IN BRIEF

SYNTHETIC BIOLOGY

Breaking away to break down

Plant cell walls contain the aromatic polymer lignin, which is considered as a sustainable source for synthetic biology applications. Biological conversion of lignin depends on specific enzymes, which are mainly secreted by fungi. However, bacteria may also possess the ability to depolymerize lignin as a carbon and energy source. Hettich, Beckham and colleagues showed that the exoproteome of the soil bacteria *Pseudomonas putida* KT2440 is distinct from the intracellular proteins in lignin-rich media. Moreover, they reported the secretion of outer membrane vesicles (OMVs) to the extracellular milieu in the presence of lignin, and that the OMVs encapsulate enzymes involved in the catabolism of lignin-derived aromatics, and the activity of those enzymes was confirmed in a functional assay. Thus, OMV-mediated secretion of functional sets of enzymes might be suitable to improve microbial lignin conversion in the synthetic biology and biotechnological settings.

ORIGINAL ARTICLE Salvachúa, D., Werner, A. Z., Pardo, I., Michalska, M. et al. Outer membrane vesicles catabolize lignin-derived aromatic compounds in ***Pseudomonas putida*** KT2440. ***Proc. Natl. Acad. Sci. USA*** https://doi.org/10.1073/pnas.1921073117 (2020)

MICROBIOME

Early changes

The early human gut microbiota affects health and disease states during life, and research efforts have focused on understanding initial colonization, development and function. Bittinger, Zemel, Wu and colleagues studied the gut microbiome, proteome and metabolome in the faecal samples of newborns taken during their first days after birth. By 16 h, bacteria became detectable using molecular methods, and the detected bacterial strains did not exhibit a genomic signature. The proteomic and the faecal metabolomic profiles were altered upon the appearance of bacteria and were consistent with anaerobic rather than aerobic bacterial growth; several amino acids decreased whereas several products of bacterial fermentation increased with the detection of bacteria. In sum, the findings of the study suggest a biochemical shift in the infant samples associated with the appearance of bacteria.

ORIGINAL ARTICLE Bittinger, K., Zemel, B. S. & Wu, G. D. et al. Bacterial colonization reprograms the neonatal gut metabolome. *Nat. Micro.* https://doi.org/10.1038/s41564-020-0694-0 (2020)

SYMBIOSIS

Deadly friends

Rough-skinned newts produce tetrodotoxin (TTX), which is a deadly neurotoxin that blocks voltage-gated sodium channels in predators. However, so far the origin of the toxin was not clear. Here, Eisthen and colleagues tested whether highly toxic newts harboured TTX-producing bacteria. They cultured isolates of the skin-associated microbiota from a toxic population and a non-toxic population of newts and identified TTX-producing bacterial strains from four genera in the collected samples, including *Aeromonas*, *Pseudomonas*, *Shewanella* and *Sphingopyxis*. This observation suggests that the symbiotic bacteria are the source of TTX toxicity in those animals. Finally, the authors showed that TTX resistance in toxic newts and other animals was owing to modified TTX binding sites in the sodium channel, which indicates a role of the host-associated bacteria in shaping the evolution of TTX resistance.

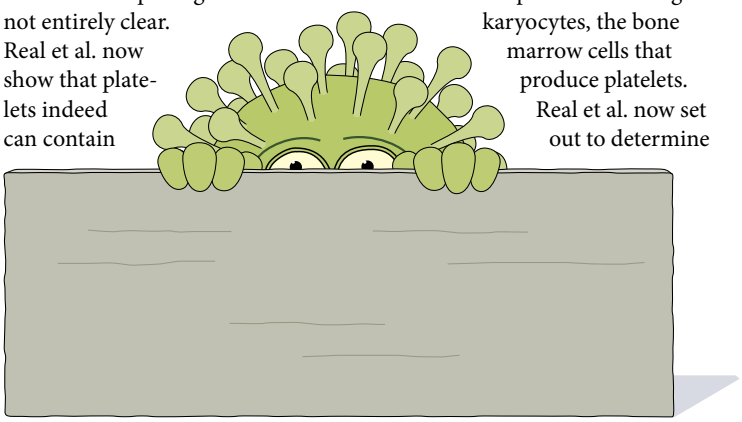
ORIGINAL ARTICLE Vaelli, P. M. et al. The skin microbiome facilitates adaptive tetrodotoxin production in poisonous newts. *eLife* **9**, e53898 (2020)

VIRAL INFECTION

HIV hides in platelets

The main target cells of HIV are $CD4^+$ T cells and other immune cells, such as macrophages and dendritic cells. In addition, the virus has been found in other cell types, including haematopoietic progenitor cells, astrocytes and even platelets. However, the relevance of these findings for infection and pathogenesis is not entirely clear. Real et al. now show that platelets indeed can contain replication-competent HIV that can propagate infection to macrophages.

Early studies from the nineties already found HIV RNA in platelets but it was unclear whether this RNA came from intact, infectious virions. Later in vitro work showed that virions interact with platelets and megakaryocytes, the bone marrow cells that produce platelets. Real et al. now set out to determine



Credit: Philip Patenall/Springer Nature Limited

BACTERIAL DEVELOPMENT

Attracting a ride

Bacteria emit various volatile organic compounds (VOCs) that are sensed by other organisms. For example, geosmin has a strong 'earthy' smell that is associated with rain falling on soil after a dry spell, and 2-methylisoborneol (2-MIB) is an odour of cork taint in wine. Yet, the ecological roles of bacterial VOCs remain largely unknown. In a recent study, Becher et al. found that developmentally regulated geosmin and 2-MIB attract springtails (small, wingless arthropods) to soil-dwelling *Streptomyces* species, promoting the dispersal of spores.

The authors performed field and laboratory experiments to investigate whether *Streptomyces* spp. VOCs attract arthropods in soil. In field experiments, they observed significant attraction of springtails to traps baited with *Streptomyces coelicolor* compared with control traps, which was confirmed in the laboratory using the model springtail *Folsomia candida*.

Next, the authors investigated chemosensory responses in *F. candida* antennae to identify the VOCs that are sensed by springtails. Gas chromatography analyses of *S. coelicolor* odour samples combined with electroantennography led to the identification of geosmin and 2-MIB as the VOCs responsible for eliciting attraction. In behavioural assays, *F. candida* was attracted to geosmin at doses as low as 1 ng, but did not show significant attraction to headspace gas samples from a geosmin mutant. At a slightly higher dose, 2-MIB also contributed as an attractant. Interestingly, the authors observed that *F. candida* fed on sporulating colonies of *S. coelicolor*, and providing *S. coelicolor* as the only food source had positive effects on *F. candida* moulting and egg