Auto accidents accelerate trauma disorder

Crime, disaster and bereavement produce plenty of heartbreak, but a new study suggests that the single most significant trauma for city dwellers lurks on highways and streets. The culprit: automobile crashes.

Serious car accidents may yield roughly 28 severely distressed persons — who meet criteria for post-traumatic stress disorder (PTSD) — for every 1,000 adults in the United States, asserts psychologist Fran H. Norris of Georgia State University in Atlanta.

However, given the sparse data on people's reactions to car accidents, establishing cause and effect proves difficult, she notes. For example, key PTSD symptoms, such as sleep problems, lack of concentration and easily provoked startle responses, may contribute to, as well as result from, car crashes.

Norris directed a 1990 survey of 1,000 adults interviewed in four cities in North Carolina, South Carolina and Georgia. The project focused on participants' level of exposure and reactions to Hurricane Hugo, which devastated large areas of North and South Carolina in 1989. Interviewers also inquired about other traumatic events, including robbery; physical assault; sexual assault; death of a close friend or family member because of an accident, homicide or suicide; automobile crash serious enough to injure one or more people; military combat; and injury or property damage due to fire.

The sample was half black and half white, half female and half male, and evenly divided among younger, middle-aged and older adults. Although the sample was not randomly chosen, the results provide a useful comparison of the frequency and severity of traumatic events across different social groups, Norris contends in the June JOURNAL OF CONSULTING AND CLINICAL PSYCHOLOGY.

Tragic deaths of loved ones occurred most often, striking 30 percent of the participants at some time in their lives and 5 percent in the year before the survey. Sexual assaults, cited by 4 percent of the sample, yielded the highest rate of current PTSD, nearly 14 percent. But serious car crashes presented the most adverse combination of frequency and emotional impact, Norris maintains. About 23 percent of the sample had survived such an incident, and nearly 3 percent cited an automobile accident in the past year. Norris found that 12 percent of all car-crash survivors suffered from PTSD at the time of the survey.

One in five people had experienced a violent event in the past year, in most cases unrelated to Hurricane Hugo, Norris says. Young adults reported the greatest number of violent encounters. This finding coincides with evidence that 40 percent of young, urban adults encounter highly stressful events (SN: 3/30/91, p.198).

Whites reported more incidents of physical assault and tragic death than blacks, an unexpected finding that Norris cannot explain. However, blacks — especially black men — reported the most stress in response to traumatic events.

The study also indicates that a person's risk of encountering traumatic events jumps dramatically over time, Norris says. For instance, within a year about 1 in 50 adults may experience a serious car crash, but 1 in 4 will experience this event at some time in their lives. *— B. Bower*

Mountains give rise to perplexing plumes

Taking advantage of the new world order, U.S. scientists have finally gathered hard evidence to explain the Bennett Island plumes, a mystery that remained unsolvable during the Cold War.

But the long-sought explanation has proved less exciting than experts had hoped. The Bennett Island plumes apparently result from airstreams passing over low mountains on the island, reports Russell C. Schnell, an atmospheric scientist who coordinated the recent aircraft experiment above the island.

Scientists would have liked to find evidence to the contrary. "Deep in my heart of hearts, I still hope they're not orographic [mountain-caused] clouds," says Schnell, director of the National Oceanic and Atmospheric Administration's monitoring station in Hilo, Hawaii.

First spotted on satellite images in 1983, the plumes are extremely thin cloud trails stretching hundreds of kilometers downwind of tiny Bennett Island, located in the East Siberian Sea. Atmospheric scientists put forward several explanations for the ephemeral contrail-like plumes, including the possibility that they resulted from Soviet activity in what was then a militarily sensitive area. At the time, western investigators could not hope to visit Bennett Island to test their ideas. In the absence of direct data, they settled on the hypothesis that the plumes originated from leaking deposits of frozen methane, known to exist beneath the floor of the Arctic Sea (SN:3/28/87, p.204).

