CHEMISTRY

From the American Chemical Society regional meeting in New Orleans

Once upon a mattress

This is a tale about a flame retardant chemical that may or may not migrate from fabrics into the body, that may or may not be mutagenic and that may or may not be linked to the apparent decline in U.S. male fertility. Ralph C. Dougherty of Florida State University in Tallahassee says the fire retardant tris (1,3-dichloroisopropyl) phosphate, or Fyrol FR-2, does migrate, is mutagenic and may be a sterilifactant. But toxicologist Ralph Freudenthal of Stauffer Chemical — the principal producer of this fire retardant — says, "It is most improper to make these accusations."

This chemical controversy began when Dougherty and colleagues reported finding trace amounts of Fyrol FR-2 in the seminal fluid of 34 of 132 university students examined. The American Chemical Society then issued a press release on the findings Dougherty eventually presented at the ACS regional meeting in New Orleans. The press release was based on an interview in which Dougherty said Fyrol FR-2 is a proven mutagen, can cause genetic damage and possibly birth defects and is a sterilifactant and potential carcinogen. Moreover, Dougherty said that sleeping on polyurethane foam mattresses treated with the chemical is probably the major source of exposure to Fyrol FR-2.

Stauffer's Freudenthal took exception to the ACS press release. He says that tests conducted by laboratories at the Consumer Product Safety Commission and the National Institute for Environmental Health Sciences, for example, indicate the Fyrol FR-2 is not even mutagenic. (Still, Stauffer officials voluntarily withdrew the chemical from the children's sleepwear market in 1977 when Bruce N. Ames of the University of California at Berkeley reported Fyrol to be a weak mutagen.) In addition, says Freudenthal, while Fyrol FR-2 is used in automobile seats and furniture, use of it in mattresses is confined to a "very small percentage of the bedding market" — mainly dormitory and other institutional bedding.

Stauffer officials discussed their objections with Dougherty, who in turn informed the ACS news service he no longer was certain of the source of Fyrol FR-2 exposure. The ACS news service issued a disclaimer of the original release.

But Dougherty maintains that the information in that release is "factually accurate," and he plans to begin investigating the chemical composition of dormitory mattresses.

THC, placentas: The estrogen connection

Researchers are studying the effect of a marijuana component on a waste product of pregnancy — the placenta. Sandra R. Stevens of Baylor College of Medicine in Houston, Tex., and colleagues are obtaining placentas from normal-term deliveries to investigate the action of delta-9-tetrahydrocannabinol (THC) — the major psychoactive component of marijuana — on one particular system of the human placenta. That system is the aromatase enzyme complex — the final enzyme group involved in the production of the high levels of estrogens needed during pregnancy. Researchers are unsure of the exact role estrogens play during pregnancy, but they believe these steroids maintain the crucial oxygen- and nutrient-carrying flow of blood through the placenta to the fetus via a vasodilatory effect.

Stevens and co-workers hypothesize that THC binds to the aromatase enzymes, blocking their normal estrogen-synthesizing activity. Results thus far obtained by the group show that THC does inhibit estrogen formation, but that the degree of inhibition varies among placentas. "In the future, we hope to be able to determine some factors involved in the variation," says Stevens, " ... to identify that portion of the [pregnant women] population that is at greater risk."

PHYSICAL SCIENCES

Dietrick E. Thomsen reports from New Orleans at the International Conference on Lasers '80

Get your ultraviolet out of my eye

Every place in which there are operating lasers is decorated with notices and alarms designed to prevent exposure and damage to human eyes from the light of the lasers. Ultraviolet, being shorter wavelength radiation than visible or infrared and therefore packing more energy per photon than they do, could be more damaging. J. A. Zulich of Technology, Inc., reviewed the possibilities of ultraviolet laser eye damage.

According to him, there are two wavelength ranges in question, the ultraviolet between 200 and 300 nanometers and the near ultraviolet between 300 and 400 nanometers. There are three structures in the eye susceptible to damage: the cornea, the lens and the retina.

In the cornea ultraviolet damage develops over hours. It produces first a sensation of sand in the eye and then a cloudiness of the cornea. The damage is limited to the epithelial or outer layer and clears up in time. There seems to be a 46-hour repair period. This raises the question of how safety standards take into account the effect on people who are exposed from day to day without necessarily the allowance of a recuperation time.

The lens transmits the near ultraviolet with a peak near 365 nanometers. The lens is resistant to ultraviolet. Nevertheless, such passage is related to formation of cataracts over years and certain wavelengths can produce opacities in the short term. Another lens hazard near 365 nanometers is that absorption at the front surface of the lens can produce immediate thermal damage.

The retina gets higher power densities because the lens tends to make images of the light source upon it. Retinal hazard appears to be severest at shorter wavelengths. At around 320 nanometers the lesions begin as bright spots that develop after exposure. After 24 hours dark haloes develop. The lesions resemble the shorter developing corneal lesions, but the retinal ones do not disappear over days. They are permanent.

It takes $^{3}/_{10}$ of a second exposure to get retinal lesions, but 14 seconds to reach the corneal threshold. The retinal threshold seems to be lower than the accepted (ANSI) standards. "The retina could be the most sensitive tissue," Zulich concludes.

Cloudy Crystal Ball department

Many people have considered the use of laser beams for long-distance transmission of information. G. C. Mooradian, speaking for himself and M. Geller, both of the Naval Ocean Systems Center, reported on what he calls the "first measurements of propagation of optical pulses through clouds in a geometry that represents satellite-to-ground transmission."

They chose the island of Kauai in Hawaii as the site of the experiment because it has the most annual rainfall (300 inches) and the most cloudy conditions. A neodymium:YAG laser that gave 50-nanosecond pulses was carried in an airplane that flew at 40,000 feet. The laser illuminated an area on the ground that was six kilometers in diameter. The position of the aircraft was monitored by high-precision radar. Sensors on the ground received the laser pulse.

The idea was to check the spatial spreading and the time spreading due to multiple scattering of the laser light by droplets in the cloud. The time spreading due to scattering along multiple paths is most important, Mooradian says.

"There is quite a discrepancy between theory and experiment," Mooradian says. The laser gave 50-nanosecond pulses; they had become 50 milliseconds by the time they reached the ground, a factor of 1,000 time distortion. This amount was not predicted by theory. Neither did a theoretical dependence of distortion on field of view of the detectors show up in the data. "Much more work has to be done," Mooradian says.