SCIENCE NEWS OF THE WEEK

DNA on X Chromosome Cloned and Identified

The most exciting advances in recombinant DNA technology have come during the past three years as molecular biologists, with their enzyme splicing of desired genetic material, insertion of the material into plasmids and insertion of the plasmids into bacteria for gene and gene product production, have harvested human genes and human gene products of great potential value to clinical medicine. These products include insulin, growth hormone, interferon, urokinase and beta-endorphin. Now another coup along these lines is reported in the August CELL by Stanley F. Wolf, Cristina E. Mareni and Barbara R. Migeon of Johns Hopkins University School of Medicine in Baltimore: DNA sequences from a mammalian X chromosome—the human X chromosome—have been cloned and identified for the first time.

Wolf and his co-workers took DNA from human cells containing three or more X chromosomes so they would have enriched X chromosomal material with which to work. They used restriction enzymes to splice the DNA at specific points and inserted the DNA fragments into bacterial plasmids (rings of bacterial DNA). They inserted the plasmids into bacteria, and the bacteria produced clones (copies) of the plasmids. The researchers then hybridized (crossed) the plasmids to DNA from mouse-human hybrid cells containing the X chromosome as the sole human chromosome and to DNA from mouse-human hybrid cells lacking the human X chromosome. Those DNA sequences on the plasmids that crossed with DNA in the former group of cells but not in the latter were deduced to be DNA sequences found on the human X chromosome. The researchers then tested these DNA sequences further to determine which were specific to the human X chromosome and which also shared certain similarities with other human chromosomes.

Although the DNA fragments cloned and identified so far represent probably less than one percent of all the genetic material on the human X chromosome, still more fragments can now be obtained with the same techniques to help scientists determine which genes are located where on the human X chromosome. Now that X chromosome DNA fragments can be cloned and identified, scientists may eventually be able to identify defective genes on the X chromosome that are responsible for hemophilia, muscular dystrophy, the Lesch-Nyhan syndrome (characterized by mental retardation, spasticity and other symptoms) and some 150 other human hereditary diseases and perhaps even find markers linked to the defective genes. Such markers might then be used to identify women carrying the defective genes before they pass on those genes, and very possibly the associated genetic disease, to their offspring. The cloning and identification of DNA sequences from the human X chromosome also may help investigators figure out why one of the two X chromosomes present in every cell in a woman's body does not express its genetic material from fetal life on. In some cells, the inactive chromosome is the X received from the mother; in other cells, it is the paternal X. □

Low cost process detoxifies PCBs

A chemical means to break down persistent and toxic halogenated pollutants, such as PCB's (polychlorinated biphenyls), PBB's (polybrominated biphenyls), DDT and certain other organic pesticides and herbicides, was announced last week by the Goodyear Tire and Rubber Co. Already tested on up to 2,000-gallon batches of oil-based heat-transfer fluids, the process can reduce PCB contamination levels from 200 parts per million to less than 10 ppm in a room-temperature reaction that takes only about five minutes, according to Dane Parker, a developer of the Goodyear technique.

Pending approval by the Environmental Protection Agency (which Goodyear has not sought since it has no plans to commercialize it), this process could be used in the disposal of some of the roughly one billion gallons of mineral-oil-based transformer fluids that are contaminated with low-level (50 to 500 parts per million) concentrations of PCB's. Development of the process is particularly timely because since July 1 of this year, EPA regulations demand that any substance contaminated with more than 50 ppm of a mono- or polychlorinated biphenyl be disposed of commercially in agency-approved incinerators or landfills—depending on the degree of contamination.

To date, only EPA-approved landfills exist for commercial PCB disposal. A limited number of facilities, however, are conducting EPA-approved noncommercial disposal of low-level contaminated substances in high-efficiency boilers owned by generators of those wastes. No incinerators to handle wastes contaminated with high levels of PCB's have won EPA approval yet, but at least two firms in Texas are currently testing experimental systems.

