Treatment blocks sites for dental bacteria

Armed with toothbrushes, toothpastes, and floss, people wage a daily war against cavity-causing bacteria. Now, researchers in England have found another way to defeat those microscopic foes. Teeth treated with a new synthetic molecule remain free of the feared bacteria for up to 4 months, they report.

Most cavities are caused by the bacterium *Streptococcus mutans*, which binds to receptor proteins on the surface of teeth and collects into the film of plaque that dentists warn their patients about. Unlike other bacteria in the mouth, *S. mutans* produces lactic acid, which erodes tooth enamel.

"If you can prevent infection with *Streptococcus mutans*, you will actually prevent tooth decay," says Charles G. Kelly of the Guy's, King's, and St. Thomas' Hospitals Medical and Dental School in London.

Kelly and his colleagues pursued this goal by creating a peptide, or short sequence of amino acids, that blocks the receptors and thus prevents *S. mutans* from sticking to teeth. Earlier work had shown that *S. mutans* possesses a large protein, called adhesin, that binds to receptors. Kelly's team identified and synthesized a critical 20–amino acid portion of adhesin that, in the test tube, successfully binds to the receptors. The researchers then tested how well the synthetic peptide prevents *S. mutans* from colonizing human teeth.

The researchers first treated three groups of four volunteers with an antiseptic mouthwash for 9 days to remove all microbes from their mouths. Over the following 3 weeks, a solution containing the peptide was dripped twice a week onto the teeth of one group, which also used a daily mouthwash with the peptide. The other two groups received similar treatments with a different peptide or no peptide at all. The researchers then monitored growth of *S. mutans* on the volunteers' teeth.

Those who received the binding peptide remained free of *S. mutans* for at least 3 months. The bacteria appeared on the teeth of the others within 3 weeks, however. Kelly and his colleagues report their findings in the January NATURE BIOTECHNOLOGY.

After treatment, the peptide remains in the mouth for only about 6 hours, Kelly says, but it appears to exert long-term antimicrobial effects. "If you can hinder [*S. mutans*] colonization initially, other bacteria occupy the niche," Kelly says. Plaque formed by harmless bacteria acts as a protective film, crowding out the acid-producing *S. mutans*.

The results of the study are "quite striking," says Randall T. Irvin of the University of Alberta in Edmonton. "If this is indicative of what will happen in a larger group, it's encouraging." He expects that bacteria subjected to this treatment would evolve resistance less readily than when attacked with antibiotics.

This approach could be applied to other microbial targets, Irvin says, "but it will take a lot of work." Receptor binding often triggers normal cell processes, so the peptides would have to be designed to deflect bacteria without interfering with those effects. *—C. Wu*

Hormone helps ring internal alarm clock

Some people find setting an alarm clock a waste of time—they can somehow simply decide when to wake up. This curious ability has been noted for at least 100 years, says William Moorcroft of Luther College in Decorah, Iowa, who in 1997 published a study documenting the phenomenon.

A hormonal surge that begins about an hour before a person's anticipated awakening may play a role in this enviable talent, Jan Born of the University of Lübeck in Germany and his colleagues now report in the Jan. 7 NATURE.

"Born and colleagues have provided the first evidence of a biological basis for what may be an internal alarm clock," says Mark R. Opp of the University of Texas Medical Branch in Galveston.

Like Opp, the German researchers investigate how certain hormones, such as cortisol, adrenocorticotropin (ACTH), and corticotropin-releasing hormone, help a body react to or prepare for stressful events, which include awakening. During sleep, the amounts of ACTH and cortisol in the blood gradually increase.

In people who are awake, anticipation of a stressful event can prompt the release of these hormones. Born's team wondered whether expecting to get up at a particular time influences the secretion of the hormones during sleep.

The scientists monitored 15 volunteers during three nights of sleep. For one night, the volunteers were told they could sleep until 6 a.m. The other two nights, they were informed that someone would rouse them at 9 a.m.—well beyond their normal wake-up times. On one of those nights, however, they were unexpectedly awakened at 6 a.m.

From blood samples drawn every 15 minutes while the volunteers slept, the scientists found that the amount of ACTH usually began to rise sharply around 4:30 a.m. in the people expecting to get up early. The hormone's concentration only increased gradually in the people awakened by surprise and in those who slept until 9 a.m., never surging to the same heights.

The investigators conclude that the expectation of arising at a specific time sets a neurological timer that continues into the sleeping state and that the ACTH surge marks the body's preparations for the alarm to sound. Born hopes to monitor electrical activity in the brain during sleep to isolate where this alarm clock resides and better explain how it gets set.

Some people visualize a clock or repeatedly think of a wake-up time, notes Moorcroft, but most report no fixed strategy to set their internal alarm. *—J. Travis*

Formaldehyde: Some surprises at home

It's hard to avoid exposure to formaldehyde, a respiratory irritant and suspected carcinogen. It protects latex paints from mildew and inhibits wrinkles in permanent-press fabrics. It's also a key ingredient in many insulating foams, durable automotive resins, and glued-wood construction materials.

A new study finds that although manufacturers have in recent years cut formaldehyde emissions from some of its most notorious sources—such as particleboard—many common consumer products still release copious amounts. Indeed, one of the big surprises was the amount coming from certain floor finishes, observes Thomas J. Kelly, a chemist who led the new analysis.

Under contract to the state of California, Kelly's team at Battelle Memorial Institute in Columbus, Ohio, measured 24-hour formaldehyde emissions from 55 domestic consumer and construction products. While polyurethane floor finishes don't emit the toxicant, he found, the more durable acid-cured resin finishes do. Until they dry, they can spew up to 1.2 grams per square meter per hour—nearly 1,000 times more than bare particleboard.

Nail polish and, especially, nail hardeners are potent, though short-lived, sources of formaldehyde emissions.