SARS Control

First nasal vaccine effective in monkeys

Inhaling a new experimental vaccine may offer protection against severe acute respiratory syndrome, or SARS. The vaccine, tested in African green monkeys, is the first to be administered directly to the respiratory tract and is also the first that confers immunity with a single dose.

“This could be used for local outbreak control,” says Peter L. Collins of the National Institute for Allergy and Infectious Diseases in Bethesda, Md. “It would be the most rapid way to vaccinate those at risk for SARS,” especially vulnerable health care workers, he says. SARS became a health crisis in 2003. To date, it has infected more than 8,000 people worldwide, killing 774.

The virus that causes SARS has spiky molecules called S proteins protruding from its surface. These proteins enable the virus to infect mucosal cells in the respiratory system. To make the vaccine, scientists added the viral gene that encodes the S protein to the DNA of a different virus, BHPIV3. This bovine-human hybrid virus provokes an immune response, but no illness, in people and monkeys.

BHPIV3 is also being tested as a vaccine against the human form of the virus, which causes respiratory infections and pneumonia in children.

“A respiratory virus is really the ideal route for a SARS vaccine,” says Collins.

The researchers gave four monkeys respiratory doses of BHPIV3 containing the gene for S protein and provided four other monkeys with BHPIV3 augmented with an irrelevant gene. The BHPIV3 virus replicated in the respiratory tracts of all the animals, but only those monkeys that received the S-protein gene developed antibodies against the SARS virus, the scientists report in the June 26 *Lancet*.

After a month, Collins exposed the animals to the SARS virus to see whether those antibodies protected the monkeys from the disease. The SARS virus wasn’t detectable in the noses and throats of monkeys that received the S-protein vaccine but did show up in the others. None of the animals became ill because African green monkeys don’t develop the symptoms of SARS.

Collins says that BHPIV3 is a good choice as the basis for a vaccine because it’s already been shown to be safe in people, a factor that would speed the FDA-approval process. The vaccine, however, may not work in adults. Most have immunity to BHPIV3 through childhood exposure to the human form of the virus. Decorating the viral surface with proteins that the human immune system doesn’t recognize could remedy this problem, Collins suggests.

Other vaccines against SARS are in the pipeline. One is already being tested in people in China. The developer of an injectable experimental vaccine for SARS (*SN*: 1/10/04, p. 28), Andrea Gambotto of the University of Pittsburgh School of Medicine, says that his vaccine, too, could possibly be administered through the intranasal route.

No clinical trials are now planned for the BHPIV3 vaccine. “If SARS was rampaging through China, we’d probably rush it through testing,” says Collins. But because SARS currently seems to be under control, scientists are exploring multiple avenues to develop the most effective vaccine.

“I think all this research is exciting and interesting,” says Donna Ambrosino of Massachusetts Biologics Laboratories in Worcester, “but which [approach] at the end of day truly benefits us remains to be seen.” —C. LOCK

Sweet Frequency

Implantable glucose sensor transmits data wirelessly

A new glucose sensor could help people with diabetes gain better control over their blood sugar while eliminating the hassles of daily pinprick tests. The researchers at Pennsylvania State University in State College who developed the sensor were inspired by the magnetic antitheft strips frequently found on commercial merchandise, such as CDs.

The sensor consists of a 4-centimeter-long strip of the magnetoelastic alloy used in antitheft markers. In a magnetic field, the alloy vibrates at a specific frequency. To adapt the material for glucose sensing, the researchers first coated the magnetic strip with a thin polymer layer and then applied a layer of the enzyme called glucose oxidase.

In a solution containing glucose, the enzyme converts that sugar to gluconic acid, increasing the acidity of the polymer. As a result, the polymer expels water, reducing its mass. This alters the frequency at which the strip vibrates in a magnetic field. The higher the concentration of glucose, the higher the frequency at which the sensor vibrates.
The researchers tested their sensor in glucose solutions representing the range of concentrations typical of the blood of diabetes patients. They describe their findings in the July 15 Analytical Chemistry.

