the actual pull of gravity changes. So Kasevich and his colleagues stacked one atom interferometer on top of another, a meter apart.

In their initial tests of the approach, the researchers gauged gradients between the devices as small as one part in 10,000,000. They have since improved the sensitivity of the setup 100-fold. Made over a broad area, such measurements can generate a map of gravitational gradients, useful for everything from prospecting for oil to warning a submarine navigator when his ship is nearing the sea floor.

The new device "is a very impressive first step" toward measuring gravitational gradients with atom interferometers, says Dave Pritchard, an atom interferometry pioneer at the Massachusetts Institute of Technology. For now, the mechanical gradiometers traditionally used to look for oil and gas deposits still beat the atom-based device in sensitivity. Part of the trouble, says Yale team member Jeff McGuirk, is that some vibrations can cause unwanted movements in the instrument's laser-directing mirrors, affecting the paths of the laser pulses through the interferometers. But McGuirk adds that the group has already tested a scheme for compensating for the vibrations, which should improve the sensitivity by another factor of 10 to 100, good enough to beat the competition, he says. –ROBERT F. SERVICE

CATHALEEN CURTISS

PROTEIN CHEMISTRY

A Two-Piece Protein Assembles Itself

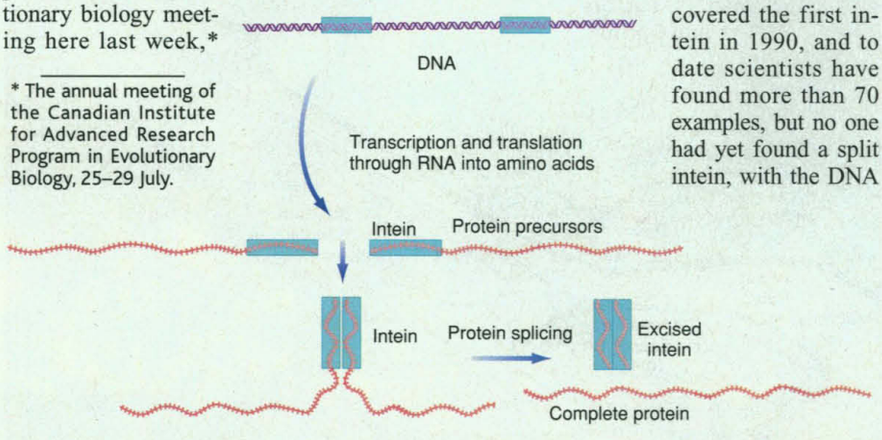
MONT-ROLLAND, QUEBEC—Proteins do many of the trickiest jobs in living cells, catalyzing reactions, passing signals, and providing basic structure. Now scientists have discovered a bacterial protein with yet another talent: seamlessly splicing together two other protein pieces. At an evolutionary biology meeting here last week,* molecular biologist Xiang-Qin Liu reported that he and his colleagues have identified a molecular matchmaker, a protein-within-a-protein called a split intein, which brings together two pieces of protein encoded on very different parts of the chromosome, knits the pieces together, and then neatly cuts itself out.

Scientists had theorized that a bit of protein with such clever action might exist, and several protein engineers had made artificial versions in the lab, but "it is gratifying and very exciting" to have an example in nature, says molecular biologist Henry Paulus of the Boston Biomedical Research Institute. Although many proteins are made from several subunits that clump together, this is the first time anyone has found a natural mechanism that actually splices two disparate protein fragments together into an unbroken amino acid chain. Researchers predict that other split inteins will surface from newly sequenced genomes, and they hope the find will lead to new ways to manipulate proteins in biotechnology.

The finding, published in the current issue of the *Proceedings of the National Academy of Sciences*, may also offer clues to the origin of more run-of-the-mill inteins—stretches of extraneous amino acids that interrupt proteins. Inteins are similar to the better known introns, sequences of extra DNA that commonly interrupt genes. Introns, however, are cut out of the RNA code for making a protein before the code is translated into an amino acid sequence. Inteins, on the other hand, are encoded in both RNA and DNA; only after they are translated into proteins do they remove themselves and splice the interrupted protein back together. In a process similar to some intron splicing mechanisms, the intein forms a loop, bringing the protein fragments together, and then catalyzes the formation of a normal peptide bond between them.

