Biomedicine

How alcohol intoxicates

Some scientists believe that the intoxicating effect of alcohol coincides with the breakdown of ethanol to acetaldehyde in the brain. Now research reported in the April JOURNAL OF NEUROCHEMISTRY, by Henry A. Sloviter and his team at the University of Pennsylvania, suggests that the breakdown takes place in the liver—not in the brain.

Sloviter and his colleagues perfused isolated rat brains with ethanol marked with a radioactive tracer. Since they could find no radioactivity in the brain's amino acids, they concluded that the perfused rat brain "does not metabolize ethanol at a measurable rate." In the same fashion, they perfused rat brains with radioactively marked acetaldehyde, and then with acetate (the metabolic product of acetaldehyde). After perfusion with either of these substances "there was considerable incorporation of radioactivity into the free amino acids of cerebral tissue."

These findings suggest that acetaldehyde is a likely candidate as the intoxicating, and possibly addicting, substance, and that it reaches the brain through the bloodstream after being produced in the liver from ethanol.

Role of catecholamines in memory

Catecholamines are chemicals secreted by nerve cells in the brain. The role of these chemicals in normal physiological and behavioral functions are just starting to be elucidated. For example, the catecholamines have been found to participate in sleep. Now they appear to affect memory.

Several investigators reported that rodents trained after treatment with the drug acetoxycycloheximide (AXM) developed amnesia. Then Louis B. Flexner and his team of neurological scientists at the University of Pennsylvania found that this drug reduced the activity of the enzyme tyrosine hydroxylase in the brain. Since tyrosine hydroxylase controls the rate of catecholamine synthesis, this loss of activity suggested that AXM-provoked amnesia might be due, in part, to a reduction in catecholamine synthesis. So Flexner and his colleagues tested for this possibility.

They now report in the February PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that this is indeed the case. Thus the catecholamines play some role in memory.

The on-off effect of L-dopa

Parkinson's disease causes rhythmic tremors and a freezing of the muscles. Until 1967, America's one million victims of Parkinson's disease were experiencing, or could anticipate, a life of physical confinement. Then L-dopa came on the market, allowing literally thousands of victims to resume normal physical activity.

L-dopa isn't without its faults, however. Sometimes patients on it experience a relapse. Such relapses might be explained by patients' blood getting low in the drug if their symptoms didn't once again disappear without their taking extra L-dopa.

Now Don Dougan and his clinical pharmacology team at St. Vincent's Hospital in Sydney have found a possible explanation for why L-dopa has an on-off effect. One of the metabolites (breakdown products) of the drug—tetrahydropapaveroline—antagonizes the action of L-dopa.

"Thus the therapeutic success or failure with L-dopa in Parkinson's disease," Dougan and co-workers conclude in the March 6 NATURE, "may depend in part on the relative rates of production and accumulation of these or similar metabolites in the brain."

Physical Sciences

Lightening the burden of the quarks

For a long time particle physicists have believed that quarks are very heavy. Quarks are the subparticles that theory says elementary particles are made of, and there are two basic reasons for thinking them heavy: A free quark has never been seen, therefore it ought to be too heavy to be created by energies now available at accelerators. From the same evidence theorists supposed that quarks were tightly bound inside the particles they make up, and this would also make them heavy since they would have to have a lot of mass-energy to give up to make the strong bond.

But now experiments that probe the structure of particles seem to indicate that the quarks are really very weakly bound together, and theorists are now trying out the idea that they are held inside by an external constraint, a kind of bag or box, as they say.

So quarks could be lightweights, and in the April 7 PHYSICAL REVIEW LETTERS, T. P. Cheng and P. B. James of the University of Missouri in St. Louis use the differences in the masses of observed mesons to calculate quark masses. The results range between 0.3 billion electron-volts and 1.4 billion electron-volts. These amounts are within current accelerator capability, so perhaps it's the bag that prevents free quarks from being seen.

The gravity of a binary pulsar

Having discovered a pulsar in a binary star system, astronomers are now busy figuring out things they can learn from it. One of those things, according to two papers in ASTROPHYSICAL JOURNAL LETTERS (196:L59,L63) is to test certain predictions of rival gravitational theories.

The two rivals are the theories of Einstein and of Brans and Dicke to which the name of Jordan is now sometimes added. Douglas M. Eardley of Yale University suggests that two effects predicted by the B-D-J theory might show up: gravitational radiation of the dipole configuration and a long-term decrease in the strength of gravitational forces. Both effects would alter the motions of the system. If the pulsar's companion is a black hole, Eardley argues, the effect of the radiation should be observable; if the companion is not a black hole, the other effect should be strong enough to show up.

Taking faith in Einstein for granted, Robert V. Wagoner of Stanford University calculates that the loss of energy due to the kind of gravitational radiation Einstein predicts (the quadrupole configuration) could also lead to observable changes in the system.

Pie-eyed in the sky

Ethyl alcohol comes in two molecular configurations, called trans and gauche. Last fall Benjamin Zuckerman of the University of Maryland and 11 others reported discovery of ethyl alcohol in the interstellar cloud Sagittarius B2. Now they report specifically (ASTROPHYSICAL JOURNAL 196:L99) characteristic wavelengths belonging to the trans form.

The abundance of alcohol in the cloud would yield 10^{28} fifths at 200 proof, more than all the booze ever fermented on earth. Taking the ethyl alcohol abundance with those of related molecules, dimethyl ether, acetaldehyde and methyl alcohol, one can begin to test the most popular hypothesis of how the interstellar molecules are formed. The abundances plus the hypothesis lead to a prediction that the radio signals of propyl alcohol, the next most complicated alcohol, should be a fifth as bright as ethanol's.