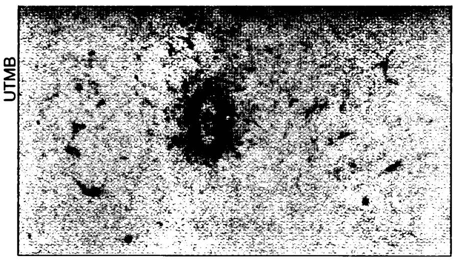
ious concerns, most of the authors say they are convinced of the surgery's utility for dying patients. Even Berkley says that if it had been available, she would have suggested the surgery to her husband during the last 5 months of his life.

The surgeons and researchers at Galveston agree that surgery and the permanent blockage of nerve signals in the dorsal column are not ideal. They have already begun testing ways to block the pathway temporarily by injecting morphine into a specific set of cells in the spinal cord. In the meantime, however, the group is not seeing any side effects from the surgery.

Two years ago, Al-Chaer, who now runs his own laboratory at Galveston, brought in a powerful tool to see whether body control is a casualty of cutting the dorsal column. Magnetic resonance imaging (MRI) allows Al-Chaer and his colleagues to study the effects of the surgery on the whole brain of monkeys instead of just the individual neurons they studied in the rats.

MRI scans of anesthetized monkeys showed certain areas of the animals' brains increasing their activity when the researchers used balloons to stretch the monkeys' colons. Al-Chaer then performed operations similar to those Nauta had conducted on his human patients. The areas that had become activated by colon stretching before the surgery did not do so in subsequent MRI scans, indicating that the surgery had stopped the pain signal.



UTMB

This cross section of a rat's spinal cord shows nerve cells (blue) clustered around the central area of the spinal cord, known to relay information from pelvic organs. The blue dye traveled up the dorsal column in the cord along the cells' long fibers, illuminating the route that some pain signals take to the brain.

"The surprising and positive outcome of this operation was that there was no loss of function at all in the [four] monkeys we did," says Al-Chaer, who reported this work at the Society for Neuroscience meeting last November in Los Angeles. Now 7 months past their surgery, the monkeys don't suffer diarrhea, constipation, or sensory loss in their legs or tails.

The Galveston group had also wondered whether cutting off pain messages from the colon might block signals that make a person hungry or thirsty, but the researchers see no such problem in the monkeys. "These guys have gone 7 months since their surgery, but they're still gaining weight," Willis says. "Their nutrition hasn't been cut off, even though their brains don't respond to colon distention."

What's more, ongoing studies by other members of the Galveston team show that the dorsal-column pathway may carry pain signals from other organs. The small intestine, pancreas, and esophagus also seem to send their painful cries up the same nerve route as the colon.

"I would be bold enough to say, after looking at four different organs scattered throughout the viscera, that this is going to be a common phenomenon for all of them," says High, who is leading the pancreas research.

Expanding the scope of dorsal column surgery may further fuel the concerns of skeptics. Yet Al-Chaer contends that modern medicine employs many methods simply because they work, even if physicians haven't ruled out all potential side effects. Doctors prescribed aspirin long before all its benefits and risks were known, he says.

"I think it would be a real shame to postpone using [this surgery] until we understand everything," he says. "Using it makes us understand it more and more." □

Technology

Chip uses less DNA and decodes quicker

Genetics laboratories nowadays routinely generate DNA "fingerprints." These bar-code–like patterns can help determine paternity or criminal guilt, or provide genetic data for scientific studies.

Conventional analysis requires snipping many copies of a DNA strand into pieces of varying lengths and using electricity to force them through a gel—a process known as electrophoresis. It can take an hour to days for the pieces of DNA to traverse the electrophoretic gel and separate into bands according to their length.

Now, scientists at the California Institute of Technology in Pasadena have demonstrated a new microchip that can make such DNA analyses 100 times faster, while requiring samples of only one-millionth as much genetic material. Channels in the rubbery plastic chip conduct molecules, one by one, past a laser.

The device takes advantage of a method developed earlier this decade to determine the length of DNA fragments tagged with fluorescent dyes. Under laser light, the fragments fluoresce according to their length. Such measurements provide a rapid profile of the sizes of the pieces.

"We've invented a chip-based, single-molecule method for sizing DNA that works on a completely different principle than electrophoresis," says Stephen R. Quake, who led the research team. In the Jan. 5 Proceedings of the National Academy of Sciences, he, Hou-Pu Chou, Charles Spence, and Axel Scherer report fingerprinting a virus' DNA cut into 3,000 pieces—just 28-billionths of a microgram—in 10 minutes.

Quake

Laser-lit DNA glows as it travels a groove 5 micrometers wide.

The device might also speed efforts to decipher the entire set of genetic instructions, or genome, of humans or other organisms, the authors say. In particular, it could accelerate mapping, a preliminary step in the process. —P.W.

Yellow light warns of nerve-gas peril

A Japanese cult's 1995 nerve-gas attack on the Tokyo subway killed 12 people and injured thousands. The tragic event demonstrated the relative ease of making poison gases, in this case sarin. Detecting these agents poses a formidable challenge.

Researchers at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., have made a sensor with high sensitivity and unprecedented selectivity for sarin and soman, a related agent, they report in the Jan. 15 Analytical Chemistry.

Amanda L. Jenkins, O. Manuel Uy, and George M. Murray developed a polymer with which they coat an optical fiber's tip. The coating glows yellow-orange when illuminated by a laser through the fiber. When it encounters and binds to certain chemical derivatives of either of the gases, however, the polymer gives off additional light at a more yellow wavelength.

The polymer was designed to react to versions of the agents that form in water. However, the researchers claim, if the agents are coated with a chemical that alters them in the same manner, the device could also detect them as gases.

The yellow light appears in response to as little as 7 parts per trillion of either agent, well below the concentration at which the compounds have ill effects. Although the sensor requires at least 15 minutes to give a full reading, it produces a detectable response within a minute—"plenty of time for people to put on masks and so on," Murray says. When tested against certain pesticides and other chemical cousins to the nerve agents, the sensor produced no false positives. —P.W.