pushed the lever fell if the nicotine levels were much higher or lower than 30 μg per kilogram of body weight.

The research doesn't just provide political support for efforts to regulate tobacco, however. According to William Corrigall of the Addiction Research Foundation in Toronto, it contains scientific information that would have speeded up research on nicotine if it had been published in 1983. At the time the Philip Morris study was conducted, researchers had shown that monkeys and dogs will self-administer nicotine, but they had had little luck in getting rats to do so—a necessity if they were to develop a suitable model in which to study the neural pathways through which nicotine exerts its addictive effects. Critics say publication of DeNoble's study would have given other researchers the animal model they were seeking. "DeNoble had the experience with [animal models of addiction] to know to start at low doses of nicotine and to work up gradually," says Jack Henningfield of the National Institute on Drug Abuse in Baltimore.

By 1989, however, Corrigall and Kathleen Coen, also of Toronto's Addiction Research Foundation, had independently arrived at the same conclusions as the DeNoble team. Corrigall and Coen found rats pushed the lever most often when they received 30 μg of nicotine per kilogram of body weight. "The compelling thing is that the [rats in the two studies] seem to respond best to the same dose of nicotine," says Corrigall. Corrigall speculates that at lower doses nicotine is not addictive, and at higher doses its aversive properties cancel out its addictive ones.

Corrigall's work, published in *Psychopharmacology*, "supercharged medical research on nicotine addiction," says Henningfield. Within a few years, the Corrigall team had used its rat model to show how nicotine activates a neural pathway, called the mesolimbic system, that creates intense cravings.

Corrigall cautions that the rat model is not a complete model of human cigarette smoking, which probably also depends on factors such as nicotine's ability to alleviate tension and to improve concentration. Nonetheless, he says, nicotine "is clearly addictive in people. People [like rats] will increase their workload to get nicotine. They will pay more for cigarettes. They will smoke outside in snow storms and rainstorms."

To determine whether the tobacco companies intend nicotine to have an addictive effect, Waxman has called a hearing on 14 April of the subcommittee on Health and the Environment, which he chairs. The CEOs of seven American cigarette manufacturers have been summoned to attend.

–Rachel Nowak

FORENSIC MEDICINE

SIDS Paper Triggers a Murder Charge

ATLANTA—Twenty-two years ago, Alfred Steinschneider made a splash in the medical community with a landmark paper detailing multiple cases of sudden infant death syndrome (SIDS) in a single family. The paper became one of the most widely cited papers in SIDS research, providing support for a theory that some cases of the disorder may result from an inborn abnormality characterized by prolonged sleep apnea, or loss of breath. Now, the paper is making news again: as exhibit A in a murder case.

On 23 March, prosecutors brought murder charges against Waneta E. Hoyt of Newark Valley, New York, the 47-year-old mother of the children whose deaths Steinschneider described in his paper. The publication, in the October 1972 issue of *Pediatrics*, triggered the murder investigation when it was brought to prosecutors' attention in connection with a completely different case in the late 1980s. If the murder charge is upheld, it would demolish Steinschneider's theory that this family's tragedy suggests a link between SIDS and severe apneic episodes caused by an abnormality present at birth—a theory that SIDS researchers say is no longer widely accepted among scientists but still has some support in the medical profession. And it would raise a troubling question: Could Steinschneider have prevented the deaths of two of the Hoyt children? Steinschneider, who is now president of the American SIDS Institute, an Atlanta-based organization, stands by the conclusions of his paper and vehemently denies that he could have done anything more to prevent the deaths.

Stands by his conclusions. Alfred Steinschneider.

Steinschneider was an assistant professor of pediatrics at the Upstate Medical Center in Syracuse, New York, when he published his paper describing the fate of two siblings identified as M.H. and N.H., plus three children from other families. Steinschneider still declines to name his former patients, but M.H. and N.H. have been identified by prosecutors as Molly and Noah Hoyt. Steinschneider notes in the paper that because three siblings of M.H. and N.H. had previously died as infants, he monitored them closely, repeatedly admitting them to the hospital for observation.

Here is how he described Molly's death, which occurred soon after she was discharged from the hospital: "At 8:15 a.m., M.H. awoke, was disconnected from the [apnea] alarm, bathed, and fed without difficulty.... Mrs H. placed her in the crib and left the room for 'a minute to get something.' When she returned, M.H. was apneic and cyantic [sic]. She was given mouth-to-mouth resuscitation without success."

