Gene therapy seeks to mend cystic fibrosis

British molecular biologists have boosted the promise of gene therapy as a treatment for cystic fibrosis by correcting a similar genetic defect in specially bred mice. But they and other experts caution that these results do not prove the approach will work in humans, and a few scientists express doubts about the data.

Cystic fibrosis (CF), an inherited disease, affects one in 20,000 babies born in the United States, few of whom live past age 30. They suffer from mutations in a gene that normally directs the production of a tunnel-shaped protein. That protein helps channel chloride ions out of the cells that line the lungs and other organs. If the protein doesn't work right, thick mucus builds up in the lungs, and the pancreas releases excess enzymes.

Last year, several research groups created genetically engineered strains of mice that contain this defective gene (SN: 9/5/92, p.154).

In their report in the March 18 NATURE, Stephen C. Hyde of the University of Oxford in England and his colleagues describe how they squirted the correct gene – encased in a lipid envelope called a liposome – into the airways of six of these mice. They then measured electrical currents caused by the movement of ions across cell membranes. Defective mice typically lack such currents, but in four of the six treated mice, "they were completely back to normal," says Oxford collaborator Deborah R. Gill.

"This is the first time there is a purported correction, but the numbers [of mice treated] are very small," comments Robert J. Beall at the Cystic Fibrosis Foundation.

Richard C. Boucher, who works with CF mice at the University of North Carolina at Chapel Hill, worries that because of underappreciated complexities in ion transport in these mice, "we don't know if it's corrected or not," he told SCIENCE NEWS.

Other researchers, including those in the United States planning to try gene therapy next month on CF patients, use altered adenoviruses, which cause cold symptoms. They transfer genes much more efficiently than liposomes. Boucher says he has been unable to show conclusively that gene transfer via virus corrects the defect in the engineered mice.

But Bob Williamson, a molecular geneticist at the University of London, hopes to try liposomes in gene therapy for CF patients sometime next year and finds the Oxford results very encouraging. "It must raise hopes that gene therapy will work," he says. *– E. Pennisi*

Quark droplets envisioned in neutron stars

The immense pressures inside the collapsed, extremely dense objects known as neutron stars (pulsars) create an extraordinary environment for matter. In principle, such extreme pressures can compress ordinary nuclear matter enough to smear neutrons and protons into their constituent quarks.

Now researchers have demonstrated theoretically that a significant fraction of a neutron star's interior may consist of nuclear matter interleaved with sheets, strands, or droplets of quark matter. Physicist Christopher J. Pethick of NORDITA in Copenhagen, Denmark, and his collaborators describe their model in the March 8 PHYSICAL REVIEW LETTERS.

"Should the quark-droplet phase exist in neutron stars, it could have important observational consequences," the researchers note. For example, the sudden movement or cracking of rigid shells of quark matter trapped within nuclear matter could account for the glitches, or sudden frequency shifts, that sometimes disturb emissions from pulsars.

Until recently, most theorists had assumed that any quark matter in a neutron star would lie at its core, separated from the overlying nuclear matter by a sharp boundary. Last year, Norman K. Glendenning of the Lawrence Berkeley (Calif.) Laboratory challenged this notion and presented theoretical arguments suggesting that quark and nuclear matter can intermingle and coexist in equilibrium.

"Instead of having a sharp boundary between them, they can form a mixed region, and the mixed region can have a very interesting microscopic structure," Glendenning says.

Inspired by Glendenning's work, Pethick and his colleagues investigated what this mixture would look like. They found that at low densities, the mixed region consists of droplets of quark matter immersed in nuclear matter.

At higher densities, the proportion of quark matter increases and its geometrical structure becomes more complicated. The quark matter adopts shapes resembling rods and plates rather than spheres. The researchers label these the "spaghetti" and "lasagna" stages.

As the density increases further, quark matter becomes the predominant constituent, and any nuclear matter present forms into rods or spherical droplets. These droplets would have roughly the same diameter as atomic nuclei.

"These new details are interesting," Glendenning says. "One can easily imagine how the presence of this mixed region would affect the rate at which the star cools and how well it conducts electricity, which would affect the rate at which the star's magnetic field decays."

Whether neutron stars actually contain quark matter remains uncertain. In their calculations, Pethick and his colleagues adopted what they considered to be reasonable estimates of such properties as the surface tension of quark droplets. But no one has ever measured or even precisely calculated what this surface tension would be.

Nonetheless, the possibility that a mixed region can form across a large region of a neutron star's interior increases the likelihood that such a star contains quark matter. *– I. Peterson*

Seeing the nerves within us

Filler, J. Tsuruda/Univ. of Wash.

Using a new magnetic resonance imaging (MRI) technique, a team of British and American researchers has obtained the clearest images yet of nerves within the body. Lead researcher Aaron G. Filler of the University of Washington in Seattle says that with modifications, commercial MRI scanners may help physicians diagnose and treat nerve-related pain and weakness much more effectively. In ordinary MRI scans and X-ray images, nerves are difficult to distinguish from other tissues, Filler says.

This cross section of a human leg highlights the sciatic nerve (bright area in the center), which channels nerve impulses to the pelvis, legs, and feet. By adjusting the magnetic fields and radio pulses used to probe the body during MRI scans, the researchers can selectively de-emphasize various tissues, leaving the image of the nerves shining out "like the smile of the Cheshire cat in Alice in Wonderland," *Filler explains.*

MRI scanners can combine these cross sections into three-dimensional images of the body's nerve networks. This technique may eventually help surgeons locate and repair the damaged or squeezed nerves that cause lower-back pain, for example. The researchers describe the new technique in the March 13 LANCET. □