Such methane plumes might have economic implications if they signaled the presence of large natural gas reserves located close to the ocean floor. But the leaks could also have an ominous message, suggesting that global warming had started melting the frozen subsea stores of methane in the Arctic. Because methane is a powerful greenhouse gas, the thawing of such reserves would accelerate the global temperature rise caused by carbon dioxide pollution, scientists warn.

To test the methane hypothesis, Schnell and colleague Anthony D.A. Hansen of the Lawrence Berkeley (Calif.) Laboratory hired a Russian airplane and crew to collect air samples downwind of the island. In late April, the plane flew through one plume and in the vicinity of several others. Analysis of the gas samples using extremely sensitive instruments reveals normal amounts of methane, says Schnell. "It doesn't appear that methane leaks at Bennett Island are causing what we see," he says.

Instead, Schnell believes, the clouds form through a more prosaic process as air masses saturated with water vapor pass over the mountains on Bennett Island. As the airstreams rise, they cool, causing water vapor to condense and form clouds that spread out downwind. Scientists have seen similar types of clouds develop downwind of other mountains, including peaks on the Novaya Zemlya islands north of Russia. Using the mountain theory, Schnell successfully forecast the appearance of a plume, lending credence to that hypothesis.

But the Bennett Island plumes have not yielded all their mystery. Meteorologists must now explain why the plumes form at an unusually high altitude, more than 3 kilometers above the mountaintops, says Schnell. *— R. Monastersky*

New glass 'lens' for intensifying X-rays

When accelerated electrons in a laboratory X-ray source smash into a metal target, the resulting interaction sprays X-rays in all directions. To get a narrowly confined, precisely characterized beam, researchers typically use an arrangement of narrow slits to block the passage of all but a small fraction of the X-rays emerging from the target, thereby throwing away most of the X-rays produced and considerably reducing the beam's ultimate intensity.

Physicist Timothy M. Hayes and his coworkers at the Rensselaer Polytechnic Institute (RPI) in Troy, N.Y., have now succeeded in using a novel "lens" consisting of a bundle of glass fibers threaded with hundreds of microscopic channels to capture diverging X-rays and gradually steer them into an approximately parallel beam. This custom-built prototype "collimator" produces four times the X-ray output of a comparable slit system.

The idea of using such glass-fiber lenses or collimators to guide X-rays and neutrons originated with Muradin A. Kumakhov of the I.V. Kurchatov Atomic Energy Institute in Moscow (SN: 6/6/92, p.373). When Hayes and his colleagues expressed an interest in using such a lens to increase the intensity of X-ray beams

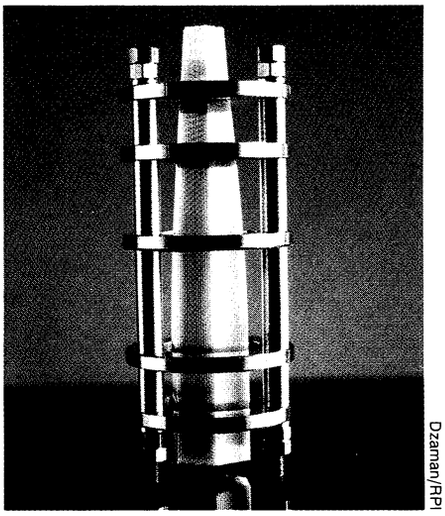
available for studying various materials in the laboratory, Kumakhov and his coworkers fabricated a lens suitable for the purpose.

"It was made by the Russians to our specifications," Hayes says.

Brought to the United States by Vladimir E. Kovantsev, who worked with the RPI group for two months, the lens consists of 919 glass fibers packed together to form a bundle with a hexagonal cross section. Made from a specially formulated borosilicate glass containing traces of sodium, potassium and aluminum, each fiber contains 547 channels, 14 microns wide, with exceedingly smooth inner walls.

"The smoothness of the glass is the critical thing, and that depends on the composition," Hayes says.