Noah Hoyt, born about 1 year after Molly's death, also made repeated visits to the hospital. Each time he was sent home, Steinschneider wrote, the infant reportedly suffered loss of breath. Finally, the paper says, "At about 8 a.m. on the morning after discharge and while asleep, N.H. had an apneic and cyanotic episode which failed to respond to resuscitative efforts." Steinschneider's paper also chronicles apneic episodes among two siblings from another family and a third, unrelated child. Of the five infants, only the Hoyt children died.

These tragic events led Steinschneider to conclude that some SIDS-prone babies may be born with abnormalities characterized by apneic episodes. If so, some SIDS deaths may be prevented by checking for abnormal respiration and using apnea monitors for infants in families that have already had one SIDS death. The paper, says Janice Ophoven of the Children's Hospital in St. Paul, Minnesota, "really was a seminal article," which influenced treatment for children in SIDS-afflicted families.

Over the years, the paper's influence has waned, however. Other researchers have found little support for the idea that SIDS is caused by apnea or that it runs in families, says Marie Valdes-Dapena, professor emeritus of pathology and pediatrics at the University of Miami, although some hospitals still provide apnea monitors for infants whose siblings have died of SIDS. Researchers have proposed more than 100 possible causes for SIDS ranging from suffocation, which may be more likely to occur when an infant sleeps on its stomach, to food allergies, to a developmental abnormality. The murder charges against Waneta Hoyt may be the final blow to the apnea-SIDS theory.

Steinschneider's paper was first brought to the attention of New York prosecutors in 1986, when William J. Fitzpatrick—then an assistant prosecutor in Onondaga County—called Linda Norton, a forensic pathologist and former medical examiner for Dallas County, Texas, for help with a different case involving the death of several children in one family. Norton, who had read Steinschneider's description of the deaths of M.H. and N.H.,

urged Fitzpatrick to read the paper. "I told him that the guy who wrote the paper was right up there in his neck of the woods, and that the victims in that paper were all homicide victims, in my opinion," says Norton.

After Fitzpatrick became the district attorney for Onondaga County in 1992, he pulled Steinschneider's paper from his files and called Robert J. Simpson, district attorney for Tioga County, where Mrs. Hoyt lives. An investigation was launched. M.H. and N.H. were identified through death records. Last week, Waneta Hoyt was charged with murder after she had signed a confession. Her attorney, public defender Raymond Urbanski, told the *New York Times*, however, that she signed the confession under duress, and that she "absolutely and categorically denies the charges."

Fitzpatrick has harsh words to say about Steinschneider's role in the events. In an interview with *Science*, he contended that Molly and Noah might have been saved if Steinschneider had alerted the police rather than treating the case as a medical-scientific matter. Steinschneider bristles at the suggestion. He says he asked independent researchers to review autopsy records for Molly and later for Noah because he was aware their siblings had also died. He even consulted with Valdes-Dapena. They "found nothing," and public health nurses observed no signs of abuse in the Hoyt home, he says.

Steinschneider, in fact, stands by his 1972 publication. "This is a good paper," he says. If the case goes to trial, he may be called to defend its 22-year-old conclusions.

–Ginger Pinholster

Ginger Pinholster is a science writer based in Wilmington, Delaware.

ASTROPHYSICS

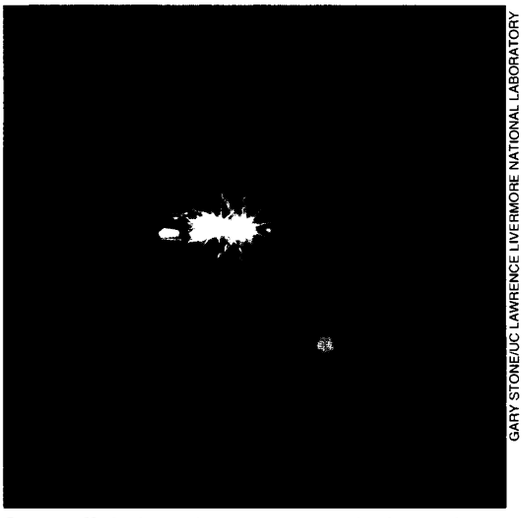
Livermore Physicists Ask for the Sun

And you thought Dr. Strangelove was scary. How about a proposal for "Creating Stars, Supernovae, and the Big Bang in the Laboratory"? Grant Mathews of the Lawrence Livermore National Laboratory, who gave a talk with this title at the American Chemical Society Meeting in San Diego last month, isn't kidding. All he needs, he says, is a proposed new laser—the largest ever built—and some pellets of hydrogen and helium the size of grains of sand.

