Supporting Material:

Using Liquid Crystals to Reveal How Mechanical Anisotropy Changes Interfacial Behaviors of Motile Bacteria

Peter C. Mushenheim,[†] Rishi R. Trivedi,[‡] Douglas B. Weibel[‡]* & Nicholas L. Abbott[†]*

[†]*Department of Chemical and Biological Engineering, University of Wisconsin-Madison, 1415 Engineering Drive, Madison, WI, 53706, USA. Fax: +1 608-262-5434; Tel: +1 608-265-5278;*

[‡]*Department of Biochemistry, University of Wisconsin-Madison, 433 Babcock Drive, Madison, WI, 53706, USA.* Fax: +1 608-265-0764; Tel: +1 608-890-1342

*Correspondence: weibel@biochem.wisc.edu and abbott@engr.wisc.edu

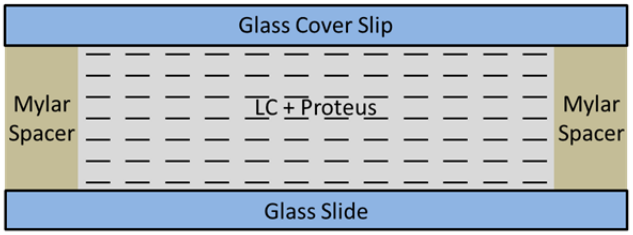

Figure S1. Experimental setup. A schematic illustration depicting imaging chambers used to analyze bacterial cells in LC solutions. The LC director profile of nematic DSCG at 25°C (in a region of the sample exhibiting uniform polar and azimuthal alignment) is indicated by the dotted lines.

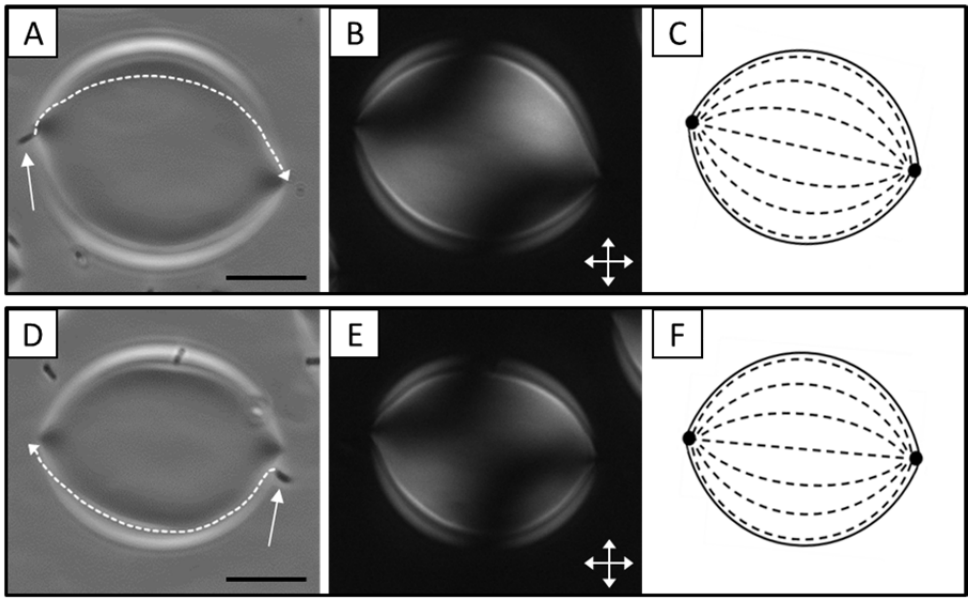

Figure S2. Additional examples of LC elasticity-induced guided motility of cells adsorbed to nematic tactoids. Two examples (*A–C* and *D–F*) of the motility of *P. mirabilis* cells adsorbed to the interface of nematic tactoids. (*A* and *D*) Bright field micrographs of nematic tactoids on which the trajectories of motile *P. mirabilis* cells (indicated by arrows) adsorbed to the N-I interface are indicated. (*B* and *E*) Corresponding crossed polars images. (*C* and *F*) Schematic representations of the LC director profiles of the tactoids in *B* and *E*, respectively. Scale bars are 10 μm.