The Goodyear process relies on the interaction of a reagent with the contaminated oil-based fluid. That reagent, sodium naphthalide, is produced by the interaction of a tetrahydrofuran solution of naphthalene with room-temperature solidified sodium droplets. All ingredients are available commercially; in fact, costs of the chemicals involved average only $0.02 per pound of recovered heat-transfer fluid, according to Parker and W.L. Cox in the Aug. 21 PLANT ENGINEERING. The heat-transfer fluid itself costs about $1 per pound new and would be sacrificed during incineration or landfill disposal.

Though Goodyear is the first to reveal its chemical detoxification process, other firms are experimenting with competing techniques. Details of those programs are guarded confidentially, however, because the developers plan commercial introduction of their schemes. Goodyear is patenting its process but offering it free to potential users. □

No nitrite ban: Data reevaluated

Immediate governmental threats to the nitrite in hot dogs, bacon and other cured foods evaporated last week under the heat of a reevaluation of the data that launched the controversial possibility of a nitrite ban two years ago (SN: 8/19/78, p. 119). A group of independent pathologists under contract to the Food and Drug Administration examined 50,000 tissue slides from the 2,000 rats in the original lifetime feeding study conducted by Paul M. Newberne at the Massachusetts Institute of Technology. They conclude, "... insufficient evidence exists to support the conclusion that sodium nitrite *per se* fed to rats causes cancer." In a joint statement, the FDA and the U.S. Department of Agriculture say there is currently no basis for any action to remove nitrite from foods.

The major difference in the analyses of the MIT data was that the independent pathologists found a much lower incidence of cancers of the lymph system than Newberne had reported. They also judged that because animals were obtained at different times and housed in different rooms, some of the comparisons were invalid. Finally, the pathologists suggest that nitrosamines, related chemicals that have been found to cause cancer in laboratory animals, probably were formed in some of the food given to the rats.

When the Departments of Agriculture and of Health, Education and Welfare proposed in 1978 that nitrites be phased out and then banned as a preservative, turmoil

resulted in both the government and the meat industry. The Attorney General advised that the departments could not order a phased withdrawal of nitrite if it causes cancer, but they would have to impose a complete ban without considering nitrite's benefits. The USDA and FDA felt a sudden ban would pose a risk of botulism to the public. Congress was faced with the question of whether or not it should change the law, the Delaney amendment, requiring a ban on any food additive shown to cause cancer.

After the recent reevaluation of the nitrite data, Rep. William C. Wampler (R-Va.) called a press conference to ask Congress to adopt a new procedure for evaluating food additives. He charged federal regulators with using scare tactics in premature announcements that cause "near chaos" in industries affected by "these on-again-off-again regulatory announcements."

Even if nitrite does not cause cancer directly, it remains suspect on health charges. Nitrites can be converted during cooking or in the body to nitrosamines, which are known carcinogens. The FDA and USDA say they will continue their efforts to eliminate nitrosamines from foods. In addition, the pathologists point out that two very recent reports conclude that nitrite-fed rats have higher tumor incidences than do control animals. Those reports are now being reviewed by the Bureau of Foods. □

Put out the fire of fire ants

Photos: USDA

Fire ant colonies build 2- to 3-foot-high mounds that house hundreds of thousands of ants. They swarm out of the hive at the slightest provocation.

Fire ants began marching through Georgia in the 1930s after they were accidentally introduced into that state. And the pests, named for their fierce sting, have continued to march. They now infect 230 million acres in nine southeastern states, and they are spreading at a rate of approximately 30 miles per year. The insecticide mirex had been used to fight the ants, but it was banned in 1978 after it was found to be carcinogenic, to cause birth defects and to accumulate in the environment. Now there is new hope that the march of the fire ants can be halted. The Environmental Protection Agency has approved an insecticide called Amdro for use in wide area ant control programs.

