Child Sex Abuse Leaves Mark on Brain

Two new brain-imaging studies, conducted independently, indicate that severe, repeated sexual abuse in childhood underlies damage to a brain structure that helps to orchestrate memory. This cerebral injury may predispose people to experience an altered state of consciousness known as dissociation and to develop symptoms of post-traumatic stress disorder (PTSD), scientists asserted last week at the annual meeting of the American Psychiatric Association in Miami.

Significant reductions in the size of the hippocampus, a seahorse-shaped structure previously implicated in short-term memory, also occur in Vietnam combat veterans suffering from PTSD, according to another new investigation. The point at which this neural loss occurs remains unclear, since many people who develop PTSD as adults have experienced prior traumas.

"I suspect there's something important about the hippocampus in PTSD and dissociation, but we now need to look at what happens in other brain areas as well," says Murray B. Stein of the University of California, San Diego.

Stein's group took magnetic resonance imaging (MRI) scans of the brains of 20 women with histories of prolonged sexual abuse before age 15 and compared them to MRI scans of 18 nonabused women. All participants were recruited at a women's health clinic, where they received general health care.

Abuse victims displayed markedly smaller hippocampal volume.

Most sexually abused women exhibited PTSD symptoms, such as recurring nightmares about their trauma, emotional numbing, and exaggerated reactions when startled. Scores on a standard dissociation scale climbed sharply in women with the smallest hippocampal volume, Stein asserts.

Dissociation, an alteration in consciousness induced by terror, includes absorption in one's thoughts to the exclusion of the external world, feelings of detachment from one's body or self, and memory lapses. Despite having been described by clinicians for a century, the concept of dissociation now has skeptics who question its role in repressed memories of sexual abuse and multiple personalities (SN: 9/18/93, p.184).

Support for Stein's findings comes from an MRI study directed by J. Douglas Bremner of Yale University School of Medicine. Bremner's team observed deficits in the hippocampal volume of 17 women who had suffered severe sexual abuse during childhood. Each woman's MRI data were compared to those of a nonabused woman of the same age and race.

Survivors of child abuse also scored significantly lower on a test of verbal short-term memory, Bremner says.

In another study, the Yale group found decreased hippocampal volume and verbal short-term memory in 26 male Vietnam veterans suffering from PTSD, compared to 22 psychologically healthy men of the same age.

If severe trauma unleashes a cascade of stress hormones that harm the hippocampus and related brain areas over time, fragmented recollections of a particular traumatic incident may follow, Bremner proposes.

However, many trauma survivors display no memory problems or symptoms of dissociation and PTSD. In fact, according to another study presented at the Miami meeting, such reactions to extreme stress may require a genetic predisposition, at least in men.

Joel Paris of McGill University in Montreal and his colleagues compared scores on a dissociation scale in 291 identical and fraternal twins. Scores of male identical twins matched more closely than those of male fraternal twins. From this, Paris calculated that genetic effects and "nonshared" environmental factors contribute about equally to men's capacity for dissociation.

The latter category consists of external influences, such as peer or parental pressures, that uniquely affect a child but not his or her siblings.

Paris expressed surprise that his study uncovered no genetic contribution to dissociation in female twins. Environmental contributors to dissociation, such as sexual abuse, probably exert a greater effect on girls than genetic influences do, says David Spiegel of Stanford University School of Medicine.

But Paris' study overestimates the role of genes in dissociation, Spiegel argues. Parents often treat identical twins more similarly than fraternal twins, an environmental effect neglected by the new research, he holds. *— B. Bower*

Record-breaking cold trap for pinning atoms

It's getting bitterly cold and unnaturally crowded in atom traps.

A year ago, a group of researchers at the National Institute of Standards and Technology in Gaithersburg, Md., chilled cesium atoms to 700 nanokelvins (SN: 9/10/94, p.175). Now, Eric A. Cornell and his coworkers at the Joint Institute for Laboratory Astrophysics (JILA) at the National Institute of Standards and Technology and the University of Colorado in Boulder have brought a clump of neutral atoms even closer to absolute zero.

Using a novel technique for cooling rubidium atoms in a new type of magnetic trap, the researchers recorded 200 nK as the temperature of a tightly confined atomic gas. At this temperature, rubidium atoms move with an average speed of only 4 millimeters per second.

The JILA team reported its achievement last week at a quantum electronics and laser science conference held in Baltimore.

Cornell and his colleagues used a specially designed, nonuniform magnetic field to trap a large number of cold rubidium atoms in a tiny volume. Atoms in such a trap travel at widely varying speeds, often changing velocities after each collision.

By gradually lowering the trap's magnetic field to let the fastest (or hottest) atoms escape, leaving behind the slower (or colder) atoms, the researchers steadily decreased the temperature of the confined atomic gas. A similar evaporative process is responsible for cooling a hot drink. An additional field adjustment kept the cold atoms trapped.

Eventually, Cornell's group packed about 50,000 slow-moving atoms into a volume only 23 micrometers across. The researchers measured the average atomic speed by shining laser light on the atoms to make them fluoresce and then videotaping the cloud motion viewed through a microscope. They could then infer the temperature.

The existence of such frigid atomic clouds may prove useful for high-precision experiments involving atomic clocks and for improved types of spectroscopy, the researchers say.

Because there is no theoretical lower limit to the temperature of atoms confined in the type of trap used by the researchers, further advances in evaporative cooling may bring atoms close enough to absolute zero that they will undergo Bose-Einstein condensation into a novel quantum state of matter. Originally predicted many decades ago by Albert Einstein and Satyendra Nath Bose, such a condensate arises when a clump of atoms gets so cold and dense that all its constituent atoms congeal into a single quantum state.

No one has yet observed this peculiar state, and physicists aren't sure how such a condensate will behave if and when it is finally found. *— I. Peterson*