Magnesium May Stave Off Cerebral Palsy

Cerebral palsy begins before birth with damage to an infant's brain. The malfunctioning brain then sends conflicting signals to the infant's muscles. In some cases, these signals pit one muscle against another, locking the limbs in place so that living in the grip of cerebral palsy is like living in rigor mortis. In other cases, the baby can move, but its muscles refuse to obey commands. About half of the infants born with the disorder are mentally retarded.

Clearly, preventing cerebral palsy would be "very desirable indeed," asserts neurologist Karin B. Nelson of the National Institutes of Health in Bethesda, Md.

Scientists at the Centers for Disease Control and Prevention (CDC) in Atlanta have taken a step in that direction. They have shown that giving magnesium sulfate to pregnant women may greatly reduce the incidence of cerebral palsy in infants born weighing less than 3.3 pounds. These low birthweight infants are 60 to 75 times more likely to develop cerebral palsy than babies that reach a normal weight before birth—and the number of children with cerebral palsy is growing. Medical advances enable many 1-pound infants to survive the trauma of prematurity.

Magnesium sulfate is routinely given intravenously to halt preterm labor or prevent convulsions in women with pregnancy-induced hypertension. In 1987, Dutch researchers found it also prevents hemorrhaging in the brains of infants whose mothers have this form of hypertension.

Last year, Nelson and Judith K. Grether of the California Birth Defects Monitoring Program in Emeryville studied infants in four California counties to see whether giving at-risk women the drug can prevent cerebral palsy in low birthweight babies.

Of the low birthweight babies born to women who had been given magnesium sulfate, 11 percent had cerebral palsy. However, 46 percent of the premature babies of women who had not been receiving the drug had cerebral palsy. The drug might have a "protective effect," the researchers concluded. It seemed to protect infants of women who experienced preterm labor and those of women with pregnancy-induced hypertension.

More recently, Diana E. Schendel and her coworkers at CDC set out to study low birthweight infants born in Georgia between 1986 and 1988. They found that less than 1 percent of children whose mothers were given magnesium sulfate developed cerebral palsy, compared to 8 percent of babies whose mothers were not given the drug.

The researchers calculated that magnesium sulfate reduced the prevalence of cerebral palsy by about 90 percent and reduced the prevalence of mental retardation by about 70 percent, although the latter link was weaker. Their findings appear in the Dec. 11 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

"One of the striking things about the CDC study is the reduction in mental retardation," says Nelson, author of an accompanying commentary.

The CDC has begun large-scale studies to test these results. Meanwhile, NIH plans to study two groups of pregnant women—one that will be given the drug and one that will not—to determine once and for all whether magnesium sulfate prevents cerebral palsy and mental retardation. —*S. Sternberg*

Atomic oxygen removes soot from paintings

Two rocket scientists may have solved a particularly vexing problem facing art conservators. Many paintings damaged by smoke sit in storage, undisplayed and unappreciated, because no one has found a good way to clean them. Now, scientists from NASA are finding that atomic oxygen, which exists in Earth's upper atmosphere and chews away materials on orbiting satellites, may give conservators the tool they need to tackle this problem.

Dabbing organic solvents onto a painting can clean off some kinds of soil, but it often does more harm than good (SN: 4/28/90, p. 261). A shower of atomic oxygen, on the other hand, can remove layers of soot without anyone's ever having to touch the surface. Sharon K. Rutledge of NASA's Lewis Research Center in Cleveland reported the finding at the Materials Research Society meeting in Boston last week.

After being approached by the Cleveland Museum of Art, Rutledge and her colleague Bruce A. Banks enlisted the help of the Cleveland Fire Department to expose samples of cotton canvas coated with acrylic gesso to smoke from a fire. Acrylic gesso is used to prepare surfaces for paint.

The samples hung on a wall inside the fire department's training facility while several pieces of furniture burned. A section of an oil painting was exposed to a motor oil fire, which covered it with a layer of black soot.

The researchers placed the samples in a vacuum chamber and bombarded them with atomic oxygen. They measured how well the samples reflected light before and after the cleaning. Black carbon from the oil fire came off in only 1 hour, whereas soot from the house fire took up to 23 hours, Rutledge says.

House fire residue is a mix of many materials and is therefore very difficult to remove, says Marion F. Mecklenburg of the Smithsonian Institution's Conservation Analytical Laboratory in Suitland, Md. Fumes from melting synthetic materials like polyester, nylon, and rayon deposit "a coat of hot plastic onto the surface," he says. Atomic oxygen reacts with the carbon-based materials, turning them into carbon dioxide, carbon monoxide, and water.

A hand-held atomic oxygen device that doesn't need a vacuum would make the technique practical for art conservation, says Rutledge. For now, though, the NASA researchers are trying to scale up their experiment by building a large vacuum chamber that can hold a painting measuring 5 feet by 7 feet.

Although atomic oxygen alters the paint slightly and the vacuum may dry it out, Mecklenburg says he thinks "it's worth exploring." Conservators may have to "accept a modicum of damage. It's the lesser of two evils." —*C. Wu*

Rutledge and Banks/NASA

After exposure to smoke from an oil fire, a section cut out of a 15-year-old oil painting is covered with black soot (left). Treatment with atomic oxygen restored the section (right).