Motherless monkeys model alcohol abuse

The stress of isolation or being raised without a mother significantly increases a monkey's alcohol consumption, report researchers who have developed a new primate model of alcohol abuse. Further studies with this model may help identify genes or environmental factors that promote heavy drinking among humans, they say.

"Under stress, genetic predisposals [to alcohol abuse] come out. Without it, early rearing experiences dominate," asserts study coauthor Stephen J. Suomi of the National Institute of Child Health and Human Development.

The 22 rhesus monkeys in the study spent the first six months of their lives — equivalent to two years in humans — either with their mothers or among monkeys of the same age, without access to adult primates, Suomi says. The researchers then housed both groups together under identical conditions.

When the monkeys reached 50 months of age, each received free access to two aspartame-sweetened solutions — one containing 7 percent alcohol, the other containing no alcohol. In general, peer-reared primates drank considerably more alcohol — often to the point of visible intoxication — than did the mother-reared monkeys, the team reports in the Aug. 15 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

"[Our model] for the first time shows that early development experiences can make individual animals vulnerable to alcohol abuse," says Markku Linnoila of the National Institute on Alcohol Abuse and Alcoholism. He notes that peer-reared primates in previous studies were more anxious and stress-prone than their mother-reared counterparts, suggesting a possible explanation for the increased drinking.

Gary W. Kraemer, a developmental psychobiologist at the University of Wisconsin-Madison, says the NIH team's "highly significant findings" support the theory that early experiences influence the physiological development of the brain, shaping its reaction to alcohol later in life. The brain "essentially molds itself to the kinds of experiences you have," Kraemer says.

Biologist Michael J. Raleigh of the University of California, Los Angeles, who also subscribes to the notion of brain "plasticity," draws an analogy between the new primate model and childhood deprivation in humans. An early lack of nurturing can "leave something that is written — if not in stone, then in ink — on the nervous system," he says.

"There's a lot of theory and speculation in all this at this point," Kraemer acknowledges, pointing out that the exact mechanism of the "imprint" remains unclear. Suomi and others suggest that psychoactive drugs somehow mimic the biological reward system involved with nurturing attachments. The absence of a mothering experience may leave primates more likely to seek gratification from alcohol and other drugs, Suomi says.

Researchers have not yet examined primate brains for rearing-induced differences. But if further work confirms the imprinted susceptibility, "the next major question is how to fix it," Kraemer says. Indeed, Suomi reports that preliminary results from a separate primate study indicate that certain antidepressants can reduce alcohol consumption. "Once [the imprint] happens," Raleigh says, "perhaps the only way to treat it is with biological intervention."

The Aug. 15 report also points to a strong link between greater stress and increased alcohol consumption, says G. Alan Marlatt, a psychologist at the University of Washington in Seattle. Previous studies provided only equivocal support for this link, he adds.

To observe the effects of stress, the NIH team socially separated the monkeys by placing them in individual cages where they could hear but not see their companions. In this situation, mother-reared monkeys "increased their drinking up to the level of the peer-reared," says Linnoila. This level, according to estimates of blood alcohol content, exceeds the drunk driving limit of most states. Many of the intoxicated monkeys vomited and staggered about.

The peer-reared primates, in contrast, generally did not increase their drinking in response to isolation; in fact, this group's average alcohol consumption decreased somewhat. During the social separation, some of these animals became almost paralyzed with fear and ignored both sweetened solutions. This indicates that isolation provoked an even stronger stress reaction in the peer-reared monkeys than in their mother-reared counterparts, Linnoila says.

When the monkeys returned to normal living conditions, the earlier drinking disparity between groups emerged again: The peer-reared group remained the heavy drinkers.

The researchers plan to look for genetic factors that make individual monkeys within each group more stress-prone or vulnerable to alcohol abuse. Linnoila points out that the primates in the study — like the general human population — were not genetically selected or inbred for a predisposition to heavy drinking. "It's a nice model to look for genetic factors in," says Raleigh.

— *J. Travis*

Ecologists seek help for menaced hybrids

Keen gardeners often cross plants of two different species to produce a hybrid bearing the best traits of both parents. Hybrids also arise in the wild between adjoining populations of different species. But even when these zones yield novel plants vulnerable to extinction, the hybrids do not qualify for protection under the U.S. Endangered Species Act.

Ecologists now hope to reverse that policy, bolstered by a new study showing that plant hybrids harbor more insects and a greater diversity of insect species than their parents. The finding suggests that plant hybrids play a vital ecological role worth protecting.

Researchers led by Thomas G. Whitham of Northern Arizona University in Flagstaff counted all the insects they could collect over a 12-minute sampling period from two species of eucalyptus trees located in adjacent forests in Tasmania, Australia. The team, which included scientists from the University of Minnesota in Minneapolis and the University of Tasmania, also sampled insects from hybrid eucalyptus trees located between the two parent species. One of the parent species is endangered.

They found twice as many insect species on the hybrid trees as on either of the parent trees. In addition, individual insects of species found on all three types of trees were three to four times more abundant on the hybrids, Whitham reported last week at a meeting of the American Institute of Biological Sciences, held in San Antonio, Texas.

Two years ago, Whitham described similar results from an eight-year study conducted along the Weber River in northern Utah, where he compared concentrations of gall aphids among narrow- and broad-leafed cottonwoods and their hybrids. In the June 23, 1989 SCIENCE, Whitham reported finding nearly all of the aphids in a zone of hybrids bearing leaves of intermediate breadth.

"It's relatively clear that the [insect] species richness is greatest in areas of [tree] hybrids," he said at last week's meeting. "Their density is also higher on hybrids than on pure parentals."

Whitham contends that his studies establish the importance of plant hybrids and demonstrate the need to conserve those threatened by extinction. "Plant hybrid zones can represent focal points of insect biodiversity, and they should be preserved for that reason alone," he asserts. "Some insect species may be so restricted to hybrid zones that the elimination of these zones may result in the extinction of the species." He cites the gall aphids as a case in point.

Other ecologists and environmentalists seem to agree. Hybrid zones exem-