that bacteria and other microbes use to get around – in order to measure their flexibility under applied forces.

Block, physiologist Bruce Schnapp of Boston University, biologist Lawrence Goldstein of Harvard University and others now are training optical tweezers on motion-making proteins – such as myosin, kinesin, and dynein. Myosin works in muscle contraction. Kinesin helps move organelles (a term for a variety of substances within cells) along microtubules – major components of the microscopic "skeletal" systems inside nerve cells. Dynein enables sperm tails to wiggle.

"The molecular mechanisms by which any biological motor works remain obscure," Block notes. One can study kinesin by coating bacteria-sized glass beads with the protein and observing how the coated particles hook onto and move along a microtubule. In these experiments, the beads appear to glide slowly along in a smooth motion that Block suspects emerges from the collective action of many kinesin molecules. "But if each of the kinesin molecules were actually doing a chiggedy-chiggedy moving along [as some models of kinesin-mediated movement propose], you might expect to see some sort of jerkiness."

Fade in optical tweezers. Beads adorned with only one or two kinesin molecules may never encounter a microtubule with an orientation that leads to an interaction. "So you grab a bead with the optical tweezers, and then you physically place it on the microtubule," Block says. Such control enables the scientists to test models of the mechanisms underlying molecular machines.

"As soon as you touch [kinesin] down to the microtubule, it just starts taking off," Block says. But the movements appear jerky, he reported this week. The sparsely adorned beads also spontaneously detach from the microtubule, a process that may reflect the kinesin molecules' natural cycle of operation. In a collaboration with other scientists, Block and his coworkers are studying the molecular mechanisms by which hair cells – the sensory cells of the auditory system – change their positions slightly as they adapt to become sensitive to different wavelengths of sound.

Scientists also use optical tweezers for sorting cells, moving organelles from one place to another within a single living cell, and for moving isolated chromosomes on a microscope slide, Ashkin says. The ability to move organelles from their normal positions opens doors to sophisticated studies of cell function. "Things are where they are [in cells] for particular reasons," Ashkin notes. What happens when you relocate them? Stay tuned, he says. – *I. Amato*

Do-it-yourself evolution appears unlikely

Evolutionary biologists John E. Mittler and Richard E. Lenski performed a few straightforward experiments and got the kind of results that pretty much everyone expected. In this case, that's news.

The University of California, Irvine, researchers set out to test the validity of a controversial report suggesting that bacteria can direct their evolutionary development in ways best suited to their particular needs. That radical proposal, made by John Cairns of the Harvard University School of Public Health in Boston (SN: 9/10/88, p.166), ran counter to traditional Darwinian thought. Darwin held that mutations occur randomly in nature and that helpful mutations simply outsurvive harmful ones when subjected to selective environmental pressures.

Cairns based his conclusion on experiments he performed on a strain of the common gut bacteria *Escherichia coli* that contains a little piece of viral DNA. The so-called Lac- strain cannot metabolize the sugar lactose, so does not grow on media with only lactose as a nutrient. But if a Lac- bacterium mutates in a way that kicks out the viral DNA, it becomes Lac+, regaining the ability to metabolize lactose and triggering growth. Cairns' research suggested that compared to bacteria who are under no pressure to do so, Lac- bacteria placed in an environment where lactose is the only food available are much more likely to mutate into Lac+ variants.

The new work by Mittler and Lenski provides strong evidence that this mutation results not from any process of self-directed mutation, but because bacteria placed in an environment with no available food tend to eject viral DNA insertions more frequently than do well-fed bacteria. "The rate of excision mutation per viable cell per day increases by orders of magnitude as cells sit starving for several days," irrespective of whether lactose is present, they report in the March 8 NATURE.

But the issue remains far from settled. Cairns says he and others have been unable to duplicate the California researchers' findings. And both groups agree that the particular bacteria they've been using may be a less than perfect experimental system, as the viral sequence itself may be responding independently to the pressures of starvation. "In short, it's a bit of a mess," Cairns says.

It's impossible for now to completely rule out the possibility that some degree of directed mutation occurs in nature, says Bruce R. Levin, a population geneticist at the University of Massachusetts in Amherst. However, he adds, the new work "very clearly shows that the observation Cairns made can be explained by more mundane processes." – *R. Weiss*

Cesarean predisposes to long labor later

Women attempting vaginal birth after previously giving birth only by cesarean section normally have long labors, similar to women giving birth for the first time. This new finding may encourage obstetricians and women attempting vaginal delivery after previous cesarean sections to be more patient and to wait longer before opting for another cesarean section, says Cynthia Chazotte of the Albert Einstein College of Medicine in New York, who coauthored the report in the March OBSTETRICS AND GYNECOLOGY.

She and her co-workers studied 204 women: 44 women attempting vaginal birth after previously delivering only by cesarean section; 24 women attempting vaginal delivery who had previously given birth first vaginally and later by cesarean; 68 women in labor for the first time and 68 women who had previously given birth vaginally. The researchers found cesarean-only and first-time mothers averaged six to eight hours longer in labor than women who had previously delivered at least one child vaginally. Longer labor times in mothers who had never delivered vaginally probably result from less efficient uterine contractions and stretching of soft tissues around the pelvis, Chazotte says.

"Although most obstetricians intuitively suspected these results, the study gives us confidence that it's a good practice to allow these women to labor longer," says Russell Laros of the University of California, San Francisco.

Nearly one in four U.S. babies are delivered by cesarean section each year, according to the American College of Obstetrics and Gynecology, who in 1988 recommended that women who had previously delivered by cesarean have the opportunity to try vaginal delivery with subsequent births. But until now, sketchy scientific data existed for obstetricians to determine whether labor abnormalities in these women, including very long labors, should be judged by the same or by different criteria as those used for women who attempt labor without having had a previous cesarean section.

And in a study of 3,917 women in New York City comparing the risks of first-time birth in women 30 years and older with those women between the ages of 20 and 29 finds that women in the older group had more pregnancy complications, including a higher cesarean rate. The study in the March 8 NEW ENGLAND JOURNAL OF MEDICINE also finds that the older group didn't have an increased risk of having babies who were premature, who died shortly after birth, who were small for their gestational age or who had a low Apgar score, which assesses a newborn's physical health. – *C. Decker*

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