# Mathematical modeling of gliding motility and its regulation in Myxococcus xanthus

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## Mathematical modelling of gliding motility and its regulation in *Myxococcus xanthus*

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*Myxococcs xanthus* manages "social" behaviors, such as cooperative feeding and fruiting-body formation, through intercellular communication and coordination. A particular intriguing intercellular coordination lies in coordination of motility between cells with physical contacts. Specifically, *M. xanthus* cells glide on substrate with periodic reversals, and physical contacts with opposite-moving colony mates regulate the reversal frequency. This contact-dependent motility coordination is known to be necessary for intriguing population patterns, such as rippling waves. Frz proteins, regulators that control the periodic reversals in *M. xanthus*, exhibit subcellular dynamics that are highly correlated with that of the gliding motility motors and change in response to cell-substrate and cell-cell contacts. To understand how control and coordination of *M. xanthus* motility works, we developed a mathematical model to capture the coupling between the Frz regulators and the gliding motility machinery in cell reversal control. Using the model, we identified several possible mechanisms through which cell-cell contacts can induce proper responses in cell reversals required for generating the rippling waves. Interestingly, we found that both phase advance and phase delay in the cell reversal upon cell-cell contact were able to generate rippling waves. Our model has proposed a new mechanistic explanation for contact-dependent motility coordination in *M. xanthus.*