Behavior

Taking care to deter child abuse

Fathers who take little part in the care of a daughter, particularly during her preschool years, are substantially more likely to sexually abuse that child than fathers actively involved in child care, a new study finds.

This link between minimal caretaking and incest stands regardless of a man's childhood physical or sexual abuse by his parents, inability to empathize with others, emotional instability, marital problems, or negative attitudes toward a daughter in the months before her birth, say Linda M. Williams and David Finkelhor, both psychologists at the University of New Hampshire in Durham.

Their results support the theory that humans have evolved a tendency to avoid sexual contact between those living closely together in the same family or group (SN: 10/19/91, p.248). Participation in child rearing may inhibit incest by enhancing a father's parenting skills and his enjoyment of a nonsexual relationship with his daughter, the researchers contend. This process may also lower the incidence of hitting and other types of physical violence by fathers, they add.

The two psychologists recruited a total of 118 incestuous fathers, 55 from the U.S. Navy and 63 from nonmilitary treatment centers. Fifty-three Navy men and 63 civilians who had not abused their daughters served as controls. Abusive men and controls matched each other closely in age, education, occupation or military rank, and age of daughter. They answered questionnaires on topics such as child care activities, childhood histories of abuse, and past sexual offenses.

Educational programs to promote fathers' involvement in caring for their children may prove useful for men with relatively healthy emotional backgrounds, Williams and Finkelhor argue. But such encouragement may backfire if given to men whose past experiences — for example, severe physical abuse by a father or a history of sexual victimization — increase their likelihood of committing incest.

One in five of the fathers reporting the highest levels of caretaking committed incest. Most of these men noted one or more prior experiences that predisposed them to child abuse, the psychologists assert in the January American Journal of Orthopsychiatry.

Some men who cited predisposing risks for incest said that they had intentionally used intensive caretaking to groom their daughters for sexual involvement by first fostering emotional dependency and the acceptance of intimate physical touch.

Musical brains pitch to the left

People who possess perfect pitch — the ability to sing or name any musical tone without hearing a reference tone — may have a brain as well as an ear for music. A key region of the brain apparently fosters perfect pitch after undergoing reorganization in the womb and perhaps in response to early musical training, according to a report in the Feb. 3 Science.

This region, involved in both language and musical perception, is markedly larger on the left side of the brain in musicians who display perfect pitch, assert Gottfried Schlaug, a neurologist at Beth Israel Hospital in Boston, and his coworkers. Messages take longer to travel from one side of the brain to the other than from one area to another on the same side. Thus the placement of much of this particular area, known as the planum temporale, in the left hemisphere may improve handling of the verbal and musical information that facilitates perfect pitch, Schlaug's group contends.

The scientists studied the brains of 30 right-handed professional musicians, 11 of whom had perfect pitch, and 30 right-handed adults lacking musical training and perfect pitch. Each volunteer underwent magnetic resonance imaging, a technique that yields detailed views of brain anatomy.

Physics

Microchilled electrons

Colder is better when an electronic circuit must operate accurately. Immersing such a device in liquid helium or using a gas compression and expansion cycle similar to the one in household refrigerators chills the electrons, narrowing their range of energies. The narrower the range, the more accurately a detector circuit registers a value.

Now, researchers have demonstrated a new way of refrigerating the electrons in tiny circuits, allowing them to reach lower temperatures than possible using conventional schemes. This technique is based on a superconducting circuit that siphons away "hot" electrons and replaces them with "cold" ones.

John M. Martinis of the National Institute of Standards and Technology in Boulder, Colo., and his coworkers describe the method in the Dec. 12, 1994 Applied Physics Letters.

The microrefrigerator consists of a small copper strip between two superconducting contacts, one made of aluminum and the other of lead. Only electrons whose energy exceeds a certain value can pass through the copper-aluminum junction. The overall effect is to lower the temperature of the electrons in the copper conductor.

In their initial demonstration, Martinis and his colleagues lowered the electron temperature from 100 to 85 millikelvins.

"One should not expect to see such refrigeration schemes appear soon in common laboratory equipment," Sean Washburn of the University of North Carolina at Chapel Hill comments in the Jan. 12 Nature. "The superconducting electrode can remove only femtowatts of power, so it is not capable of cooling any but the tiniest of conductors, and then only slightly."

Nonetheless, such cooling may prove helpful for increasing the sensitivity of high-resolution particle and radiation detectors.

Probing superconductor electron pairs

Copper oxide superconductors maintain their ability to conduct electricity, without resistance, to unusually high temperatures. Theorists generally agree that current-carrying electrons in these materials behave as if they were paired, even though electrons repel each other. So far, however, they have failed to pinpoint the mechanism that leads to the pairing responsible for superconductivity.

One way to study the behavior of electrons in these materials is by bombarding the surface of a superconductor with high-energy photons. These photons knock electrons out of the material, and researchers can measure the energies of the ejected particles. Zhi-Xun Shen of Stanford University and his collaborators have now used this technique, known as photoemission spectroscopy, to take a detailed look at six high-temperature superconductors. They describe their findings in the Jan. 20 Science.

The researchers determined the binding force between superconducting electron pairs by measuring differences in the energy and direction of electrons emitted from a material in its normal and superconducting states. They found that this binding force was a little stronger in one direction — relative to the material's lattice of atoms — than another.

This result supports the idea that electron pairing in high-temperature superconductors is characterized by so-called d-wave symmetry (SN: 4/2/94, p.213). And this suggests that some kind of magnetic effect may be responsible for pairing the electrons in these superconductors.

But the issue remains far from settled. "While the evidence for exotic pairing... appears quite strong, uniform agreement on this point has yet to be reached," Daniel L. Cox of Ohio State University in Columbus and M. Brian Maple of the University of California, San Diego, comment in the February Physics Today.