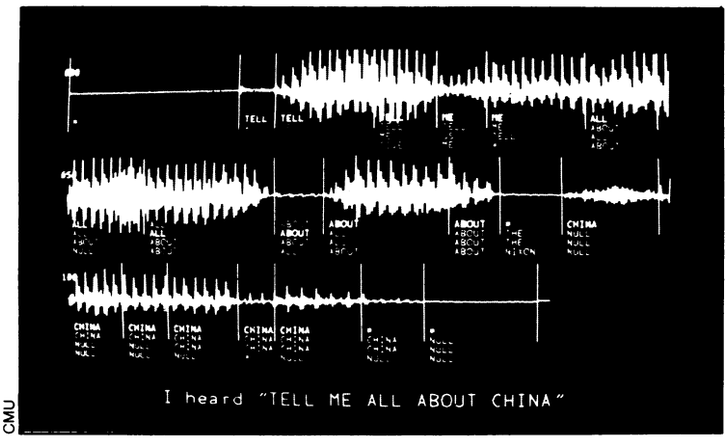

CMU

This voiceprint was deciphered by CMU's *voice-recognition computer,* HARPY. *It is generally slower and less accurate than Zue, and has a very limited vocabulary.*

problem gets thornier. And consider trying to differentiate between "this lip" and "the slip" without benefit of hearing them used in a sentence.

The test came in 1977 and 1978 when scientists at Carnegie Mellon University flew Zue out to test and film his skills. Having developed a voice-recognition system — a computer with limited skills — they felt they understood the types of syntactic and contextual cues that could be used to cheat, in a sense, on actually reading each individual phoneme, according to Rone Cole, the principal investigator. Cole showed the film his group made of Zue's unique talent at the American Association for the Advancement of Science meeting in Houston, last week.

The tests proved Zue wasn't cheating. Unusual sentences, such as "Yesterday Bill saw the Goodyear blimp," were phoneticized correctly in a minute or two. Some prints represented just a string of nonsense syllables; Zue recognized them also. Although Zue usually segments and labels prints with a pen, he was even able to decipher several mentally and read them aloud seconds later.

While reading voiceprints is a neat trick, Cole is more interested in its potential applications. He said it's his personal goal to read voiceprints in real time. A Zue protégé, he has already taught a class in the art himself, but lacks speed. He hopes that if one can read voiceprints as fast as the words are spoken, it may be possible to train the deaf to literally read speech prints off a visual screen. Another application might be to help the deaf mimic natural speech. Using a split-screen oscilloscope in a procedure akin to biofeedback, Cole thinks the profoundly deaf (those with essentially no hearing) might be able to match the sounds they utter, but can't hear, with the programed spectra of a model speaker. Finally, it might be possible to program computers to apply the same reasoning that humans do in interpreting spectra so that nonhuman speech-recognition machines will match or better the 90 percent accuracy Zue has exhibited with free-form random speech. □

Disease risk: Genes, germs, carcinogens

The sweep of an infectious disease through a population strikes some people and leaves others untouched. Some great-grandfathers are in top form after smoking all their lives, while other men succumb to heart attacks or lung cancer at 50. The healthy have long suspected that they have their genes to thank, at least in part, and now collaboration between geneticists and epidemiologists is substantiating more and more hereditary factors in disease susceptibility. But knowledge of the range of human susceptibilities and an increasing ability to screen for genetic differences provide sticky ethical questions about the best health protection.

Malaria is one disease to which susceptibility clearly has a genetic component. The classical example is that persons who are heterozygous for sickle cell disease (having one normal gene and one sickle cell gene at the relevant locus) have high resistance to malaria's most dangerous form. At the AAAS meeting last week in Houston, Arno G. Motulsky of the University of Washington School of Medicine reviewed findings of geneticists and epidemiologists on other genetic variations. For example, a genetic enzyme (G6PD) deficiency also increases malaria resistance. Motulsky showed on a map of Sardinia that the regions once threatened by malaria contain the highest incidence of G6PD deficiency. In addition, absence of the Duffy blood group factor, which had not been associated with any medical condition, was recently discovered to protect against another type of malaria.

Susceptibility to a few noninfectious diseases has also been linked to simple genetic traits. A deficiency in alpha-trypsin inhibitor correlates with chronic obstructive pulmonary disease; a mutation in a cell membrane component correlates with familial hypercholesteremia, which predisposes people to premature heart disease; and certain variations in the genetic markers used in tissue typing are associated with juvenile-onset diabetes and other autoimmune diseases (SN: 9/9/78, p. 182). In addition, some cancer may be the result of a person being heterozygous for a rare genetic disease of chromosome breakage.

People vary dramatically in response to drugs, and that drug metabolism appears also to be genetically determined. For every drug so far examined, Motulsky says, identical twins are alike in the drug level that appears in the blood and in the time the active drug lingers in the body.

"Genetics may be an important area of environmental protection," Motulsky suggests. Carcinogenic chemicals must often be enzymatically altered before they can cause cancer. In those cases, persons lacking the modifying enzymes would be unaffected by the chemical, while those genetically endowed with an especially sensitive enzyme might be unusually susceptible. There is already some evidence, Motulsky says, of variation among people in the hydroxylase enzyme that converts polycyclic hydrocarbons to the more carcinogenic epoxides.

Such findings lead Leon Gordis of Johns Hopkins University to speculate that "environmental counseling" may soon follow the pattern of today's genetic counseling. An environmental counselor, in the future, may advise clients on their susceptibility to pollutants or occupational chemicals on the basis of genetic traits, disease history and exposure to other environmental agents. A major ethical problem Gordis foresees is whether industrial employers could require screening tests to select persons to work with certain materials and whether industry's responsibility for environmental control would be reduced if it screened its employees.

Last week an incident at an American Cyanamid facility in West Virginia dramatized a related concern. Must working conditions be safe for a fetus, and, if not, may all women capable of becoming pregnant be excluded? Five women workers at that plant claim they had to undergo surgical sterilization to retain their jobs in the pigment division, because safe levels for lead exposure are much lower for a fetus than for an adult. A company spokesman said that it would currently be impossible to reduce lead levels in that operation to the amount safe for the unborn.

Gilbert S. Omenn of the Office of Science and Technology Policy says that so far realization of the diversity in disease susceptibility has prompted more stringent safety standards. The Environmental Protection Agency, for example, now takes the position that standards should protect the most susceptible. Omenn says that the standard for lead was set to protect 99.5 percent of children and the standard for ozone to protect 99 percent of those with chronic respiratory disease. In the past regulations were based just on the level of a toxic substance safe to an average person, plus a margin of safety. □