

## Supplementary information: Video captions

### Video 1:

This video is playing back at 10 fps. In this video, *S. oneidensis* has a vertical orientation relative to the surface. Its body is spinning around its long axis, and the rotation is fast, generally constant, and generally in one direction.

### Video 2:

This video is playing back at 10 fps. In this video, *S. oneidensis* has a vertical orientation relative to the surface. Its body is wobbling back and forth about its long axis. In real time, this motion is nearly indistinguishable from the regular vertical spin behaviour in video 1, which is more common.

### Video 3:

This video shows an assortment of surface motility behaviours for *S. oneidensis*. There is vertical, tilted, and horizontal rotation about an axis normal to the surface and through one of its poles. While horizontal, the cell body can also vibrate back and forth without fully revolving. Another unique motion is the cell body undergoing nutations. The cell body orientation oscillates between a vertical and horizontal orientation while it is revolving about an axis normal to the surface and through one of its poles. This behaviour is highlighted in video 4 in slower motion.

### Video 4:

This video is playing back at 10 fps. This video highlights the nutation behaviour for *S. oneidensis* mentioned in video 3. The cell body orientation oscillates between a vertical and horizontal orientation while it is revolving about an axis normal to the surface and through one of its poles. This nutation is preceded by the cell body rotating about its long axis while the body orientation is tilted, and the nutation is followed by the cell body rotating about its long axis while the body orientation is near vertical.

### Video 5:

In this video, *V. cholerae* has a vertical orientation relative to the surface. Its body is spinning around its long axis, and the rotation is fast, generally constant, and generally in one direction. In general, *V. cholerae* does not spend a lot of time in this state.

### Video 6:

In this video, *V. cholerae* is mostly horizontal relative to the surface. While in this state, the cell body is rotating with one pole near the axis of rotation. This rotation is intermittent and can change directions. Near the end of the video, the cell body begins rotating about its long axis and transitions to a vertical orientation. This rotation is similar to the rotation in video 5. The cell body then transitions to a horizontal orientation while rotating about its long axis and begins rolling around the surface in a circular trajectory. It then detaches from the surface while in this rolling horizontal state.

### Video 7:

This video shows an assortment of surface motility behaviours for *P. aeruginosa*. There is vertical, tilted, and horizontal rotation about an axis normal to the surface and through one of its poles. Clockwise rotation direction is highly correlated with horizontal rotation, while counterclockwise rotations highly correlate with tilted and vertical rotations. Rotations in both directions have relatively constant angular speeds.

Video 8:

This video shows another type of horizontal rotation behaviour for *P. aeruginosa*. The rotation is still about an axis normal to the surface and through one of its poles. The cell body tends to vibrate back and forth without fully revolving, although it sometimes makes a full rotation.