Guayule: A native natural rubber

The United States may be encountering still another important product shortage: this time, rubber. What makes rubber production so vulnerable to shortages is its dependence on petroleum supplies and imports. Seventy percent of American-made rubber is synthesized from oil products, and the remainder comes from natural rubber shipped from Malaysia and Indonesia. Figures published by the World Bank predict that the demand for natural rubber will outstrip the supply three times over by 1985.

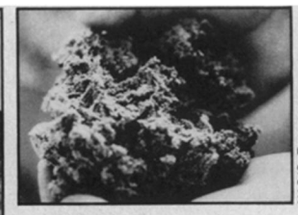
Anticipating this shortage, the National Academy of Sciences has suggested the cultivation of guayule (pronounced wy-oo-lee), a natural rubber-bearing shrub that grows wild in the high, arid plateaus of Texas and Mexico. According to the Academy report, issued last week, the rubber processed from guayule *(Parthenium argentatum)* is virtually indistinguishable from rubber tapped from the tropical hevea tree, the main U.S. source of natural rubber.

Although synthetic isoprene accounts for our major source of rubber, natural rubber is still important to production, especially in the tire industry. On the average, 20 percent of all rubber used in tires in the United States is natural rubber. Radial tires, increasing in popularity, use up to 40 percent natural rubber, and special performance tires for aircraft and heavy machinery use even more.

Guayule, the report suggests, can provide an important source of natural rubber. Seventy years ago, guayule provided half the rubber used in the United States, and guayule production in Mexico and California was a big business. The ultimate downfall of guayule resulted from its inefficient refining process. Too much resin and debris remained in rubber after refining, and its quality fell far below the easily cultivated hevea tree. While hevea rubber can be tapped from the tree, guayule shrubs have to be harvested, beaten to a pulp, parboiled and refined before their rubber can be used.

By the time hevea rubber supplies were cut off in World War II, guayule had been overharvested in Mexico and abandoned in California. The Emergency Rubber Project rushed 32,000 acres of guayule into production, and at the end of the war, some 3 million tons of rubber from wild and cultivated guayule were produced. After the war, however, the project's other major effort, synthetic rubber, priced guayule out of the market. Growing guayule became so unprofitable that Congress ordered all experimental fields burned in 1946.

All major research on processing and hybridization halted in North America until the Mexican government renewed interest in the shrub in the early 1970s. The Mexicans have focused their research primarily on improving the processing of the plant and have reduced the amounts of resin and by-products left in the rubber. But they have not been too interested in research on cultivation since so much wild guayule grows in Mexico. In the United States, where wild guayule is scarce, the Academy report suggests experimental projects in cultivation be undertaken focusing on the production of higher yield plant strains and the discovery of optimal soil and moisture requirements. The purpose of any research would be the demonstration of the commercial viability of the plant. Experimental farms in the Southwest should be reopened, the report advises.



NAS/C. Emerson

Unirrigated guayule, Manzanar, Calif., in 1943. Work was done by Japanese-Americans detained in relocation camp. Above, the crude form of the rubber.

Although guayule production holds many hopeful promises, the first profitable guayule farms growing rubber for American tires are still some 20 years distant. At least 10 years of research will be needed for plant research alone.

The first step in the guayule research program was taken shortly after the report was released. Sen. Pete Domenici (R-N.M.) and Rep. George Brown (D-Calif.) introduced legislation in the Congress authorizing $60 million over the next five years for research on guayule. □

Cystic fibrosis: An immune disease?

Cystic fibrosis is an inherited disease, usually beginning in infancy, which impairs breathing, causes pancreatic insufficiency and a poor response to heat. No cure is presently known, so researchers are trying to determine precisely what biochemical abnormality triggers the disease. They have one encouraging lead at least. Persons who carry genes for cystic fibrosis have blood that, when placed in lung tissue, interferes with the movement of tiny hairs (cilia) that line the tissue. Such activity has also been found in the blood of patients with asthma and with some other breathing disorders. So there may be something in the blood that causes cystic fibrosis.

Now Gregory B. Wilson and H. Hugh Fudenberg of the Medical University of South Carolina report in the March 31 NATURE that they have confirmed that blood from cystic fibrosis carriers and from persons with asthma is able to interfere with the movement of lung cilia. But more crucial, they have found that carrier blood interferes with the cilia in a way different from that of asthmatic blood, suggesting that the activities are due to two different factors.

Their bioassay involved placing blood from 16 cystic fibrosis homozygotes (persons with genes from both parents for the disease), 15 cystic fibrosis heterozygotes (persons with genes from one parent for the disease) and 14 healthy subjects in the presence of rabbit lung tissue. All of the blood from persons with a double dose of the gene interfered with the movement of cilia lining the tissue, and in only 14 minutes' time. All of the blood from persons with a single dose of the gene interfered with the cilia, but in 25 minutes. As for blood from the healthy subjects, 13 out of 14 samples failed to react with the cilia at all during the 60-minute assay period. These results confirmed those obtained by previous researchers that blood from cystic fibrosis carriers elicits a cilia-interfering activity.

To evaluate the specificity of this activity, they then bioassayed blood from eight patients with asthma. In agreement with previous researchers, they found that all eight asthmatics' blood interfered with the movement of lung cilia. However the asthmatics' blood acted differently; it actually stopped cilia movement, indicating that the cilia-altering activity in asthmatics and in cystic fibrosis carriers differs.

To test this hypothesis, they purified the cilia-altering activities of cystic fibrosis blood samples and asthmatic blood samples with chromatography and showed that the activities are indeed distinct and hence probably due to two different substances. What might the substance be? They believe it might be an abnormal complement protein. Some 12 complement proteins help make up the body's immune system. □