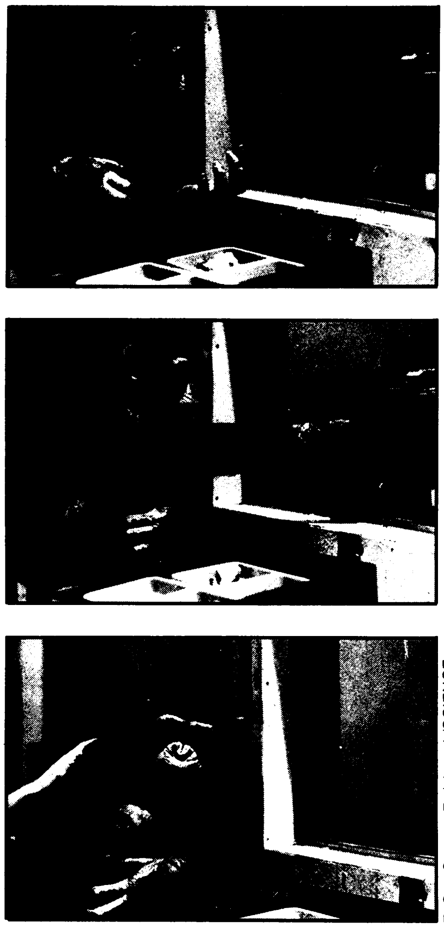

E. Sue Savage-Rumbaugh/SCIENCE

Sherman "reads" Austin's request for bread (top), complies by feeding his friend (center) and "smiles" broadly in response to praise from technician.

chimps were separated by glass with a square hole cut into it. The chimp on one side requested a certain dish, whose symbol was flashed by the projector for the other's view. The chimp with various containers of food — there were 15, including peanut butter and jelly sandwiches, orange drink and M&Ms — read the request and complied by serving his companion through the square opening. Over numerous trials of this type, the chimp team was accurate from 70 to 100 percent of the time, according to the researchers.

In the latest, yet-to-be-published experiments, the chimps have learned to ask one another for certain "tools" to get at specific dishes of food placed in hard-to-reach spots. A sponge, for example, is used to sop up water where the chimp's hand will not reach; other tools include a lever, key and stick.

This type of "cooperative and reciprocal symbolically mediated food exchange" is "very atypical" of chimps in the wild, says Savage-Rumbaugh. She added that the chimp communication system is being applied experimentally to several youngsters at the Georgia Retardation Center. It is designed to get the children to learn to communicate with each other during meals and in other instances, rather than depend exclusively on staff members. ☐

Chloroplast genes: A separate map

If you plan to thank a green plant today, you should probably thank its chloroplasts. Those are the layered structures within plant cells that are responsible for a leaf's green color, as well as for photosynthesis, the light-powered conversion of carbon dioxide and water into carbohydrate and oxygen. Along with the chemical machinery for photosynthesis and protein production, each chloroplast contains DNA separate from the genetic material of the plant cell. The maize chloroplast chromosome is large enough to contain 100 average-size genes, but few have been identified. With the same methods used to analyze the DNA in cell nuclei (SN: 8/3/78, p. 83), investigators are now examining chloroplasts' genetic messages.

A chloroplast gene expressed during one stage of development is reported in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES by researchers at Harvard University and Massachusetts Institute of Technology. The scientists grew maize seedlings in the dark for a week and then exposed them to light. As the chloroplast developed to its mature, green state, a new membrane protein was produced. John R. Bedbrook, Gerhard Link, Donald M. Coen, Lawrence Bogorad and Alexander Rich identified the active gene on the chloroplast chromosome by binding a radioactive probe to cut DNA pieces.

Known genes account for about 10 percent of the chloroplast chromosome. Besides the membrane protein, researchers have located the sequences that produce the RNA of the chloroplast's ribosomes and most of the transfer RNA the chloroplast uses for protein production. the only other protein so far mapped to the maize chloroplast chromosome is a subunit of the major soluble plant protein, ribulose bisphosphate carboxylase. Experiments on a green algae, *Chlamydomonas reinhardtii,* have shown that some genes for the proteins of the large subunit of the chloroplast ribosome are on the chloroplast chromosome, but others are on the DNA in the plant cell nucleus. Such dispersion of genes suggests that genes may have moved from the chloroplast to the nucleus during evolution or that chloroplast genes mutated and plant genes were able to provide a satisfactory substitute for the chloroplast product. The question remains whether chloroplasts originated from microorganisms trapped in nucleated cells or from clusters of genes and metabolic machinery compartmentalized by a membrane. ☐

Vitamin lack: Bat mimics human condition

When a South African hematologist learned that fruit bats never suck blood, he followed his hunch that the bats might become a suitable small animal model for a poorly understood human vitamin deficiency. Vitamin B_{12} is required in such small amounts that it has been difficult to make laboratory animals deficient. Rats, mice and guinea pigs, even if successfully made deficient, do not develop symptoms like those of humans. Human victims suffer both blood and bone marrow abnormalities and neurological symptoms, ranging from loss of touch and position sensation to psychotic behavior and paralysis. The clinical problem is inability to absorb the vitamin, rather than a nutritional lack.

Fruit bats in a laboratory, living on a strict diet of insect-free bananas, oranges and other fruit, do develop neurological symptoms, reports Ralph Green of the Scripps Clinic and Research Foundation in La Jolla, Calif. In his experiments in South Africa he found that vitamin B_{12}-deficient animals had difficulty climbing the sides of their cages and were unable to fly normally. "They don't seem to have any control of position of their wings in space," Green says. The bats showed serious deficiencies after only 200 days of the vitamin-deficient diet. They thus seem to use up their stored vitamin more rapidly than humans, who stock enough vitamin B_{12} in the liver to last for 12 years.

Twenty fruit bats were recently flown to California from South Africa, and Green plans to import about 80 more. To satisfy government officials that the bats would not get loose, multiply and threaten California's fruit orchards, Green imports only males and houses them in cages secured with double doors. Green plans to examine the bats' entire nervous system in microscopic detail to determine how it is damaged by vitamin B_{12} deprivation. (In preliminary experiments there was no change in the bats' blood.) Vitamin B_{12} deficiency in humans causes deterioration of the myelin sheath that insulates nerve fibers, so examining myelin is first priority.

A final puzzle is why the fruit-eating bats do not develop vitamin B_{12} deficiencies in the wild. Other small herbivorous animals ingest their own feces, which contain vitamin B_{12} from bacteria in the lower portion of their intestinal tract. But the bats do not eat fecal matter. Green speculates that the vitamin may come from the bats' drinking water or from insects that also prey on the fruit. ☐

SCRF