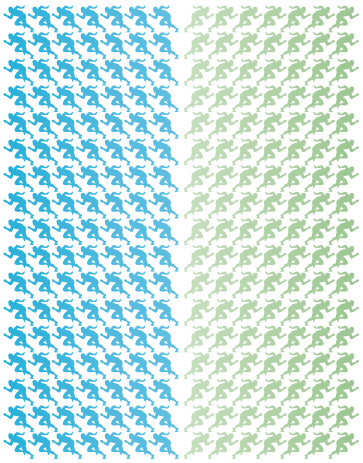
CELLULAR MICROBIOLOGY

Synchronized switching

A new report published in *The EMBO Journal* presents a mechanism to explain the synchronous polarity switch that occurs in the two motility machineries that are present in *Myxococcus xanthus* cells and allows this soil bacterium to reverse its direction of movement.

M. xanthus cells have two different motility systems that control their gliding movements: the social (S-motility) and adventurous (A-motility) systems. S-motility is used for gliding in multicellular groups and is dependent on type IV pili, which localize to the leading cell pole and generate a motive force by retraction. A-motility is used for individual cell gliding, but how motive force is generated is unknown. *M. xanthus* cells periodically reverse direction when they move over a surface, so that the lagging pole becomes the leading pole. The regulation of the frequency of cell reversal is crucial for making swarming colonies in the presence of nutrients and fruiting bodies in the absence of nutrients, and occurs by the Frz two-component system.

To further investigate the A-motility system and the mechanisms that underlie polarity switching, Søgaard-Andersen and colleagues focused on the uncharacterized RomR (required for motility response) regulator



protein. The authors produced a strain of *M. xanthus* that had a *romR* insertion mutation and found that RomR is required for A-motility. Localization studies using green fluorescent protein showed that RomR localizes in a bipolar, asymmetric pattern, with a large cluster at the lagging pole (opposite to the pole that contains pili), and a smaller cluster at the leading pole. In addition, the relocalization of RomR is essential for cell reversal, and is a dynamic process that involves the transfer of RomR between the poles, such that the large RomR cluster relocates to the new lagging pole in synchrony with cell reversals.

The authors then showed that the dynamic relocalization of RomR is regulated by the Frz two-component system, and that the small GTPase MgIA, which is important for the activity of both motility systems in *M. xanthus*, is necessary for establishing the correct polarity of the two systems, and for RomR pole switching.

Further investigation revealed that the S-motility protein FrzS localizes with the type IV pili (opposite the RomR cluster) and relocates to the opposite pole during cell reversals in an Frz-dependent manner. Moreover, it was found that RomR and FrzS localize to the poles and relocate independently, but synchronously.

This paper suggests that part of the A-motility machinery is specified by the large RomR cluster, and that the dynamic localization of RomR is necessary for cell reversals; in addition, these results indicate that the Frz two-component system is the mechanism that synchronizes the polarity switching of the motility machineries in *M. xanthus*.

Sharon Ahmad

ORIGINAL RESEARCH PAPER Leonardy, S. *et al.* Coupling of protein localization and cell movements by a dynamically localized response regulator in *Myxococcus xanthus*. *EMBO J.* **26**, 4433–4444 (2007)
FURTHER READING Zusman, D. R. *et al.* Chemosensory pathways, motility and development in *Myxococcus xanthus*. *Nature Rev. Microbiol.* **5**, 862–872 (2007)