Biomedicine

Researchers solve syphilis genome

Syphilis, a debilitating sexually transmitted disease, has long frustrated researchers. Because it needs a living host to survive, the bacterium that causes the disease cannot be grown in laboratory cultures. To study the disease, scientists have had to use rabbits—an expensive requirement.

"Without being able to use readily available [test-tube] systems, it's been almost impossible to [examine] the biology or virulence of syphilis," says Claire M. Fraser of the Institute for Genomic Research in Rockville, Md.

So, Fraser and her colleagues took another approach to unraveling the secrets of syphilis. They decoded the entire genome of spiral-shaped *Treponema pallidum*, the bacterium that causes it. Their findings appear in the July 17 SCIENCE.

Although syphilis is curable with antibiotics and hasn't become resistant to drugs, understanding its genetic structure remains valuable. For example, the findings may help researchers devise new means of detecting syphilis, which can be asymptomatic.

Also, if the disease mutates into new forms by swapping genes with other bacteria—as some other microbes have done—a genetic blueprint will enable scientists to track those changes, she says. "It's naive to assume that antibiotic resistance won't ever develop," Fraser says.

The genome reveals that *T. pallidum* has few surface proteins, complicating the search for a vaccine against syphilis. "While it won't be impossible to come up with a vaccine, it will certainly be more difficult than with other bacteria," Fraser says.

Furthermore, the researchers speculate that the dearth of surface proteins on *T. pallidum* may explain why the body doesn't readily recognize and eliminate the microbe, allowing it to ravage vital organs and tissues, including those in the cardiovascular and nervous systems. —*N.S.*

Asthma drug's effect fades over time

Salmeterol, a commonly prescribed asthma preventive, keeps its immediate potency even after a month of daily use, a new study shows. But although it is designed to keep asthma at bay for up to 12 hours, the drug didn't ward off late-day attacks after 2 weeks of use, researchers report in the July 16 NEW ENGLAND JOURNAL OF MEDICINE.

Scientists in Cleveland measured the power of inhaled salmeterol to prevent exercise-induced attacks in 20 people, averaging 29 years old, who had asthma. In some tests, the volunteers inhaled an inactive substance, or placebo, instead of the drug. To simulate real-life conditions that bring on an asthma attack, participants breathed frigid air while pedaling a stationary cycle vigorously for 4 minutes. They performed this exercise 30 minutes after taking a morning dose of the drug or placebo, and they repeated it 9 hours later.

In exercise-induced asthma, bronchial tubes in the lungs constrict. While getting the placebo, participants experienced a 19 percent loss of exhalation capacity after the morning exercise and an 18 percent loss after the evening session.

While getting salmeterol, their exhalation capacity dropped only 5 percent after the morning exercise on the first day and 9 percent after a month, demonstrating the drug's continuing effect.

The exercise session late in the day initially produced a 6 percent drop in exhalation capacity among those inhaling salmeterol. However, after 2 weeks, the late-day drop was 15 percent, a figure that remained constant through four weeks.

The researchers don't know why the drug loses its lasting effectiveness against exercise-induced asthma attacks, says study coauthor E.R. McFadden Jr., a pulmonologist at the University Hospitals of Cleveland and Case Western Reserve University School of Medicine. Scientists need to ascertain how many hours the drug remains effective throughout its administration and re-examine dosage schedules, he says. —*N.S.*

Materials Science

From Arlington, Va., at the Innovations in Materials Conference.

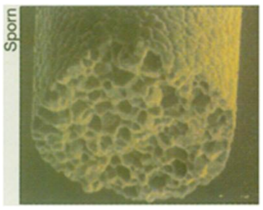
Smart threads act sensitively when hit

Researchers at the Fraunhofer Institute in Germany have created gossamer threads of a compound that converts mechanical energy to electricity and vice versa. These threads form the heart of a miniature device that can be integrated into a material to act as a sensor or to dampen vibrations.

Dieter Sporn of Fraunhofer in Würzburg and his colleagues formed 30-micrometer-thick fibers of PZT, a so-called smart compound of lead, zirconium, titanium, and oxygen. "Anyone who has tried to do this knows how difficult it is to make thin [PZT] fibers," says Eric Cross of Pennsylvania State University in State College. "It really is a major step forward."

Sporn arranged the PZT fibers across an array of thin metal electrodes and then embedded the structure in a composite material. When the composite was struck with a rubber mallet, the PZT produced a measurable electrical signal. Conversely, running an electric current through the structure caused the material to vibrate.

A device like this one offers some advantages over the sensors and actuators used now, Sporn says. The large strips or plates of smart materials employed today risk compromising the mechanical strength of any composite in which they're embedded. The goal is to have fibers "as thin as possible while maintaining the active properties," he explains. Such a multifiber arrangement should also make it easier to pinpoint an impact's location, he adds. —*C.W.*



Sporn

Scanning electron micrograph of a PZT fiber.

Vacuuming metals into molds

One day, a peek under the hood of a car might reveal an exhaust manifold of gleaming stainless steel instead of dull cast iron.

Today, 25 percent of an automobile's fuel goes toward cooling down the motor so the cast iron components won't self-destruct. Able to withstand higher temperatures, stainless steel parts would allow car engines to run more efficiently.

This year, several automakers will begin making stainless steel exhaust manifolds using a new technology that allows molds to be filled in an unusual way. Instead of being poured in from the top, the molten metal is drawn in from the bottom by means of a vacuum—similar to how a milkshake is sucked through a straw.

"The process is capable of making very thin-walled steel parts, enabling people to design parts that they couldn't have before," says G. Dixon Chandley, president of Metal Casting Technology in Milford, N.H.

Pouring often splatters molten metal onto the sides of the mold, leaving defects in the finished piece. With the vacuum technology, however, a manufacturer can control how fast the mold fills and thus improve the quality of the finished piece. —*C.W.*

Burger boxes as starchy as the bun

Recently, fast-food restaurants have stopped packaging their burgers in polystyrene boxes and begun wrapping them in more environmentally friendly cardboard and paper. Now, scientists at E. Khashoggi Industries of Santa Barbara, Calif., have come up with another alternative. Drawing on their experience with cement composite materials, the researchers have developed biodegradable foam packaging out of starch, chalk, and wood fiber. Coated with wax, these containers meet industry standards for strength and durability, says Amitabha Kumar, a Khashoggi research scientist. Because the foam biodegrades rapidly, he adds, its breakdown products should consume less landfill space than either polystyrene foam or cardboard. —*C.W.*