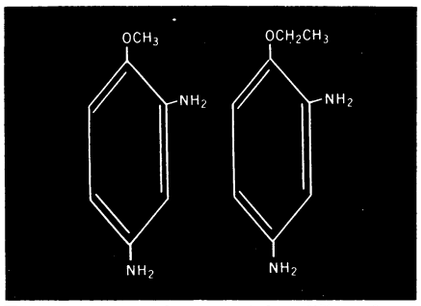
Hair-dye mutagen: Color it FDA-immune

When the U.S. Food and Drug Administration announced in January 1978 that all hair dyes containing 4-methoxy-*m*-phenylenediamine (MMPD) — a confirmed carcinogen in rats and mice — would require a cancer warning label, at least one hair dye manufacturer replaced the MMPD in its product with 4-ethoxy-*m*-phenylenediamine (EMPD). By adding three atoms — one carbon and two hydrogens — to MMPD, Revlon avoided the FDA "warning label" regulation. "By juggling atoms this way," says Larry Katzenstein of CONSUMER REPORTS, "manufacturers can stay a step ahead of government regulators almost indefinitely."

So Katzenstein, in a move he hoped would help government regulators catch up with manufacturers, brought the use of EMPD in hair dyes to the attention of the FDA. Now, Michael J. Prival and colleagues of the FDA report in the Feb. 22 SCIENCE the results of their evaluation of this hair-dye chemical: EMPD is a frameshift mutagen in certain bacterial strains.

A frameshift mutagen is a substance that increases the frequency with which DNA is altered by the removal or insertion of one or two of the paired nucleotides that constitute the double helix. A confirmed mutagen is not necessarily a carcinogen; however, because of their structural similarity, there is "no basis for believing that exposure to EMPD is any less hazardous than exposure to an equal quantity of MMPD," Prival says. Still, mutagenicity in bacteria is not considered a sufficient basis for allowing FDA regulation. "Results from cancer tests in animals *in vivo,* which usually require more than two years to initiate, execute and evaluate are needed before governmental agencies in the United States and most other countries will regulate a chemical as a carcinogen," Prival says.

Moreover, the FDA's only recourse against a carcinogenic hair-dye chemical is to require that products containing that chemical bear a cancer warning label. "No matter how hazardous the chemicals used in hair dyes may be," Katzenstein says, "the FDA has no power to ban them." FDA's lack of authority in the hair-dye area dates back to 1938, when industry persuaded Congress to exempt dyes containing coal-tar chemicals — still the essential ingredient in most hair dyes — from any law controlling cosmetics, Katzenstein explains. The 1938 law is still in effect today, despite efforts by several legislators to repeal it. Sen. Thomas Eagleton (D-Mo.), for example, introduced in 1979 legislation to repeal the coal-tar exemption. Although the bill passed in the Senate, a crowded agenda kept the House from considering it. Eagleton probably will pursue the legislation again in 1981, says Marsha McCord of Eagleton's staff: "It appears from the legislative cycle that next year will be a food and cosmetic year," she says.



Science

The structure of EMPD, right, differs from MMPD, left, by the addition of CH_2.

Until such legislation is passed, FDA's authority over hair-dye ingredients remains limited. And, in the case of EMPD, the possibility of even limited regulation is not without its snag: "Although we recommended EMPD as a substance to be further investigated as part of the National Toxicology Program," explains Heinz Eiermann of FDA's Division of Cosmetics, "that's no guarantee of further investigation; it [EMPD] has to compete with other hazardous substances for priority." Substances receive investigative priority partially on the basis of exposure of the population to that substance. Since FDA is aware of only two companies — Revlon and Jeffrey-Martin Inc. — using EMPD in their hair dyes, its case for further investigation may be a weak one, Eiermann says. Without further government investigation — evaluating EMPD for its carcinogenic potential — FDA is powerless to require a warning label on hair dyes containing this mutagen. "And it's highly unlikely that industry will spend $500,000 to test the product and probably come up with a positive result," Eiermann says. An industry's choice not to test a particular chemical, says Eiermann, is "perfectly legal."

Even so, Prival says, "EMPD should have been subjected to thorough evaluation for skin absorption, carcinogenicity and mutagenicity in a variety of test systems before it was used in hair dyes." The confirmed mutagenicity of EMPD, Prival says, illustrates "the importance of considering the possible relationships between chemical structure and biological effects before exposing consumers to new chemicals."

Interestingly, Katzenstein reported in the August 1979 CONSUMER REPORTS that Richard Schnetzinger, director of biological sciences for Revlon, "revealed that Revlon had performed the Ames test [a standard test for mutagenicity] on the chemical [EMPD] as well as on the product [the hair dye]. The test on the chemical was positive [revealed mutations]." Frank Johnson, spokesman for Revlon, was not available at the time of this printing to confirm or deny that tests had been conducted. □

Ancient whale: By land and sea


Univ. of Michigan

Whale teeth discovered by Gingerich resemble teeth of a prehistoric land mammal called Dissacus, *from which he suggests whales may have descended.*

In what may be the oldest whale fossil find yet recorded, a back portion of a skull and several teeth of whales that inhabited the ancient Tethys Sea about 45 to 50 million years ago have been uncovered by University of Michigan paleontologist Philip D. Gingerich. The fossils, found in 1978 in a solid rock layer in the Himalayan foothills of Pakistan, were mixed with remains of both land and marine mammals in an area that was once a shoreline — which suggests that the primitive whale may have been both a sea and land dweller, Gingerich says. He further speculates that the whale, which was 6 to 8 feet long and weighed 400 to 500 pounds, was one of several "transitional animal forms [that] fed on fish in the sea during the day and came back to land at night." During that Eocene period, whales most likely still had four limbs, he says, and adds, "We first suspected that the cranial bone comes from a whale because the brain cavity is not very large. Whales have much smaller brains than other mammals relative to their skull or body size." □