Lead investigator Craig Grimes says that the device’s sensitivity compares well with that of other glucose sensors being developed. But the real advantage is that this device is wireless and doesn’t require a battery, he says. Doctors could implant the sensor under a patient’s skin, say at the wrist. A small reader that both generates a magnetic field and detects changes in the sensor’s frequency could then be worn like a wristwatch. “Or, if you were at home and you didn’t want to wear a watch all the time, you could periodically wave your hand in front of the reader,” says Grimes.

Each implantable sensor would cost less than a penny, while the cost of the reader would be about $50, the researchers estimate.

“The concept is interesting, and it’s very innovative work,” says Francis Moussy, a biomedical engineer at the University of South Florida in Tampa. However, modifying the device to make it work in animals is going to be a challenge, he adds.

Over the years, researchers have tried numerous schemes for implantable sensors but have had difficulty keeping them functional inside the body, says Moussy. The body forms scar tissue around foreign material, preventing a sensor from providing accurate readings. The one commercially available glucose sensor that’s implanted under the skin has to be replaced every 3 days.

Grimes is also working on chemical and biowarfare sensing. Arrays of magnetic strips, each strip designed to respond to a different toxin, could simultaneously sniff strips, each strip designed to respond to a biowarfare sensing. Arrays of magnetic strips, each strip designed to respond to a different toxin, could simultaneously sniff.

MONSTER JET Artist’s depiction of a blazar spewing from a black hole.

**Powerhouse Astronomy**

**Blazing black hole from the early universe**

A jet of matter and radiation shooting from a newly discovered black hole could provide new information about the radiation left over from the Big Bang and about the first galaxies. This monster black hole, one of the heaviest and most distant known, was already gargantuan when the universe was only a billion years old.

Estimated to weigh as much as 10 billion suns and residing 12.5 billion light-years from Earth, the black hole powers the oldest known blazar, a rare class of quasar in which a jet of particles and light points toward Earth. Many blazars also generate high-energy radiation, but X rays and gamma rays from the newfound blazar would have special significance. Such energetic emissions would provide a novel searchlight on the early universe, says Roger W. Romani of Stanford University in Palo Alto, Calif. He and his colleagues describe their finding in an upcoming Astrophysical Journal Letters.

By using cosmological models to estimate the density of the background photons from the X-ray data, researchers can deduce the composition and energies of the charged particles in the high-speed jet. They can also investigate how the black hole boosted the particles to such high energies.

Gamma rays from Q0906+6930 should tell yet another story; but it will have to wait for a telescope that’s scheduled for launch in 2007. Gamma rays that collide with lower-energy radiation sometimes vanish, leaving pairs of electrons and positrons in their wake. Because a gamma-ray spectrum reveals how much of this high-energy radiation is absorbed, it provides a tally of the lower-energy photons generated by all the galaxies that lie between the distant blazer and Earth, says Romani.

By comparing this spectrum with spectra from blazars that lie closer to Earth, astronomers can infer the brightness of galaxies around the time that the remote blazar formed, notes Richard Mushotzky of NASA’s Goddard Space Flight Center in Greenbelt, Md. That time is of special interest because some of the first galaxies lit up the cosmos then, notes Romani.

The remote blazar is also intriguing because its black hole dates back to just a billion years after the birth of the universe, he adds. Other teams, observing quasars that existed even earlier, have found black holes of similar mass. Theorists are paying close attention to these observations, and current models of black hole formation are consistent with the data so far, says Avi Loeb of Harvard University. —R. COWEN

**Before the Booze**

**Cactus extract dulls hangovers**

An inflammation-fighting plant extract, taken hours before consuming alcohol, appears to suppress some of the symptoms brought on by a bout of heavy drinking. The new study, supported by the extract’s manufacturer, may have intriguing implications for understanding and preventing the effects of excessive alcohol consumption.

Too much alcohol increases short-term inflammation and can cause tissue damage, according to previous data. That may explain the link observed between frequent hangovers and elevated risk of heart attack. In contrast, moderate alcohol consumption seems to reduce risk of heart disease and dementia, possibly by reducing inflammation of blood vessels (SN: 3/8/03, p. 155).

Numerous companies sell products intended to prevent or treat hangover symptoms, such as headache, nausea, and dizziness.