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► COVER: 'Directing current' by Philip Patenall, inspired by the Review on p706.

Since the discovery of archaea, their origin and evolutionary relationship with eukaryotes have been fundamental questions in biology. Two opposing theories have been put forward to explain the relationship between archaea and eukaryotes: one theory proposes that they are sister lineages originating from a common ancestor, whereas the other suggests that eukaryotes arose from one lineage of archaea. On page 743 Simonetta Gribaldo and colleagues examine why the large-scale phylogenetic studies that have been carried out to resolve this issue have yielded opposing results and have yet to reach a consensus. They go on to propose alternative strategies (for example, the analysis of orthologous genes) that they believe will provide answers to these questions.

Insight into this important evolutionary question has also recently been provided by the discovery of an archaeal homologue of ESCRT-III (eukaryotic endosomal sorting complex required for transport III), which in archaea is involved in cell division. On the basis of this finding, Stephen Bell and colleagues (page 731) carry out a comparative genomic analysis of the cell division machineries used in bacteria and archaea. They identify at least four different potential division machineries and propose that the ancestor of archaea contained all these membrane remodelling systems, which were lost as archaea evolved.

This issue also includes the third article in our series on Applied and Industrial Microbiology. On page 706 Korneel Rabaey and René Rozendal introduce the concept of microbial electrosynthesis — the microbial production of chemicals by using electrical current to drive microbial metabolism — and discuss the opportunities for its use as well as the challenges that might arise.



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