Swimming behaviour of polarly-flagellated bacteria

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Lophotrichous bacteria swim through fluid by rotating their flagellar bundle extended collectively from one pole of the cell body. Cells experience modes of motility such as push, pull, and wrapping, accompanied by pauses of motor rotation in between. We present a mathematical model of a lophotrichous bacterium and investigate the hydrodynamic interaction of cells to understand their swimming mechanism. We classify the swimming modes that vary depending on the hook's flexibility and the magnitude of torques the motor generates. We also investigate reoriented directions of cells in three-dimensional perspectives as the cell experiences different series of swimming modes. Our simulations show that the transition from a wrapping mode to a push mode and pauses in between are the key factors to determine a new path and that the reoriented direction depends upon the start time and duration of the pauses. It is also shown that the wrapping mode may help a cell to escape from a confined region near a wall.

REFERENCES

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