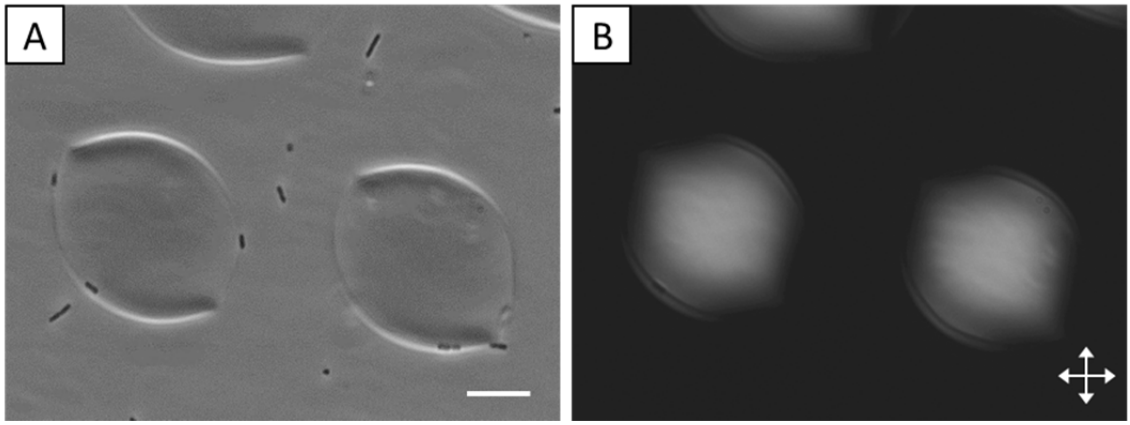

Figure S3. Orientations of non-motile bacteria adsorbed to nematic tactoids. (*A*) Bright field and (*B*) crossed polars images, respectively, of non-motile *P. mirabilis* cells adsorbed at the interface of nematic tactoids that formed on a glass substrate following cooling of an isotropic phase of DSCG (15 wt%) from 40°C to 33°C. The scale bar is 10 μm.

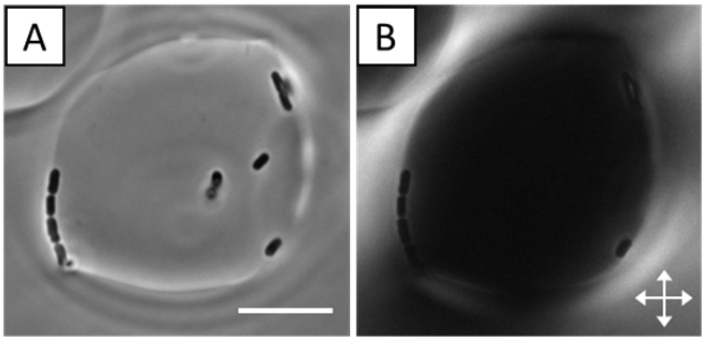

Figure S4. Trapping of non-motile cells at the boojum associated with an isotropic tactoid. (*A*) Bright field and (*B*) crossed polars micrographs of non-motile *P. mirabilis* cells adsorbed at the N-I interface of an isotropic tactoid. Scale bars are 10 μm.

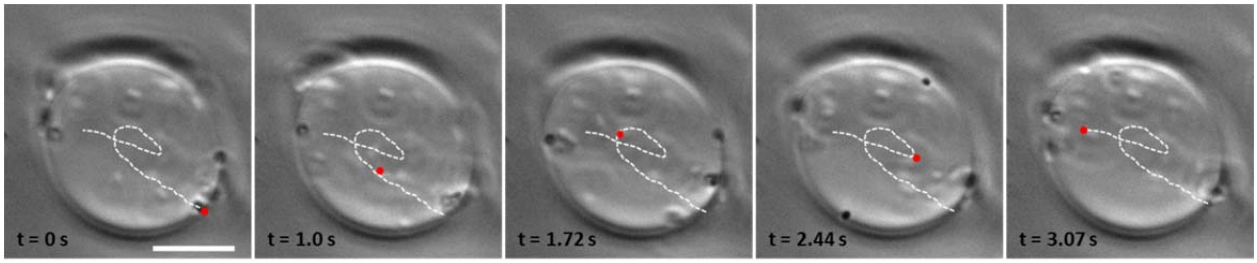

Figure S5. Escape of an adsorbed motile cell into the interior of an isotropic tactoid. Sequence of bright field micrographs that depicts the trajectory of a motile *P. mirabilis* cell, initially adsorbed to the interface of an isotropic tactoid, which escapes into the interior of the tactoid. The trajectory of the cell (indicated by a red dot) is depicted in the images. The random motion of the cell suggests that it is not adsorbed to the N-I interface. The scale bar is 10 μm.

