**Supplementary Information**

**Supplementary Video 1**

Real-time video corresponding to Figure 4 at 0 minutes. An 8.8 µm magnetic bead with a small bacterial cell population attached within a rotating magnetic field.

**Supplementary Video 2**

Real-time video corresponding to Figure 4 at 30 minutes. An 8.8 µm magnetic bead with a small bacterial cell population attached within a rotating magnetic field after 30 minutes of growth.

**Supplementary Video 3**

Real-time video corresponding to Figure 4 at 60 minutes. An 8.8 µm magnetic bead with a small bacterial cell population attached within a rotating magnetic field after 60 minutes of growth.