Biology

John Travis reports from Washington, D.C., at a meeting of the American Society for Microbiology

Bacterial genomes sequenced

Imagine taking a bundle of identical French newspapers and cutting them into thousands of random sentence fragments. To reconstruct a single copy of the paper in English, one could translate the fragments and then, by matching up the overlapping phrases between them, reassemble the text.

That's the essence of a method some researchers are using to spell out the complete DNA sequence of organisms. With that strategy, researchers announce, they have for the first time deciphered the entire genome of a free-living organism, the bacterium *Hemophilus influenza*. (Viruses, a number of which have been sequenced, can't live without the DNA of a host organism.)

Francis S. Collins, director of the National Center for Human Genome Research, hails the effort as a "significant milestone" on the road to sequencing the much larger human genome.

The *H. influenza* work stems from a collaboration led by Hamilton O. Smith of Johns Hopkins University Medical School in Baltimore, who won a Nobel prize for isolating *H. influenza* enzymes useful in biotechnology, and J. Craig Venter, who heads the Institute for Genomic Research in Gaithersburg, Md.

The two groups chopped up DNA from many *H. influenza* bacteria, creating short spans of genetic material from which they could identify individual base pairs, the chemical units that make up DNA. From these sequenced fragments, they reassembled one genome representing the bacterium.

H. influenza's genome apparently packages 1,830,121 base pairs into some 1,749 genes, says Venter. As expected, the bacterium's genome is considerably larger than that of viruses, a number of which have been sequenced.

"It's going to take us months, if not years, of looking at this data to truly understand it," comments Venter.

Already, however, he and his colleagues have picked out known families of genes within the genome and have discovered others whose functions are a mystery.

With the experience of *H. influenza* to guide them, says Venter, it took his group only a few months to sequence the 500,000 or so base pairs of *Mycoplasma genitalium*, a simpler bacterium. He notes that a laboratory with equipment similar to his might sequence 10 or more microbial genomes a year.

"The door to comparative evolution and functional genome analysis is open, and the first steps have been taken through it," says American Society for Microbiology President David Schlessinger of Washington University in St. Louis.

Ulcer-causing bacteria found in water

After much controversy, physicians and researchers are beginning to accept that the bacterium *Helicobacter pylori* causes most stomach ulcers. They're now turning their attention to why so many people, more than 30 percent of the U.S. population, seem to harbor this troublesome microbe, which also appears to cause stomach cancer.

Researchers from the Massachusetts Institute of Technology say an answer may lie in contaminated drinking water. They obtained water samples from Narino, Colombia, an area with one of the world's highest prevalences of ulcers and gastric cancer and where *H. pylori* infects more than 90 percent of the population. David Schauer and his colleagues analyzed the water for pieces of DNA belonging to the bacterium. "No one had ever gone out and looked at environmental water samples," he notes.

Some of the samples indeed test positive for *H. pylori*, reports Schauer. This summer, his group hopes to examine samples collected in the United States. Identifying where the bacterium normally resides, Schauer comments, "may tell us a lot about how one can actually prevent the disease."

Physics

Thumbs partly up for Gravity Probe B

Scheduled for launch in 1999, Gravity Probe B (GP-B) represents an ambitious, space-based attempt to test the general theory of relativity. Conceived more than 30 years ago, the experiment has survived a number of controversies over its cost, scientific value, and design (SN: 3/18/95, p.167). So far, NASA has spent about $240 million on the project, and the agency estimates that another $340 million will be needed to complete it.

Now, in response to a request last fall by NASA Administrator Daniel Goldin, a National Academy of Sciences panel has reviewed progress on the GP-B experiment and rendered its verdict. Because this space mission offers the possibility of a unique, direct test of general relativity, a majority of the 12 panel members judges the experiment "well worth its remaining cost to completion." Physicist Val L. Fitch of Princeton University headed the panel.

A significant minority of the panel, however, argues that the project's purpose is too narrow in comparison to alternative scientific space missions, such as the proposed Stratospheric Observatory for Infrared Astronomy (SOFIA). With GP-B, "it does not appear that unexpected new knowledge will be gained," the minority contends.

The panel commends the work done to date by Francis Everitt and his colleagues at Stanford University and the team at the Lockheed Missiles and Space Co. in Sunnyvale, Calif., in developing and building the GP-B spacecraft. For example, the group's report notes several innovations made in designing an apparatus for storing liquid helium aboard the spacecraft. This technology may prove useful to other researchers conducting low-temperature experiments.

The panel members identify no major technical shortcomings likely to hinder GP-B from functioning properly. Nonetheless, "the extraordinary experimental requirements and the impossibility of ground tests of some critical systems at the necessary level of accuracy introduce significant risks," the report points out.

At the same time, a few panel members express concern about the mission's complexity. "This minority believes it likely that some as yet unknown disturbance may prevent GP-B from performing as required," the report states. In any event, should the experiment yield results different from those predicted by general relativity, the scientific community would almost certainly not accept them unless a repeat mission confirmed them.

With the review panel's report in, the decision on whether to continue the project rests with Congress.

Lasing in a photonic wire

Confining polarized photons to a microscopic "tube" in the shape of a ring can squeeze the light into a laser beam. Now, Seng-Tiong Ho of Northwestern University in Evanston, Ill., and his collaborators have constructed and demonstrated the first semiconductor microcavity laser based on this principle.

The researchers cage photons in a ring made of a gallium-arsenide-based material coated with silicon dioxide. Such an optical "wire" retains and guides photons despite tight curvature. The ring itself has a diameter of 4.5 micrometers and a width of 0.4 μm.

Shining a pulse of light from an argon lamp on the ring injects photons, which circulate within the waveguide. These confined photons settle readily into a coordinated mode, turning the microcavity into a tiny laser considerably more efficient than conventional lasers.

The researchers described their "photonic wire" ring laser last month at a quantum electronics and laser science conference held in Baltimore.