A man's drinking may harm his offspring

For a long time scientists have assumed that if a man drinks heavily, it will not harm his ability to sire genetically healthy offspring. Now research reported in NATURE (Vol. 253, p. 134-6) calls this assumption into question. It suggests that a male's heavy drinking can lead to spontaneous abortions, and perhaps to birth defects as well, presumably by damaging the genes in sperm.

F. M. Badr and Ragaa S. Badr, a husband and wife team at the Worcester Foundation for Experimental Biology, conducted experiments on male mice to determine whether drinking might affect their offspring. In the first experiment, eight male mice were given alcohol once a day for three consecutive days. The amount of alcohol they received was comparable to four drinks a day for humans. Each male mouse was then mated to a different female each week for six consecutive weeks. The offspring from each of the six matings were then examined for litter size, sex ratio and bodily abnormalities.

The offspring from the mice that had been drinking alcohol did not differ in litter size from the offspring of control mice, except for the litters produced from matings that took place 14 days after termination of alcoholic intake. This result suggested that the male mice's alcoholic intake leads to a loss of prenatal life which could be, in large part, the result of genetic mutations induced by alcohol in the male's sperm. The result also suggests that sperm are more sensitive to alcohol at certain stages of their maturation.

Thus, in the second experiment, the biologists tried to pinpoint the effects of male drinking on offspring. This time they gave 19 male mice alcohol at 40 percent or 60 percent concentration, mated them to females at four-day intervals, then sacrificed the pregnant females to see whether they contained aborted fetuses. Controls were used.

This experiment showed no difference in the number of fetuses implanted in females mated with drinking males as compared with those implanted in females mated with nondrinking males. However, there was a significant increase in the number of dead embryos in the females mated with drinking males as compared with nondrinking males, especially in females mated with males 9 to 13 days after drinking. This result again suggests that alcohol could lead to spontaneous abortions, by damaging genetic material in sperm at a particularly sensitive stage of sperm maturation. There were also more aborted fetuses from males who had drunk 60 percent alcohol, as compared with those who had drunk 40 percent alcohol. This result implies that there is a relationship between the amount of alcohol a male drinks and the severity of harm to the offspring he sires.

The experiments also suggest that a male's intake of alcohol might lead to defects in his offspring. One male mouse mated 10 days after drinking sired a mouse with an abnormal bulging of the head. The mouse was underweight for its age and died a few days after birth. The Badrs stress, however, that "it would be premature to conclude that this abnormality was due to alcohol treatment of the father."

As for humans, F. M. Badr, along with Steven Beaton and Robert M. Trudell of St. Vincent's Hospital in Worcester, Mass., have conducted a pilot study on heavily drinking men that suggests that drinking can lead to both spontaneous abortions and birth defects. The scientists studied 52 men who were taking at least four drinks a night. The men were drinking this amount of alcohol six weeks prior to conception. The results included a number of spontaneous abortions or infants with birth defects. The investigators admit, however, that they did not use controls in this pilot study. Nor did they rule out other causative factors that might have led to abortions or birth defects, such as emotional stress.

Studies such as those conducted by the Massachusetts investigators obviously need to be expanded and carried out more rigorously to see precisely how a male's drinking habits can affect his offspring. The sperm of males who drink heavily should undoubtedly also be checked for chromosome breaks or genetic defects, thereby definitively underscoring the link between alcohol and its ability to cause genetic damage.

* * * *

A similar study of the offspring of male rats treated with methadone and morphine has produced equally disturbing results—markedly higher infant mortality in virtually all litters. Only 26 percent of offspring sired by rats treated with methadone and 66 percent of those sired after treatment with morphine survived three weeks. The survival rate among offspring in a control population was between 90 and 95 percent.

The work was done by Durwood J. Smith and Justin M. Joffee of the University of Vermont, who also report their results in NATURE (Vol. 253, p. 202-3). The investigators further found that the infant mortality rate depends sharply on the size of methadone dosage given the male parent and that the lethal effect was most prominent when insemination took place within 24 hours of treatment. Smith and Joffee note that 1 to 3 percent of all human infants born suffer some congenital defect that cannot be explained in terms of present knowledge. They conclude that their experiments indicate doctors should not confine themselves to checking on what drugs a woman takes during the prenatal period, but should also consider possible effects of drugs taken by fathers before a child is sired. □

Turn off catalase, wake up seeds

Farmers do not always reap all that they sow, and often reap what they don't sow. They sow plant seeds, but many of them never germinate. They don't sow weed seeds, but these often do germinate and compete with useful crops for space, sunlight and nutrients. One key to both encouraging crops to germinate and controlling unwanted weeds lies in understanding the mechanisms of seed dormancy and germination. One team now reports new information on these mechanisms.

Plant physiologists Sterling B. Hendricks and Ray B. Taylorson of the Agricultural Environmental Quality Institute in Beltsville, Md., report research on breaking seed dormancy in the January PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. It has been known for several years that in the presence of favorable temperatures and moisture levels, but in the absence of light, many types of seeds can lie dormant for centuries. A weed seed can lie dormant until a plow or a burrowing animal or erosion exposes it to a brief period of sunlight. It is also known that exposure to certain compounds can break dormancy, but the mechanism was unknown until now.

The team exposed dormant lettuce and pigweed seeds to thiourea (CS $(NH_2)_2$), sodium nitrite ($NaNO_2$),

and hydroxylamine ($NH_2OH \cdot HCl$), compounds shown previously to break dormancy. They suspected that these compounds might interfere with an enzyme called catalase which breaks down peroxide (H_2O_2), so they measured catalase activity during seed exposure to the compounds. They found that the catalase was inhibited, allowing peroxide to be picked up by another set of enzymes. These enzymes break up the peroxide, pass hydrogen on by way of a carrier molecule (NADP) and allow for the increased operation of a metabolic pathway important during germination. Thus when catalase is inhibited, metabolic activity can be stepped up and germination begins.

