cycle at G2 and eventual cell death. Although the authors have yet to identify the specific compound or compounds responsible for the effect, they propose the name 'colibactin' for the compound(s) involved.

The *pks* island is widely distributed within *E. coli* phylogenetic group B2, which contains many extraintestinal pathogens. In these pathogenic isolates 'colibactin' could be a virulence factor. However, *pks* is also found in commensal representatives from group B2 and the authors suggest that here, the cell-cycle-blocking activity of 'colibactin' might slow the turnover of the intestinal epithelium, and therefore prolong colonization. The authors conclude with the intriguing suggestion that this new genotoxic activity could promote both commensalism and pathogenicity, depending on the circumstances.

Sheilagh Molloy

ORIGINAL RESEARCH PAPER Nougayrède, J-P. *et al.* *Escherichia coli* induces DNA double-strand breaks in eukaryotic cells. *Science* **313**, 848–851 (2006)

virus replication. How can a 5′-motif facilitate synthesis of a complementary minus-strand RNA that must initiate from interactions between the DV RdRp and the 3′-end of the genomic template? The authors engineered hybrid templates that were efficiently transcribed irrespective of length — but only if a combination of conserved sequences and SLA was present. The authors argue that SLA is the promoter for the DV RdRp, and that long range communication between the 5′- and 3′-ends of the viral RNA position the promoter adjacent to the 3′-end of the genome. As SLA also functions as a promoter *in trans*, the authors speculate that plus-strand synthesis might occur through the use of a double-stranded template

Other *Flaviviridae* include hepatitis C virus and yellow fever virus, so this research might shed light on the replication strategies of these important pathogens.

Susan Jones

ORIGINAL RESEARCH PAPER Filomatori, C.V. *et al.* A 5′ RNA element promotes dengue virus RNA synthesis on a circular genome. *Genes Dev.* **20**, 2238–2249 (2006)

INDUSTRIAL MICROBIOLOGY

'Microdiesel' to the rescue?

In an era in which the prospect of diminishing fossil-fuel supplies is an inescapable reality, alternative energy resources that are financially viable, sustainable and ecologically friendly are urgently required. Biodiesel is one alternative energy source that is derived from renewable plant material, primarily vegetable oil feedstocks; however, despite the many environmental benefits, biodiesel production is hampered by a requirement for extensive acreage to harvest the necessary amounts of oilseed crops. In a recent paper in *Microbiology*, Steinbüchel and co-workers report on the construction of a metabolically engineered strain of *Escherichia coli* that can produce biodiesel – termed 'microdiesel' – from renewable carbon sources, a step towards the goal of extracting fuel from readily available bulk plant materials, including sugar and cellulose.

Biodiesel is produced from renewable biomass by the transesterification of triacylglycerols derived from plant oils. The products of this reaction are monoalkyl esters of long-chain fatty acids with short-chain alcohols including fatty acid ethyl esters (FAEEs), and these molecules form the basis of the biofuel. The transesterification process and the subsequent purification steps are cost-intensive and time-consuming, which, when coupled with the low yield of biodiesel that is ultimately obtained from oilseed crops, combine to put significant limitations on this fuel becoming an effective alternative energy source. To address these issues, Kalscheuer *et al.* developed a microbial process to produce biodiesel-adequate FAEEs from renewable and simple carbon sources. Their strategy consisted of co-expressing the gene encoding acyltransferase (WS/DGAT) from *Acinetobacter baylyi* strain ADP1, an enzyme that has the advantage of low substrate specificity, with the ethanol production genes — encoding pyruvate decarboxylase and alcohol dehydrogenase — from the fermentative bacterium *Zymomonas mobilis*. Heterologous expression of these genes in the recombinant host, *E. coli*, resulted in significant FAEE biosynthesis by a metabolic process that allowed the significant amounts of ethanol produced to be combined with the subsequent esterification of the ethanol with the acyl moieties of coenzyme A thioesters of fatty acids. FAEE concentrations of over 1 gram per litre, constituting approximately 26% of the bacterial dry mass, were achieved by fed-batch fermentation using renewable carbon sources.

Although the FAEE yields obtained were significantly below the requirements of a viable industrial process, the feasibility of the approach was clearly demonstrated in the study. One caveat with the current approach is that the substantial FAEE biosynthesis achieved was dependent on the addition of exogenous fatty acids to the bioreactor cultivation. *De novo* fatty-acid biosynthesis by *E. coli* does not provide sufficient acyl substrates for WS/DGAT-mediated FAEE synthesis, indicating that this microorganism is not the ideal 'platform' for biodiesel production. Future work will focus on sourcing alternative, more appropriate bacterial hosts to maximize FAEE production efficiency, and on optimizing the metabolic reactions involved in producing microdiesel from cheap, globally abundant and renewable plant sources.

David O'Connell

ORIGINAL RESEARCH PAPER Kalscheuer, R., Stölting, T., & Steinbüchel, A. Microdiesel: *Escherichia coli* engineered for fuel production. *Microbiology* **152**, 2529–2536 (2006)
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WEB SITE
Alexander Steinbüchel's laboratory: http://mibi1.uni-muenster.de/Biologie.IMMB.Steinbuechel/Steinbuechel/Index.html