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IN BRIEF

MARINE MICROBIOLOGY

UCYN-A fixes N_2 in the sea

Species in the cyanobacterial genus *Trichodesmium* are considered to be the main contributors to microbial dinitrogen (N_2) fixation in the ocean. However, Martínez-Pérez *et al.* now show that the symbiotic cyanobacterium UCYN-A, which associates with eukaryotic algae, also fixes N_2 in the surface waters of the tropical North Atlantic. They assessed N_2 fixation rates and the diazotrophs (N_2-fixing microorganisms) that are responsible for them on a west–east transect. *Trichodesmium* spp. were mainly present in the western basin, whereas UCYN-A was abundant in the western, eastern and central basins. UCYN-A1 and UCYN-A2 were both present and they were associated with a smaller and larger alga, respectively. Importantly, all UCYN-A1 and UCYN-A2 algal associations could actively fix N_2; this may be the first demonstration of UCYN-A2 doing so. Finally, as UCYN-A is abundant in many parts of the ocean and has a much faster growth rate than *Trichodesmium* spp., UCYN-A–algae associations might be key diazotrophs globally.

ORIGINAL ARTICLE Martínez-Pérez, C. *et al.* The small unicellular diazotrophic symbiont, UCYN-A, is a key player in the marine nitrogen cycle. *Nat. Microbiol.* **1**, 16163 (2016)

STRUCTURAL BIOLOGY

Zooming in on F pili

Despite the importance of the bacterial F pilus in DNA transfer and as an entry point for phages, its structure was unknown. Costa *et al.* now solve the structure of two plasmid-purified F family pili — the pED208 and F pili — at 3.6 Å and 5.0 Å, respectively. Both pili, which are polymers of the pilin protein VirB2, were 87 Å in diameter with an internal lumen of 28 Å and, interestingly, also contained a phospholipid entity. Further analysis revealed that pED208 contained two major phosphatidylglycerol species, whereas F pili contained one, and that these pili are helical assemblies of protein–phospholipid units. Phosphatidylglycerol head groups line the pili lumen, which changes its electrostatic charge from positive (in the absence of phosphatidylglycerol) to moderately negative. The importance of these findings is highlighted by data showing that phosphatidylglycerol preserves pilin structure and confers an electrostatic charge that facilitates DNA transfer and phage infection through pili.

ORIGINAL ARTICLE Costa, T. R. D. *et al.* Structure of the bacterial sex F pilus reveals an assembly of a stoichiometric protein–phospholipid complex. *Cell* **166**, 1436–1444 (2016)

ANTIMICROBIALS

Hitting malaria on several levels

Current antimalarial drugs cannot target all stages of the *Plasmodium* spp. lifecycle and are challenged by drug-resistant strains of *Plasmodium falciparum*. Kato *et al.* sought more effective drugs against this parasite by testing synthetic compounds, the structures of which were based on all of the natural products available rather than on one specific product. One series of compounds, represented by bicyclic azetidine BRD3444, was effective against a multidrug-resistant strain of *P. falciparum* at the blood-stage (asexual and sexual) and liver-stage of its lifecycle. Several assays revealed that BRD3444 inhibits phenylalanyl-tRNA synthetase, a previously unknown antimalarial target. Optimized analogues of BRD3444 were subsequently generated and could eliminate blood-stage and liver-stage *Plasmodium berghei* (a rodent malarial parasite) and *P. falciparum*, and prevent their transmission to mosquitoes.

ORIGINAL ARTICLE Kato, N. *et al.* Diversity-oriented synthesis yields novel multistage antimalarial inhibitors. *Nature* http://dx.doi.org/10.1038/nature19804 (2016)