Is this mechanism likely to be a universal one during the change from dormancy to germination? "It is difficult to know if catalase inhibition has significance across the board," says Taylorson. "It is important as far as the compounds reported, but it would be premature to extend the hypothesis to all germination."

Knowledge of this mechanism, however, might be put to work even before it has been confirmed or denied as a universal. Says Taylorson, "We are concerned with weed seed populations, and we would like to devise some compounds that do act in this way for control over germination. We would like to be able to get weeds to germinate when we want them to, so we could destroy them conveniently with low levels of herbicides when the crop is not present." They will investigate the use of these and similar compounds.

Taylorson says the team also is continuing to study plant enzymes in an attempt to "get closer to what turns germination on and what allows dormancy." Besides assisting in weed control, this knowledge may help to ensure the germination of crop seeds. □

Marijuana: Truth on health problems

In 1972 the editors of the highly respected CONSUMER REPORTS published a book by Edward M. Brecher titled *Licit and Illicit Drugs*. In an exhaustive study that was five years in the making, the author opposed the nonscientific handling of the drug problem, and recommended that marijuana be regulated rather than prohibited (SN: 12/2/72, p. 357). Brecher has now finished another extensive investigation into the problems accompanying the study of marijuana, to appear in two parts in the March and April CONSUMER REPORTS.

Brecher concludes that unsubstantial research data, based on insignificant statistical differences and nonrandom study groups, has led to a misrepresentation of the facts. Although many of the recent allegations concerning the effects of marijuana on health have appeared in reputable scientific journals, he found a general and rather frightening pattern emerging: "When a research finding can be readily checked—either by repeating the experiment or by devising a better one—an allegation of adverse marijuana effects is relatively short-lived. No damage is found—and after a time the allegation is dropped (often to be replaced by allegations of some other kind of damage due to marijuana).

"If the test procedure is difficult . . . independent repeat studies are not run in other laboratories. So these allegations of damage continue to be cited in the scientific literature and in the lay press. Then they, too, are eventually replaced by fresh allegations of marijuana damage."

Consumer's Union does not say marijuana is harmless, but instead points out, as it did in the earlier study, that "no drug is safe or harmless to all people at all dosage levels or under all conditions of use."

In Jamaica, where marijuana has been a daily custom for generations, scientists would not have to predict the long-term consequences of marijuana use, Brecher says. "If dire adverse effects existed they would surely be readily visible." The National Institute of Mental Health commissioned the Research Institute for the Study of Man to study marijuana effects in Jamaica. Although the Jamaica report was completed nearly three years ago, it has not been published in the United States. An edition in English was finally scheduled to be published in February by Mouton, a Dutch firm in The Hague. From the Jamaica study these assumptions were disproved:

- A reduction in motivation: Field workers actually perform more motions and expend more energy after smoking marijuana than before, but they appear to accomplish less. Marijuana used in group labor situations tends to increase social cohesiveness and increases the laborer's willingness to work.
- Susceptibility to disease: No significant physical abnormalities were reported in 28 of 30 marijuana smokers; the smokers weighed an average seven pounds less than nonsmokers, which, the report noted, might indicate chronic use of marijuana causes some suppression of appetite.
- Precancerous lung cell damage: X-rays of lungs were normal in both smokers and nonsmokers; the extent of lung damage due to smoking is probably more closely related to the amount of smoke inhaled than to the type of smoke.
- Brain damage: Personality and intelligence tests showed little, if any, differences between smokers and nonsmokers, leading the Jamaica research team to conclude that "the data clearly indicate that the long-term marijuana use by these men did not produce demonstrable intellectual or ability deficits when they were without the drug for three days. There is no evidence in the results to suggest brain damage."

Brecher cites several conflicts between earlier marijuana studies. The late A.M.G. Campbell and his associates in December 1971 reportedly showed "evidence of cerebral atrophy" —a wasting of brain tissue. Such X-ray studies can be painful and hazardous, and have not been repeated by other groups. But Harold Kolansky, a psychiatrist at the University of Pennsylvania School of Medicine, says of the Campbell study: "Of 10 study subjects, one subject had a previous history of convulsions, four had significant head injuries, and a number had used sedatives, barbituates, heroin or morphine. In the 10 cases reported, all 10 men had used LSD—many of them over 20 times."

Lester Grinspoon of the Harvard Medical School similarly disagrees with another scientist, Robert G. Heath, who recorded monkeys' brain waves before, during and after heavy exposure to marijuana smoke. Grinspoon points out that Heath's monkeys did not smoke marijuana voluntarily, but had the heavy doses forced into their lungs. Since the monkey lung is about one-fifth the size of a human lung, the concentration of marijuana in the monkey lung may have been 15 times as high as that of a comparable dose in the human lung.

Other findings confirmed that marijuana smokers are not necessarily subject to a drop in disease immunity or damage to chromosomes. Lung problems may follow heavy smoking, Brecher says, and he recommends heavy users consume marijuana in other forms, such as drinking marijuana tea, to protect their lungs from smoke.

"The truth about marijuana should be known," the report concludes. "But if the reports are poorly founded, that fact needs to be reported, too. For such misinformation serves only to frighten the public unnecessarily, especially the millions of marijuana smokers, former smokers and their families—many of whom may now be waiting in dread for brain damage, cancer and other predicted disasters to strike themselves or their loved ones." □