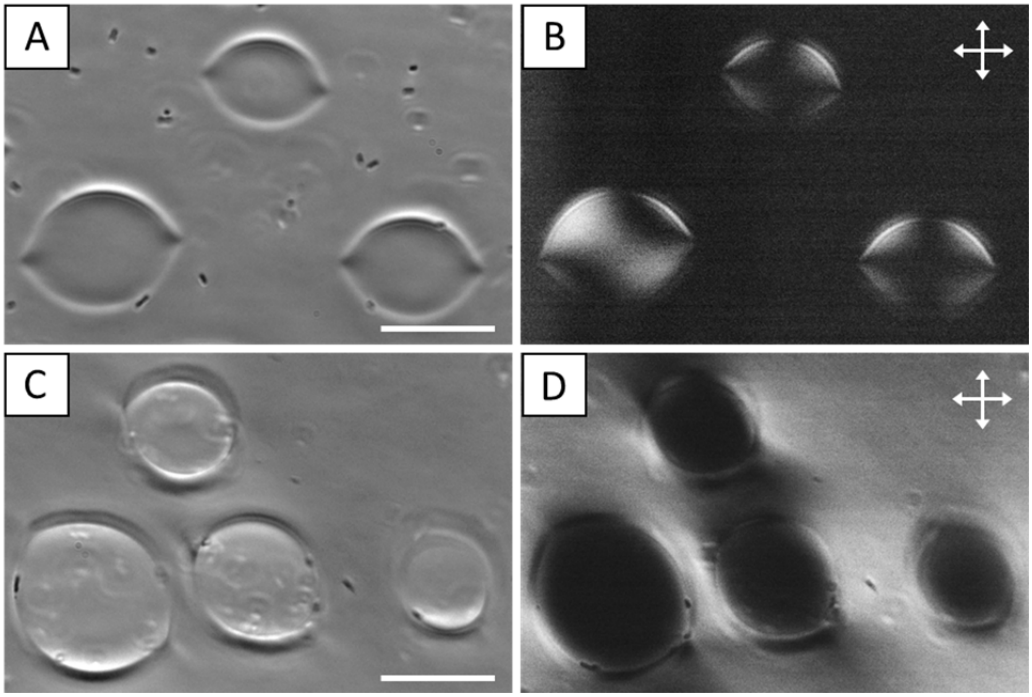

Figure S6. Temporal accumulation of motile bacteria at the interface of isotropic tactoids. (*A* and *B*) Bright field and crossed polars images, respectively of motile *P. mirabilis* cells dispersed in DSCG solution quenched to 33°C that contains nematic tactoids encompassed by isotropic phase solution. (*C* and *D*) Bright field and crossed polars images, respectively of motile *P. mirabilis* cells dispersed in DSCG solution heated to 30°C that contains isotropic tactoids surrounded by a continuous nematic phase. All images were obtained following 15 min of equilibration at the specified temperatures. Scale bars are 20 μm.

Supplementary Movie Captions

Movie S1 Bright field optical microscopy movie in which the trajectories of motile *P. mirabilis* cells adsorbed to the N-I interface of a nematic tactoid largely map out the interfacial director profile of the tactoid. Additionally, bacteria can be observed escaping the interface at the cusped poles of the tactoids where a boojum is present. Scale bar = 10 μm.

Movie S2 Bright field optical microscopy movie in which a single motile *P. mirabilis* cell adsorbed to the N-I interface of an isotropic tactoid escapes into the continuous nematic phase at the cusped pole of the tactoid, which is adjacent to a boojum defect in the nematic phase. Scale bar = 10 μm.

Movie S3 Bright field optical microscopy movie that shows accumulation of motile *P. mirabilis* adsorbed to the N-I interface of an isotropic tactoid at the cusp-shaped pole. The large aggregate of cells collectively escape into the continuous nematic phase. Scale bar = 10 μm.

Movie S4 Bright field optical microscopy movie that shows the accumulation of motile *P. mirabilis* within and at the N-I interface of a large isotropic domain that spans the entire thickness of the experimental cell. This isotropic domain formed by quenching the 15 wt% DSCG solution from 40°C to 30°C. Scale bar = 20 μm.