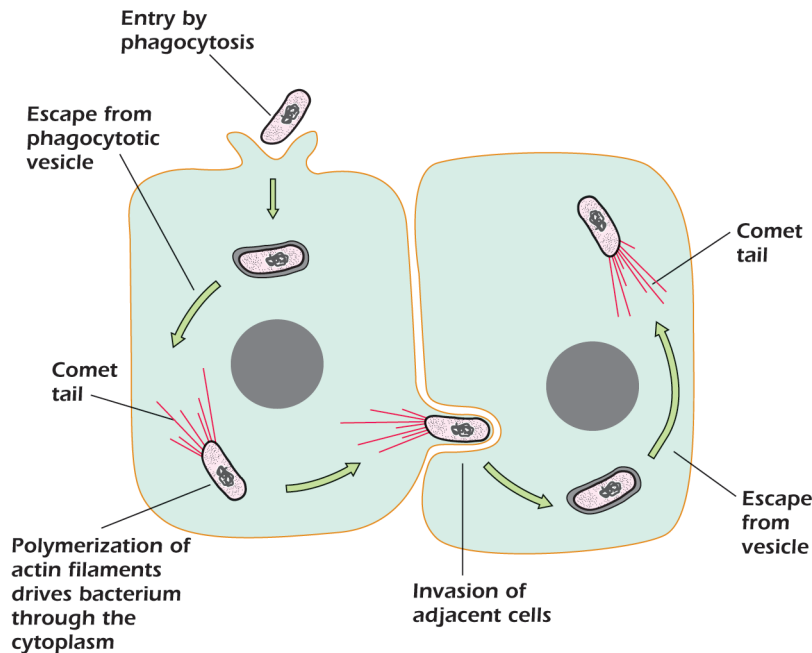


Chapter 17

Web Text Box 2

How *Listeria* uses actin polymerization to pass between host cells

Most bacteria that invade our bodies are neutralized by the immune system before they cause infection. Some, however, escape the immune response by hiding out inside the cells of their host. A good example is the bacterium *Listeria monocytogenes*. Named after the British physician Joseph Lister who pioneered sterility in the operating theatre, *Listeria* normally lives in soil and water. When ingested, for example, by eating vegetables contaminated with *Listeria*-bearing soil, the microbe rapidly crosses the intestinal barrier leading to the potentially fatal disease, listeriosis. *Listeria* expresses a protein called internalin on its surface. This binds to human cadherin (book page 292) triggering the uptake of the bacterium by phagocytosis. The role of internalin in *Listeria* infection was discovered through a series of remarkable experiments. Scientists noticed that mice were completely resistant to huge doses of *Listeria*. They checked the sequences of the cadherin genes of both species and noticed that whereas mouse cadherin had a glutamic acid at position sixteen in humans this amino acid was a proline. Could this tiny change be the source of such dramatic differences in sensitivity to the microbe? To test this a transgenic mouse was created in which the mouse gene was replaced by the human form. Sure enough, the modified mice were now killed by *Listeria*.



How *Listeria* uses actin polymerization to pass between host cells

Listeria spreads from cell to cell by highjacking the host cell cytoskeleton. One pole of the rod-shaped bacterium expresses the protein ActA which activates the host cell Arp2/3 complex (book page 288). This results in the polymerization of a 'comet tail' of actin filaments that drives the bacterium through the host cell cytoplasm. When the actin-powered bacteria collide with the cell membrane they form protrusions which are engulfed by the neighboring cell. Thus, once inside the first cell *Listeria* never again leaves the safety of the host cells and is a true intracellular parasite. *Listeria* is a particular problem for pregnant women because it can cross the placental barrier causing neonatal mortality. It can also enter the nervous system and cause meningitis.

An excellent movie of *Listeria* moving inside a living cell is available on [Julie Theriot's web site](#). Notice the protrusions that form when the bacteria reach the edge of the cell. In a solid tissue, these would push into, and be taken up by, the neighboring cell.

For more details on internalin and cadherin, see Lecuit et al. 1999. EMBO J, 18:3956 and Bonazzi et al. 2009. Cold Spring Harbor Perspectives in Biology Biol 1, a003087.