Researchers discovered the first intein in 1990, and to date scientists have found more than 70 examples, but no one had yet found a split intein, with the DNA

* The annual meeting of the Canadian Institute for Advanced Research Program in Evolutionary Biology, 25–29 July.



Some assembly required. A bacterial DNA polymerase protein is made in two pieces and then spliced together by a bit of protein called an intein.

ScienceScope

LANE, RICHARDSON GET GREEN LIGHT

While Congress and much of Washington head out of town this week on vacation, Bill Richardson and Neal Lane will start work in their new positions as, respectively, energy secretary and director of the White House Office of Science and Technology Policy (OSTP). The Senate confirmed both nominations by President Bill Clinton hours before leaving for a monthlong recess.

Richardson's confirmation came after Clinton assured Senator Larry Craig (R–ID) that the new secretary would have full authority over nuclear waste issues at the Department of Energy (*Science*, 31 July, p. 623). Craig had threatened to hold up the nomination because of his concerns about undue White House influence on DOE's approach to nuclear cleanup. Lane's nomination, in contrast, was not controversial, but was held up for months because of the Republican-controlled Senate's tardiness in approving Clinton nominees. Lane's confirmation clears the way for Rita Colwell to succeed him as National Science Foundation director.

... BUT VISA FIGHT ON HOLD

Congress left town, however, before resolving a controversy over how many software-savvy foreigners should be allowed to work in the United States. U.S. high-tech companies, citing a booming economy and tight job market, are lobbying lawmakers to increase the number of visas granted to skilled overseas workers—such as computer programmers, engineers, and scientists—from 65,000 this year to 115,000 in 2001. The visas, which can be extended for up to 6 years, can be an important step for workers looking to settle permanently in the United States.

Last May the Senate approved legislation to boost the visa ceiling, but the House was still struggling to pass its own version as *Science* went to press. If the bill is approved, it won't be until September that both chambers can come up with a single bill to send to President Bill Clinton for his signature. The White House has threatened to veto the legislation, saying that its provisions so far—including one designed to ensure that an employer tried and failed to find an American for the job and that no Americans were fired in order to hire a foreigner—don't go far enough to protect jobs for U.S. citizens.

Contributors: Andrew Lawler, Erik Stokstad, and Luis Campos.

encoding its loop-forming ends located in different places on the chromosome.

Liu and his colleagues at Dalhousie University in Halifax, Nova Scotia, made their discovery while "mining" the complete genome of a cyanobacterium called *Synechocystis*. They found that the genetic code for a key protein called DnaE, which helps to replicate DNA, was split between two genes separated by a very long stretch of other DNA. They also found telltale signatures of intein ends in the DNA in both genes.

Two other groups independently found the same signatures, but Liu's group is the first to report biochemical evidence that the intein works. The enzyme is too rare to be detected in *Synechocystis*, so the team inserted copies of the two genes, intein signatures included, into *Escherichia coli* bacteria and forced the bacteria to overexpress these genes. Three proteins were produced in quantity: the products of the two individual genes and a third, larger protein the same size as the other two spliced together, minus the intein fragments. The team examined parts of this large protein's amino acid sequence, including the suspected splicing site, and found that it was identical to the predicted DnaE protein, similar to those found in other bacteria. Thus they concluded that the split intein is active in cells.

Researchers hope that additional work on the split intein, which lacks a DNA-cutting sequence seen in most inteins, may eventually help solve the mystery of how inteins arose in the first place. Researchers have argued whether the original inteins had the DNA-cutting function—which is suspected of helping inteins spread from one genome to another—or were simply ancient protein manipulators, sewing together protein fragments to make new and improved enzymes. Liu's team is studying DnaE genes from closely related species, seeking clues to what this intein looked like before the splitting event.

The find may also help protein engineers find better ways to manipulate and produce proteins. Some therapeutic proteins, such as human growth hormone, are toxic in high amounts to the organisms enlisted to manufacture them. With a split intein, researchers could make the protein in two pieces in different organisms and assemble them later, Paulus says. Based on studies of regular inteins, at least two teams have already had some success at producing artificial split inteins. But Paulus says that perhaps nature does it better: "The fact that it can occur in [nature] means it's potentially a very efficient process."

