Biomedicine

From Universal City, Calif., at a meeting sponsored by Research to Prevent Blindness

Car safety tied to vision testing, clarity

States that require drivers to pass vision tests to renew a driver's license have a lower incidence of traffic fatalities involving people over age 60 than do states that don't require such testing, a new study shows.

Optometrist Melvin D. Shipp of the University of Alabama at Birmingham assessed the effect of vision policies on the 48 contiguous U. S. states and the District of Columbia. He found that several factors—including high population density and license renewal without a vision test—boosted the probability of fatal traffic crashes involving elderly drivers.

Shipp then isolated the effect of vision tests from other variables. Applying his model to Alabama, one of the 10 states without a mandatory vision test as of 1990, he estimated that instituting such a policy would cut crash fatalities among the elderly from 48 to 43 per 100,000 people. Similar calculations for other states lacking mandatory vision tests yielded, on average, a potential 12 percent rate cut, says Shipp.

Besides Alabama, no vision test is required for license renewal in Connecticut, Kentucky, Mississippi, New Jersey, Oklahoma, Pennsylvania, Tennessee, Vermont, and West Virginia. Some groups representing elderly people oppose vision screening, saying it discriminates against the elderly.

Many older people don't notice poor vision creeping up on them, Shipp says. "There is no pain associated with it, no discomfort," he notes. Thus, many elderly people don't seek help.

Development of a cataract, in which the lens of the eye becomes opaque and produces cloudy vision, is one such slowly advancing condition. Cynthia Owsley, an experimental psychologist and epidemiologist also at Alabama, reports that older drivers who have cataracts removed are significantly less likely to get into an auto accident than are those who aren't treated for the condition.

Between 1994 and 1999, she tracked 288 drivers between 55 and 85 years of age who had cataracts; nearly all had them in both eyes. Of these people, 187 elected to have surgery and 101 didn't. Adjusted for miles driven over a 3-year period, those not getting surgery were twice as likely to be involved in an accident as those who did have the operation, Owsley says.

People with cataracts see an increasingly "washed-out" world, similar to that seen when one turns down a television's contrast, says Owsley. This makes driving more difficult.

While it's not clear why some people don't get surgery, those who don't read much and don't do fine, detailed work that requires good acuity of sight may simply not want to bother, Owsley suggests. —*N.S.*

Photodynamic treatment used on eyes

The severest form of age-related macular degeneration, the so-called wet form of this eye disease, results when new blood vessels sprout under the retina. The vessels leak fluid, which causes vision loss (SN: 10/2/99, p. 215).

Only about 15 percent of cases of wet macular degeneration are treatable using the only current technology available—laser light to cauterize the rogue vessels to stanch the flow. This procedure risks destroying some of the retina.

Now, researchers have devised a new technique that combines photosensitive dye with cooler laser light. The dye gravitates to the fast-growing vessels. When exposed to laser light, drugs in the dye kill the rogue vessels, Joan W. Miller of Harvard Medical School in Boston reports.

Early results of the procedure on several hundred patients offer promise to some of the thousands of people diagnosed with wet macular degeneration each year, she says. This photodynamic therapy technique, which is still being tested, is currently under review for approval by the Food and Drug Administration. —*N.S.*

Mathematics

Optimal paths to atomic clusters

In identifying the lowest point in a rugged landscape of high mountains and deep valleys, a large squad of searchers has a distinct advantage over a single explorer traversing the same terrain on foot. Mathematicians look for a similar advantage when searching for the global minimum in a complex geometric landscape—which might represent, for example, the energy of interactions among a large number of atoms.

Inspired by the Japanese game pachinko, similar to pinball, Robert H. Leary of the San Diego Supercomputer Center has developed a computational algorithm that speeds up such searches by sending out a large contingent of scouts instead of just one.

One standard way for a computer to find the lowest spot is to locate the bottom of a valley near a starting point, then take a flying leap in a random direction over a ridge. The excursion may lead to a nearby valley. If the bottom of that valley is lower than the first one, the new valley becomes the starting point for the next jump. Every once in a while, the method calls for a leap to an uphill location to avoid being trapped in a deep valley that is not actually the deepest valley of all. Leary's variant accepts only downhill moves but compensates for that restriction by checking the results of more trial leaps from a given location.

The two "basin-hopping" methods differ in the same way that standard pinball and pachinko differ, Leary says. In pinball, a player sends out one ball and uses flippers to make it go uphill occasionally and stay in play. A pachinko machine sends out many balls, which then follow downward paths. With enough balls in play, at least one of them is likely to drop into the desired slot at the bottom.

Leary and Jonathan P.K. Doye of the University of Cambridge in England have used Leary's global-optimization algorithm to discover a new way of arranging 98 atoms in a cluster. The resulting configuration, which displays an unusual tetrahedral symmetry, has less energy than any other known arrangement. The researchers describe the result in a paper submitted for publication. —*I.P.*

Pi by the billions

The number pi (π) represents the ratio of a circle's circumference to its diameter. Starting with 3.141592653 . . . , its digits go on forever. That hasn't stopped researchers from trying to calculate as many of those digits as computer technology and mathematical methods allow. Last month, computer scientist Yasumasa Kanada and his coworkers at the University of Tokyo Information Technology Center announced computing 206,158,430,000 decimal digits of pi, surpassing their own previous world record of 51,539,600,000 digits (SN: 8/9/97, p. 92). The researchers did the calculation twice, with two different methods. Using two multiprocessor computers, one computation required about 37 hours, and the other, 46 hours.

"It is a pretty spectacular computation," says Jonathan M. Borwein of Simon Fraser University in Burnaby, British Columbia. The accomplishment "highlights just how far both software and hardware have come," he adds. Even a desktop computer can now calculate as many as 1 billion digits of pi.

Kanada took advantage of significant improvements in the efficiency of software for performing the underlying arithmetic and for passing information from one computer processor to another. He also needed an enormous amount of computer memory to achieve the record. "It is very tricky to do these large calculations," notes David H. Bailey of the Lawrence Berkeley (Calif.) National Laboratory.

The 206,158,430,000th decimal digit of pi (not counting the initial digit, 3) is 4. Kanada is now checking the computed digit string to determine how often each digit appears and to identify any interesting patterns among the digits. —*I.P.*