Actually, Mathews' cosmic cataclysms would be so small and fleeting—less than a millimeter across and lasting just a billionth of a second—that nobody outside the laser facility would notice. And they are just an extension of something investigators at the weapons lab have done for years: using a firing squad of laser beams to squeeze tiny samples of hydrogen to such high temperatures and pressures that they undergo nuclear fusion. In the past, investigators studied this laser-induced fusion for clues to nuclear weapons design and as a possible energy source. But the new laser, the National Ignition Facility (NIF), say Mathews and his colleagues, could make laser fusion a window on the stars.

NIF, a $500-million successor to Livermore's Nova laser (currently the world's largest), is designed to achieve the long-sought goal of fusion research: exceeding the "break-even" point, which implies gaining more energy from the fusion of a hydrogen pellet than it takes to heat and compress it (*Science*, 3 December 1993, p. 1504). Doing so, NIF's designers figure, will take about 200 beams, each with about a quarter of Nova's total power. That should also be enough power, says Livermore researcher John Castor, "to produce conditions very similar to those in the centers of stars—temperatures of 50 million degrees or so and densities of 100 grams per [cubic centimeter]." By varying the makeup of the lasers' targets, Mathews and Castor say they should be able to simulate the nuclear processes of stars and the early universe as they look for clues to astrophysical puzzles. Among those puzzles:

■ **The solar neutrino problem.** Debate rages about whether the apparent shortage of the sub-atomic particles called neutrinos coming from the sun stems from a misunderstanding of the sun's nuclear reactions or some new particle physics involving neutrinos. Castor, Mathews, and colleagues think they might tip the debate by substituting pellets of helium-3 for the heavy-hydrogen pellets used in fusion research. Astrophysicists believe reactions among helium-3 nuclei are the source of solar neutrinos, so researchers could trigger these reactions under sun-like conditions and see if they produce neutrinos at the expected rates.



GARY STONE/UC LAWRENCE LIVERMORE NATIONAL LABORATORY

Star stuff. An incandescent target at the focus of Livermore's Nova laser is a preview of astrophysics experiments proposed for Nova's successor.

■ **The existence of brown dwarfs.** Astronomers know from the motions of stars and galaxies that the universe is full of invisible—and so far unknown—"dark matter." One candidate for the dark matter is the material in brown dwarfs, which are planet-sized globes that glow briefly as they condense, but soon grow dark because they are too small to undergo fusion. Brown dwarf searches, however, have turned up next to nothing. One explanation, says Castor, is that the dwarfs cool off and vanish faster than expected. By subjecting a mix of star ingredients (mostly hydrogen with bits of heavier elements) to pressures and temperatures comparable to those inside brown-dwarf–sized stars, says Castor, he and his colleagues could study the cooling rate and test this theory.

■ **The "neutron capture"** process, a poorly known series of reactions that builds successively heavier nuclei in bloated red giant stars. To simulate the material of the pre-collapse giant, says Mathews, he and colleagues could shine the lasers on a mixture of protons and helium. If they get the conditions in the mini-star just right, these starting materials would fuse into middleweight nuclei, such as carbon and oxygen, releasing free neutrons; the neutrons would trigger a chain reaction that would build up still heavier elements.

To astrophysicists outside Livermore, those are tempting prospects, though by themselves they might not justify NIF's $500-million price tag, says University of California, Berkeley, astrophysicist Steve Kahn. But "if it exists already, then it seems like a very attractive opportunity." Kahn warns, however, that outside astrophysicists like him probably wouldn't be able to afford time on the pricey facility. He notes that Livermore is considering a proposal to guarantee time on NIF to outside astrophysicists.

Inside the fence at Livermore, the experiments promise some researchers a welcome return to their roots. Says Livermore scientist David London, "Quite a few of us [on the laser fusion program] are astrophysicists." Compared with weapons simulation, he says, starmaking "would be fun." But none of this can happen unless the Department of Energy approves the project and secures the necessary funds from Congress. That could take several years, and adding another 5 years for construction means the fun won't begin before 2001.

–Faye Flam