Amdro belongs to a new class of chemical compounds called amidinohydrazones. Scientists at American Cyanamid Co. developed and tested more than 500 such compounds before hitting upon Amdro, which is applied to pastures, range grass, lawns, turf and non-agricultural lands (4 to 6 grams are distributed per acre). Because Amdro must be carried back to the mound by foraging worker ants if it is to be effective, it must be applied when soil temperature is more than 60° F and when the ants are active.

The fight against fire ants (also known as imported fire ants) is serious because they are more than picnic pests. They threaten both human health and agriculture. In 1979, for instance, one Georgia county treated more than 28,500 sting cases, says Joseph J. Garbarino of American Cyanamid. A fire ant sting produces a burning sensation, and the resultant itchy pustule can become infected. A fire ant can sting repeatedly, and victims are usually attacked by many ants at once.

Farmers suffer economic losses not only because of the ants but because of their mounds, which may be 18 inches high, 2 feet in diameter and house 250,000 ants. Livestock avoid the mounds, thus reducing grazing land. The mounds damage mowers, balers and other farm equipment so large sections of fields cannot be harvested mechanically. In addition, bales of hay left on the ground overnight cannot be handled because of already resident ants. The ants attack and sometimes kill young livestock and ground-nesting birds.

Short-term laboratory tests indicate that Amdro doesn't cause genetic changes or birth defects. Long-term studies are currently underway. Calvin Alvarez of American Cyanamid says their studies indicate Amdro doesn't accumulate in the food chain or in the environment, but instead is degraded by sunlight and by soil microorganisms. The insecticide has already been tested on approximately 100,000 acres of land, and Cyanamid hopes to sell enough insecticide to treat 1.2 million acres this fall. □

Unlocking buried geothermal energy

A unique form of geothermal energy lies deep in a part of Texas. Whether it can be used efficiently as an energy alternative is a question Myron Dorfman and colleagues at the University of Texas at Austin have set out to answer.

Dorfman and co-workers are investigating subsurface waters trapped at abnormally high temperatures and pressures. These aquifers eventually may be not only a third source of geothermal energy — hot-water and dry-steam fields are the two conventional forms of the earth's heat energy currently being tapped — but also a source of natural gas: The geopressured waters contain a significant quantity of dissolved methane. Although a 16,500-foot geopressured well was drilled last year to test the feasibility of gas recovery and geothermal energy production from these waters, an ownership change-of-hand forced the then only 10-day-old investigation to cease. Now the business barrier has been removed and tests are due to resume, reported Dorfman at the American Chemical Society meeting last week in Las Vegas, Nev.

The test well, about 35 miles south of Houston, sits on one of the largest geopressured zones in the world — one that underlies a large portion of the northern shore line of the Gulf of Mexico. Dorfman says there are seven other such basins in the United States and 42 in other countries. These geopressured zones are primarily the result of compaction phenomena: Newly deposited, water-saturated sediments eventually are covered by younger sediments. As the water-saturated rock is buried deeper, it begins to expel water; if the overlying rock is impermeable the water is trapped, and the weight of the rock keeps this water at higher than normal pressures. Underlying shales are believed to be the source of the methane in these geopressured aquifers.

Mathematical calculations indicate that the test well is capable of pumping 40,000 barrels of water per day, from which 1 million cubic feet of gas could be extracted. The total amount of recoverable natural gas in the geopressured aquifer is 200 to 250 trillion cubic feet. Known reserves of conventional natural gas in the United States are about 200 trillion cubic feet.

But, says Dorfman, "We can do paper studies all day long," and the figures "will mean nothing. That is why we have set out to study long-term [field] tests."

One field test will focus on determining the most efficient use of the hot waters. The aquifer waters — at temperatures 200° to 300°F lower than dry-steam and hot-water fields — may be cooler than what is necessary with present-day technology to yield geothermal generation of electricity. Other tests will assess the en-