variable loop, which might explain the increased promoter stringency.

ORIGINAL RESEARCH PAPER Campagne, S. *et al.* Structural basis for –10 promoter element melting by environmentally induced sigma factors. *Nature Struct. Mol. Biol.* http://dx.doi.org/10.1038/nsmb.2777 (2014)

SYMBIOSIS

Activating root nodule organogenesis

Rhizobia-derived nodulation factors initiate a spike in calcium levels in the nucleus of plant root cells, which leads to the activation of symbiosis-associated genes and root nodule organogenesis. Nuclear calcium- and calmodulin-dependent kinase (CCaMK) has emerged as a key regulator in symbiotic development, but the underlying mechanism has been unclear. Singh *et al.* now report that increased calcium levels induce the CCaMK-mediated site-specific phosphorylation of its interaction partner CYCLOPS, which results in the dissociation of CYCLOPS from the complex and the release of its DNA-binding and transcriptional activation domains. The authors show that CYCLOPS binds to a specific motif in the promoter of *NODULE INCEPTION* (*NIN*; a mediator of organogenesis) to induce gene expression. These data reveal a mechanism whereby CCaMK 'decodes' a symbiotically induced calcium signal to initiate symbiotic organ development.

ORIGINAL RESEARCH PAPER Singh, S. *et al.* CYCLOPS, a DNA-binding transcriptional activator, orchestrates symbiotic root nodule development. *Cell Host Microbe* http://dx.doi.org/10.1016/j.chom.2014.01.011 (2014)

MICROBIOME

Revealing secrets from ancient dental calculus

Calcified dental plaque (dental calculus) is a source of well-preserved biomolecules, and Warinner *et al.* now report the high-resolution characterization of the oral microbiome from human dental tissues in four adult human skeletons from approximately AD 950–1200. They identified DNA and proteins from opportunistic pathogens implicated in local and systemic disease as well as DNA sequences with homology to antibiotic resistance genes. They reconstructed the genome from *Tannerella forsythensis* — a pathogen that has been implicated in periodontal disease. Moreover, the identification of both host and microbial proteins within the dental calculus revealed a long-term role of host immunity and virulence factors in periodontal disease. In addition, biomolecular analysis of plant and animal DNA sequences recovered from the samples provided insights into the medieval human diet.

ORIGINAL RESEARCH PAPER Warinner, C. *et al.* Pathogens and host immunity in the ancient human oral cavity. *Nature Genet.* http://dx.doi.org/10.1038/ng.2906 (2014)