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-

plify "evolution in progress," says Elaine Hoagland, executive director of the Association of Systematics Collections, a Washington, D.C.-based organization representing 80 North American botanical gardens and natural history museums. Although the association primarily seeks to preserve individual species, it is also considering lobbying for the protection of plant hybrids. "You can go overboard in trying to freeze what exists now," Hoagland explains. "You can't outlaw evolution."

Hoagland represents her association on the Endangered Species Act Reauthorization Committee, a coalition of environmental groups drawing up changes to the 1973 Endangered Species Act for congressional consideration. The law will cease to exist if it does not gain reauthorization during the current congressional session, which will end in 1992.

David Blockstein of the American Ornithologists' Union in Washington, D.C., is a member of the reauthorization committee's working group to formulate conservation measures for all endangered hybrids, plant or animal. Recently, critics have assailed captive breeding programs for the extinct-in-the-wild red wolf, arguing that the animal is a hybrid between the gray wolf and the coyote (SN: 6/15/91, p.374). "We're looking to see if there's a need to incorporate a legal remedy [into the Endangered Species Act to protect hybrids]," Blockstein says.

In the meantime, the U.S. Fish and Wildlife Service may loosen its strictures against hybrid preservation. Larry Shannon, chief of the agency's division of endangered species, says it will propose new regulations this fall to protect hybrids with parent species listed as endangered. *– C. Ezzell*

Organs spread hepatitis C

Transplanted organs, the gift of life for many, can cause a potentially fatal liver disease if they come from donors infected with hepatitis C, warn researchers who have identified 12 such cases.

Their study confirms earlier hints that the virus responsible for hepatitis C can spread via transplanted organs, as is the case with hepatitis B. This finding may compel organ banks to begin screening donor tissues for evidence of the hepatitis C virus, says Andrew S. Levey of the New England Organ Bank in Brookline, Mass.

Levey and his colleagues tested frozen blood serum obtained from 716 organ donors whose tissues were transplanted from 1986 through 1990. The analysis identified 13 donors who had antibodies to the hepatitis C virus – a microorganism first identified in 1988. Kidneys, hearts and livers from the infected donors went to 29 recipients, the team reports in the Aug. 15 NEW ENGLAND JOURNAL OF MEDICINE.

When the researchers contacted the physicians of the 29 transplant recipients, they learned that 14 of these patients (48 percent) developed some form of hepatitis within about four months after the transplantation. All 14 cases were severe; two of the patients later died of the disease.

Levey's team analyzed blood samples from 13 of the 14 hepatitis-afflicted recipients, using a recently developed test that detects antibodies to the hepatitis C virus (SN: 1/6/90, p.7). Evidence of the virus turned up in 12 of the samples, strongly suggesting that it caused their liver disease.

Levey says the New England Organ Bank now includes the hepatitis C test in routine donor screens. It does not allow transplants of C-infected organs unless the recipient is near death and has no alternative. □

Buried rock, bacteria yield deep-sea feast

It took seven long years, but oceanographers believe they have finally identified the kitchen, the raw ingredients and the cooks that prepare one of the more intriguing feasts on Earth.

Nearly every food web on the planet is supported by photosynthetic organisms, which use solar energy to produce carbohydrates. The 1984 discovery of groups of animals thriving at extreme depths in the Gulf of Mexico – well beyond the reach of the sun's rays and far from any seafloor hot springs – left scientists wondering what energy source sustained those communities. Analyses soon revealed that the animals exist in symbiosis with bacteria that produce carbohydrates by consuming energy-rich compounds. However, researchers could not tell where these compounds – primarily methane and sulfide – originated.

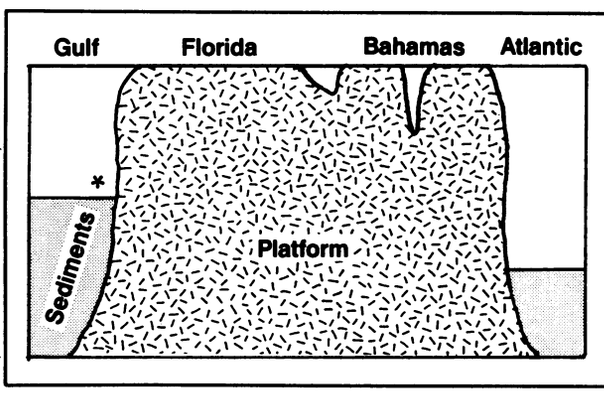
New work suggests that the compounds are produced in rock lying several kilometers beneath Florida's continental platform, report Christopher S. Martens and Charles K. Paull of the University of North Carolina in Chapel Hill and Jeffrey P. Chanton at Florida State University in Tallahassee.

During an expedition in the deep submersible *Alvin* in 1984, Martens and his colleagues found communities of mussels, tube worms, crabs, fish and other animals living on the cold seafloor at the base of the Florida escarpment – a 1,500-meter-high cliff that rises to the carbonate platform that holds Florida and the Bahamas. Paull says the cliff is about as tall as and steeper than a one-sided Grand Canyon. Studies by other researchers have suggested that the mussels derive their energy from bacteria that consume methane, while the tube worms draw their sustenance from bacteria that eat hydrogen sulfide.

Methane, the chief component of natural gas, can form through many processes, including the type of chemical reactions that produce petroleum. For this reason, scientists suspected that the methane on the seafloor might come from buried petroleum reservoirs. But Martens and his colleagues, who have examined the ratios of various carbon isotopes in the deep-sea methane, now suggest that it does not seep out of petroleum traps beneath the seafloor. Instead, they say, the methane has a biological source.

In the August GEOLOGY, the researchers propose that bacteria living in porous rock deep within the Florida platform produce the methane by consuming ancient organic matter stuck in the rock. Other bacteria in the rock convert seawater sulfate into the energy-rich sulfide, they suggest. Seawater circulating through the platform then transports the methane and sulfide to the hungry animals living by the foot of the cliff. In effect, the deep rock provides the kitchen and some of the raw materials, and the bacteria play the role of cooks.

These findings help scientists get to "the bottom of biology," Paull says. "We certainly know there are things that live in the ground, but how far down do they live?" The new evidence suggests for the first time that extremely active bacteria can exist beneath several kilometers of overlying rock, he says. *– R. Monastersky*



Adapted from Paull and Neumann/GEOLOGY

Bacteria living in porous rock deep within the Florida platform may produce energy-rich compounds that seep out of the platform edge, sustaining biological communities living at the base of the Florida escarpment (asterisk).