Purcell described the experience of a 1 μm bacterium being pushed through water at 30 $\mu m \cdot s^{-1}$. Given its cross-section and the viscosity of water, if you stopped applying force, the bacterium would stop in 1×10^{-11} m. To get a feel for what this means, imagine you scale the bacterium up to the same size as a school bus (10 m long – now that's a terrifying picture).[1]

1. How fast would the bus-bacterium be moving while being pushed (scaling linearly on length)? What's some other macroscopic object that moves roughly this fast?

2. Over what distance does the bus-bacterium stop after the force is no longer applied (scaling linearly on length)?

3. Water molecules are approximately spheres with radius 1.4×10^{-10} m. If they were on the same scale as the bus-bacterium, how big would they be? What object can you think of that is about this size?

4. Imagine the bus-bacterium immersed in a giant vat of the object you came up with above. Given this mental image, let's think about a real

[1] Note: We're only scaling on length to get a notion for the relative distances. Things like energy and momentum won't be on the right scale, so no fair imagining what it would be like for you to sit on a bus that behaves this way!

bacterium. What, molecularly, might be happening that causes it to stop over such a tiny distance?