Hayes expects that improvements in the alignment and positioning of the glass fibers alone could increase the intensity of a collimated X-ray beam by an additional factor of six. The availability of such intensities would greatly expand the types of materials studies that researchers could undertake without having to go to special facilities. —*I. Peterson*



Dzaman/RPI

In this 6-inch-long, custom-fabricated Kumakhov collimator, diverging X-rays enter the narrow end of the hexagonal fiber bundle. Microscopic channels within each fiber guide X-rays so that they emerge from the bundle's wide end as a parallel beam about 1 inch across.

Etching technique lights up porous silicon three ways

With its three dimensions, a hologram packs much more information onto a flat surface than a typical photo. Holographic data storage could thus lead to denser computer memories. Chemists have now taken a step in that direction by using light-emitting silicon as the holographic surface.

Four months ago, as part of a flurry of research aimed at understanding and harnessing photoluminescence in acid-etched silicon, scientists demonstrated they could use light to control the degree of etching and, consequently, the character of the resulting porous silicon (SN: 2/15/92, p.103).

That control has enabled them to reproduce images on silicon wafers, from self-portraits to a picture of Elvis Presley.

Now those scientists, working at the University of California, San Diego, have etched porous silicon so finely that the wafers reflect light in a rainbow of colors. The precision may lead to porous silicon layers thin enough to steer light through a computer chip, Michael J. Sailor and Vincent V. Doan report in the June 26 SCIENCE. The technique also lets scientists create diffraction gratings, "so you can use this silicon surface to make a hologram," says Sailor.

Sailor likens the silicon surface to a decorated T-shirt. Nowadays, designers can reproduce a simple image, a 3-D picture or a fluorescing design on the cotton cloth. The same is true of silicon, "except it all happens simultaneously," Sailor says.

The luminescent colors arise because of the photoluminescing property of porous silicon. During etching, the San Diego chemists project a black-and-white slide—in the case of these photos, George Washington's face from a dollar bill — onto the silicon wafer through a lens that reduces the size of the image. Variations in the projected light's intensity lead to different etch rates and, as a result, to variations in the light later emitted by the silicon.

The human eye barely perceives the difference between the cherry and orange reds in the silicon's glow. But that glow's wavelengths actually reproduce the gray scale of the dollar bill image, Sailor says.

"That's a pretty novel approach," comments Terry Guilinger, a chemical engineer at Sandia National Laboratories in Albuquerque, N.M. Guilinger's group has worked to make patterns in porous silicon using ion beams.

In daylight, Doan and Sailor's etched silicon wafer becomes much more colorful. But unlike a T-shirt decorated with paint or dye, the wafer uses optical magic to create its rainbow of colors. "There is no pigment; it's just the way [the silicon layer] interferes with the light," says Sailor.

Doan and Sailor say their etching process differs from that of most other researchers. They use a smaller current and slowly make the silicon porous in a controlled fashion. The process takes about half an hour.

As a result, "the porous silicon is not so grainy that it causes light to scatter," Sailor explains. "You can constructively and destructively interfere with light on this film."

Thus, just as clear, colorless oil will spread to make a multicolor sheen on wet pavement, so will the porous silicon make a false-color image. Etched to one thickness, the porous silicon cancels all but green light. In other parts of the image, layers of different thicknesses impart a blue, yellow or purple hue.

Doan and Sailor also discovered that the etching recreated the fine lines used as shading in the dollar bill. When they shine a laser light on one spot on these fine lines, that one spot "splits" and reflects back as a characteristic pattern of spots, indicating that the grid of lines acts as a prism. "We see light diffracting off that grid," says Sailor. "That's the same thing as storing a holographic image."

In this way, a single technique leads to three ways of storing information on porous silicon. —*E. Pennisi*

Image of dollar reproduced on a 1-centimeter-square piece of porous silicon, seen in daylight (left) and luminescing under ultraviolet light.

Doan & Sailor/SCIENCE