

## IN BRIEF

**SYNTHETIC BIOLOGY****Rewriting the code of life**

The genetic code of all living organisms is based on the sequence of the four nucleobases adenine, thymine, cytosine and guanine, which form paired bonds (G·C and A·T) in the DNA double helix. Now, Malyshev *et al.* report the generation of the first semi-synthetic microorganism that stably replicates an unnatural base pair (UBP). Expression of an algal nucleotide triphosphate transporter (NTT) in *Escherichia coli* cells enabled the direct uptake of the triphosphates of the nucleobases d5SICS and dNaM, which were previously shown to form an UBP. NTT-expressing cells that carried a plasmid containing the d5SICS-dNaM UBP were grown in medium that was supplemented with the two unnatural triphosphates. Importantly, the authors showed that the UBP was retained in the plasmid following days in culture and was replicated with high fidelity, possibly by polymerase I. The construction of a bacterium that encodes an extra base pair provides a platform to engineer cells with a vastly expanded genetic alphabet to increase biological diversity.

**ORIGINAL RESEARCH PAPER** Malyshev, D. A. *et al.* A semi-synthetic organism with an expanded genetic alphabet. *Nature* <http://dx.doi.org/10.1038/nature13314> (2014)

**BIOFILMS****Two kingdoms come together**

A multitude of microorganisms coexist in the human oral cavity and form polymicrobial biofilms, but the role of microbial interactions in pathogenesis and virulence has remained elusive. This study investigated inter-kingdom communication between the fungal pathogen *Candida albicans* and the caries-promoting bacterium *Streptococcus mutans*. Biofilm biomass and cell densities were increased in co-cultures compared with monocultures, whereas the secretion of extracellular polymeric substances that contribute to cariogenesis by *S. mutans* was inhibited. By contrast, co-culturing with *C. albicans* led to the induction of quorum sensing in *S. mutans*, including the expression of genes that are important for survival and competence. Virulent hyphal growth of *C. albicans* was also promoted, which suggests that both pathogens benefit from inter-kingdom interactions.

**ORIGINAL RESEARCH PAPER** Sztajer, H. *et al.* Cross-feeding and interkingdom communication in dual-species biofilms of *Streptococcus mutans* and *Candida albicans* *ISME J.* <http://dx.doi.org/10.1038/ismej.2014.73> (2014)

**BACTERIAL GENETICS****Bacterial small RNAs scoop up proteins**

The homodimeric repressor of secondary metabolism (RsmA) binds to the ribosome-binding sites of a subset of bacterial mRNAs to repress translation, but in response to environmental stimuli, RsmA is sequestered by the binding of the small non-coding RNA (sRNA) RsmZ. Allain and colleagues now report the structural basis of RsmA sequestration by *Pseudomonas fluorescens* RsmZ. They show that RsmA binds to the GGA motifs of RsmZ and that RsmZ can bind up to five RsmA dimers in a sequential, ordered and cooperative manner. Two distinct ribonucleoprotein conformations were observed, which suggests that there are two assembly pathways. Finally, RsmZ contains three RNase E cleavage sites that are located close to the GGA motifs; thus, in addition to sequestering RsmA, progressive binding of RsmA protects the sRNA from degradation by RNase E.

**ORIGINAL RESEARCH PAPER** Duss, O. *et al.* Structural basis of the non-coding RNA RsmZ acting as a protein sponge. *Nature* <http://dx.doi.org/10.1038/nature13271> (2014)