fragile, much-pitted porous silicon. But to really be useful, siloxene also needs to luminesce when subjected to electrical current, he says. Moreover, researchers have not demonstrated that siloxene can be doped and fashioned into practical devices, says Reuben T. Collins of IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y.

Using a charge-coupled device, the Stuttgart group showed that siloxene materials can emit a rainbow of colors, including porous silicon's red and blue, a color not yet reported from porous silicon and one crucial for creating color displays or signs, Brandt says.

A siloxene molecule groups six silicon atoms as a hexagonal ring with three oxygen and six hydrogen atoms attached. These rings link up, using an oxygen atom to bridge two rings, and arrange in flat layers, Brandt explains. He adjusts the color of the luminescence by replacing the other attached atoms with different chemical side groups.

Siloxene that forms on surfaces of porous silicon during acid etching could cause that material's luminescence, says Brandt, noting similarities in the optical properties of the two types of silicon materials.

Leigh T. Canham of the Defense Research Agency in Malvern, England, who first described luminescing porous silicon, proposes a different mechanism. He suggests that luminescence occurs because etching creates silicon crystals so thin that an effect called quantum confinement occurs. After light or electrical current excites electrons in these 1- to 5-nanometer-thick "quantum wires," these "confined" electrons can calm down again only by emitting light.

But for both these explanations, "the arguments are a bit indirect," says Collins. Other researchers have proposed different mechanisms for luminescence, and while many have some evidence to back up their ideas, no single model seems to explain all the observations. Indeed, a combination of mechanisms may lead to silicon's bright glow.

"It could be quantum confinement *and* siloxene," Gösele suggests. *— E. Pennisi*

Picking out the Lymes from the lemons

Ever since Lyme disease became well known back in the '70s, Lyme-transmitting ticks have aroused a public worry much like that caused by frothy-mouthed dogs. And with 1,282 cases of Lyme disease reported across the United States so far this year, no one denies that the disease poses a real health threat. But some researchers are beginning to wonder whether Lyme may produce a previously undocumented symptom: paranoia.

Researchers at the University of Connecticut Health Center in Farmington and the Yale-New Haven Hospital examined 70 children diagnosed with Lyme disease and found that only 53 percent of them actually harbored the Lyme-causing bacterium, *Borrelia burgdorferi.* The remaining 47 percent, they discovered, had been misdiagnosed. To confirm these findings, the researchers telephoned parents of the misdiagnosed children one to three years later and found that advanced symptoms of the disease never materialized.

"The problem of Lyme disease is real, but I think a lot of people have become hysterical about it, including some doctors," says study coauthor Henry M. Feder Jr., a pediatrician at the University of Connecticut Health Center. Feder reported his group's findings at the American Pediatric Society meeting in Baltimore last week.

In its early stages, Lyme disease produces symptoms — such as fever and muscular aches — similar to those of many other illnesses. This makes diagnosis difficult. "If a doctor sees a patient and wants to make the symptoms fit Lyme disease, he can do it. That's the tricky part of it," Feder says.

Furthermore, blood tests widely used to screen for Lyme disease often yield ambiguous results. These tests look for antibodies in the bloodstream. But since the body mounts a very weak immune response to *B. burgdorferi*, the antibodies sometimes elude detection, making diagnosis a judgment call. Moreover, commercially available test kits vary widely in their reliability. Feder's group carefully prepared their own blood test rather than use a commercial kit.

Faced with inconclusive evidence, physicians often prescribe antibiotics just in case. But this approach has risks too. For example, freely distributed antibiotics could allow other infectious organisms to build up a tolerance, notes Andrew Spielman of the Harvard School of Public Health in Boston.

In recent years, scientists have developed more accurate tests that look for *B. burgdorferi* DNA rather than for human antibodies (SN: 12/9/89, p.374), but these genetic tests haven't become widely available. Until they do, diagnosing Lyme disease will continue to involve an element of guesswork. At the same time, Feder advises clinicians to weigh the evidence and the odds more carefully: "If someone gets a tick bite in a Lyme-endemic area, the risk is one in 100 of getting [the disease]. So saying, 'Uh-oh, a tick bite, you're in big trouble' — that, in my mind, is just not right." *— M. Stroh*

Flash-in-the-plasma generation of X-rays

The firing of extremely brief, intense pulses of laser light into solid targets has an extraordinary effect on ordinary matter. Electrons in the material rapidly absorb energy, and these hot electrons in turn force the ejection of other electrons from atoms to produce a high-temperature spark of plasma at the solid's surface, from which X-rays emerge.

The use of a novel laser capable of firing powerful pulses of infrared light lasting only 120 femtoseconds (quadrillionths of a second) has now enabled researchers at Stanford University to generate bursts of "hard" X-rays having energies greater than 1 million electron-volts. In previous, similar experiments, other research groups had reported X-ray energies less than one-tenth as high.

"We detected surprisingly large amounts of very hard X-rays," says Jeffrey D. Kmetec, now at Lightwave Electronics in Mountain View, Calif. "No one had looked for them before." He reported the new findings at the Quantum Electronics and Laser Science Conference, held this week in Anaheim, Calif.

The Stanford group used a custom-built, titanium-doped sapphire laser to generate five pulses per second of light at a wavelength of 807 nanometers. Tightly focused onto a tantalum target about 1 millimeter thick, each laser pulse delivered energy to a tiny spot on the metal target's surface at a rate greater than 10^{18} watts per square centimeter.

The researchers estimate that the hot flash accompanying each brief pulse yielded about 1 million X-ray photons having energies greater than 1 million electron-volts. That output suggests an unexpectedly efficient source of hard X-rays.

Kmetec and his co-workers suspect that this high-energy radiation arises from the passage of highly energetic electrons through the solid target. However, because no one has investigated in any detail the conditions that exist within a laser-bombarded material during the very short time intervals involved in these intense interactions, it isn't clear yet exactly what physical mechanism creates the hard X-rays.

"It's not a regime that we've accessed before," says Mordecai D. Rosen of the Lawrence Livermore (Calif.) National Laboratory. "It's an area that I'd like to study. It's critically important to the field to know just what hot electrons are made and why."

Fast, compact X-ray sources capable of delivering short but extremely bright pulses of radiation may prove valuable in the study of materials undergoing rapid changes and as a means of supplying energy to an X-ray laser. *— I. Peterson*