care to their newborn offspring.

The mutant animals, described in the April 9 SCIENCE and October 1998 NATURE GENETICS, were created by M. Azim Surani of the University of Cambridge in England and his colleagues. The team first made mice lacking *Mest*, a gene whose paternal—but not maternal—copy is normally active throughout the growing embryo, notably in the developing brain. The gene also functions in many tissues of adult mice, again including the brain.

The researchers found that mice lacking their working paternal copy of *Mest* developed normally—except that they were significantly smaller than usual. This growth retardation, a finding that supports the parental-conflict model, did not seem to disturb the general health of the rodents.

The scientists had begun breeding the small mutant mice when they realized that the females were neglecting their pups. In laboratory tests, the mothers built nests poorly and didn't retrieve displaced pups as readily as normal mice did.

This aberrant maternal behavior was evident even immediately after birth. "When pups are born, one of the functions the mother performs is to chew off and clean up the umbilical cord and remove the placenta. The *Mest* [mutant] mice showed deficiency in this behavior," says Samuel A. Aparicio, one of Surani's coworkers.

Similar results emerged when Surani and his colleagues mutated the paternal copy of *Peg3*, which is also active in the embryonic and adult brain of mice. The mutant mice were smaller than normal but otherwise healthy. When the mutant females gave birth, however, they neglected their pups so much that few survived. Compared with normal mothers, the mutant females took 8 times longer to build nests and 11 times longer to retrieve wayward pups.

The scientists also discovered that the females carrying *Peg3* mutations failed to provide milk to their young, even though their mammary glands were full. Further studies revealed a possible explanation. In the brain region called the hypothalamus, cells that secrete a chemical called oxytocin play a crucial role in females' ability to lactate. Normal females have nearly 4,500 such cells, but the female mice lacking *Peg3* have, on average, less than 3,000 of them.

At first glance, it's striking that two paternal genes somehow encourage a mother's care of her young. "Maternal behavior is obviously [something] that could have important consequences for the survival of genes," notes Aparicio.

It is far from clear, however, that the conflict model of imprinting can accommodate these findings. Why would females have inactivated a gene, such as *Mest* or *Peg3*, that would promote their daughters' caring for offspring?

While he is playing with ideas about how adult behavior might lead to imprinting, Haig stresses that the parental-conflict model doesn't have to account for the role of *Mest* and *Peg3* in maternal behavior. That influence may have evolved after the genes had already become imprinted. "The simplest thing to say is that the genes are imprinted because of their effects on fetal growth," says Haig.

Although Hurst considers that type of explanation perfectly legitimate, it illustrates why he's a bit frustrated with the parental-conflict hypothesis. Like many theories in evolutionary biology, it's almost impossible to prove or disprove.

"There doesn't seem to be a test that we can do to show that the theory is actually wrong," laments Hurst. That said, the evolutionary biologist admits that he still favors, albeit reluctantly, the parental-conflict model.

Hurst sums up his current take on the conflict theory of imprinting by paraphrasing Winston Churchill's oft-quoted judgment of democracy. "It's the worst of all explanations, except for all the others," he says. □

Chemistry

From Seattle at a meeting of the Electrochemical Society

Catalysts make hydrogen under the hood

Government researchers have discovered a new class of catalysts that convert fossil fuels into clean-burning hydrogen gas at temperatures much lower than previously thought possible.

Because combustion of hydrogen produces only heat and water, automakers hope to tap it as fuel for a new generation of pollution-free vehicles. Without a national system of hydrogen filling stations, however, engineers are designing cars with onboard reactors that can generate hydrogen from gasoline (SN: 11/1/97, p. 279). Currently available reactors operate at temperatures of 1,100°C or higher, says Shabbir Ahmed of the Department of Energy's Argonne (Ill.) National Laboratory. These hot temperatures mean high engine wear and energy usage.

The new catalysts, whose composition the Argonne researchers have not revealed, operate below 800°C and work on a variety of fuels. Gasoline and diesel exposed to the materials yield a mixture of gases that is 60 percent hydrogen, while natural gas yields 42 percent. The catalysts also seem not to plug up reactors with solid carbon, a problem with other catalysts.

About 2 liters of a catalyst in pellet form can generate a hydrogen flow that will yield about 3 kilowatts of power. A light vehicle needs 40 to 50 kW to run. If others confirm the results, says Argonne's Michael Krumpelt, "industry will have to come to its own conclusions" about the usefulness of the catalysts. The scientists are currently seeking a patent for the materials. —*C.W.*

Can graphite nanofibers store hydrogen?

Tiny graphite fibers can hold more than 40 percent of their weight in hydrogen, says Nelly M. Rodriguez of Northeastern University in Boston. Such fibers, only about 20 nanometers in diameter, could be a compact, lightweight way to store hydrogen as fuel in portable devices (SN: 1/16/99, p. 47).

At the molecular level, the fibers consist of graphite disks stacked like dinner plates and connected at their edges by oxygens. The hydrogen diffuses into the space between the plates, which accommodate a large volume of gas, says Rodriguez.

Other researchers have doubts. "It's physically unrealistic," says Michael J. Heben of the National Renewable Energy Laboratory in Golden, Colo. "The conceptual limit is one hydrogen per carbon atom, which is 8 percent by weight." —*C.W.*

Electricity switches a mirror to a window

Thin films of a gadolinium-magnesium alloy possess a curious property: When hydrogen diffuses into the material, the shiny, reflective metal turns as clear as a piece of glass (SN: 3/23/96, p. 182). The alloy is a natural choice for privacy windows, optical shutters, and active displays, but pumping gas into and out of a chamber isn't a practical switching method.

Researchers at Philips Research Laboratories in Eindhoven, the Netherlands, have made a prototype device that changes the alloy from a mirror to a window simply with application of an electric voltage. A thin layer of liquid potassium hydroxide covering the alloy sends hydrogen to the metal and takes it back in response to changes in voltage.

This design lasts through only 500 switching cycles, though, says Philips' Anna-Maria Janner. A protective layer of palladium peels off the alloy, allowing a hydroxide to form. The hydroxide slows the switching time so much that the material no longer turns completely transparent. Janner and her colleagues are now trying to replace the potassium hydroxide with organic materials that won't have this problem.

One possibility is a polymer called imidazole. If the polymer remains stable through many switching cycles, "we will think of making a gel out of it," Janner says. The researchers would then have the basis for a completely solid-state device. —*C.W.*