–GRETCHEN VOGEL

PHYSICS

Accelerator Gets Set to Explore Cosmic Bias

An understanding of why the universe is biased in favor of matter may have come a step closer with a burst of collisions in a particle accelerator that has a bias of its own. Called the Asymmetric B Factory and based at the Stanford Linear Accelerator Center (SLAC), the machine collides a beam of electrons, accelerated in a ring 2200 meters around, with positrons, their antimatter partners, accelerated to lower energies in a second ring of the same size. The collisions spawn B mesons, particles containing heavy bottom quarks, and the energy mismatch flings the B's off to one side for study. On 23 July, just days after the positron ring was completed, the two rings collided particles for the first time—a critical step in the long process of getting this novel facility up and running, which should be completed early next year.

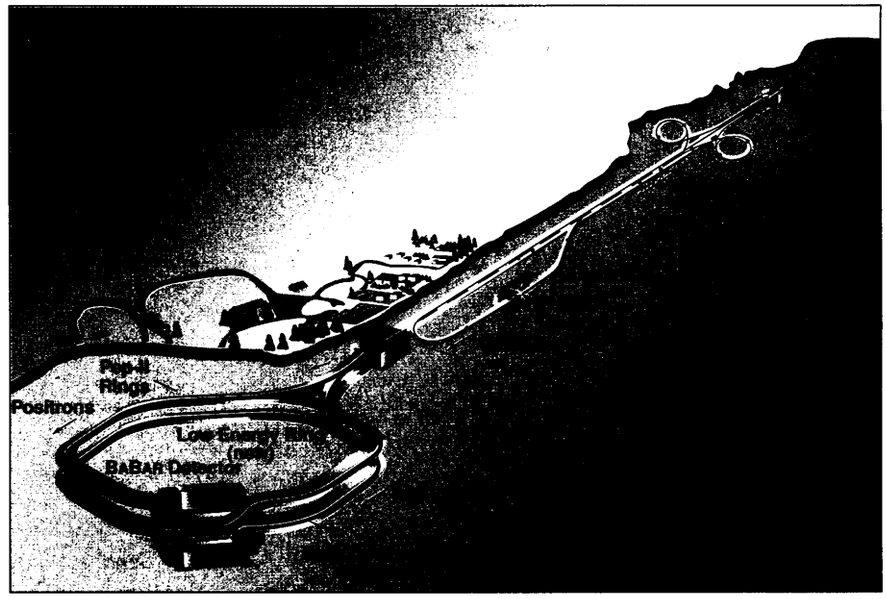
"We're very excited about what we have managed to do," says project leader Jonathan Dorfan. "It's definitely a milestone," agrees George Brandenburg of a competing facility, CESR, the Cornell Electron-Positron Storage Ring. The B mesons made in the Stanford machine, CESR, and other colliders around the world should enable physicists to probe a phenomenon called CP violation, a subtle effect that distinguishes matter from antimatter and could explain why we live in a matter-dominated universe. The asymmetric Stanford machine could offer an especially sharp view of the phenomenon, because it boosts the short-lived B mesons to a large fraction of the speed of light, extending their lifetime through the time dilation predicted by Einstein's theory of relativity.

The new machine, built on time and on budget at a cost of $177 million, uses electron and positron beams from the existing SLAC linear accelerator. It stores the 9.0-billion-electron-volt (GeV) electrons in the old, rebuilt PEP ring, while a new ring stores the lower energy, 3.1-GeV positron beam. The two superbright beams are brought into collision at a single crossing point, where the BaBar detector, now nearing completion, will watch for the creation and subsequent decay of about 100 million B mesons per year.

"The asymmetric energies make the design of the interaction region very complicated," says SLAC's John Seeman. The challenge, Dorfan explains, was designing a set of magnetic optics that can handle two beams of different energies simultaneously. The payoff, he believes, will be a better understanding of the symmetry between matter and antimatter, and why it breaks down.

In almost all particle interactions, matter and antimatter show a basic equivalence, CP symmetry. CP symmetry holds that the behavior of a set of particles and that of the matching antiparticles look identical—one system is a mirror-image of the other, with all the particle spins reversed. But, mysteriously, some exotic particle systems violate CP symmetry. "CP violation is one of the remaining enigmas of the standard model of particle physics," says Andreas Schwarz at the DESY accelerator center in Germany. It "can be linked to the very fact that matter dominates over antimatter in the universe."

B mesons, containing either a bottom quark or its antiparticle, are thought to show especially strong CP violation when they decay, making them ideal for probing this gray area in particle physics. That has spurred a worldwide surge of interest in accelerators that can mass-produce B mesons. Cornell,



TERRY ANDERSON/SLAC