GENETICS

Map Human Chromosome

Scientists are using electronic computers to map the location of specific genetic determiners, such as for some diseases, on the human chromosomes.

THE LAST "terra incognita" of the human body is being mapped and computers are helping to do the job.

Researchers at Johns Hopkins University have developed a way to use computers to map the human chromosome, Prof. S. A. Talbot told scientists at a medical symposium in Poughkeepsie, N. Y.

"What we are out to determine by linkage studies is the location of genes for such things as eye color, blood groups and specific hereditary diseases," he said. By using marker traits — the various blood groups and inherited traits like the ability to taste certain chemicals—it is possible to map the chromosome.

Actually, this is done by determining what genes travel together. The computers, or electronic "brains," are used to figure the probabilities of two hereditary traits, for example, being located on the same chromosome. By "telling" the computer which persons have a certain specific genetic disease, it is possible to compute the genetic make-up of parents and other relatives, using the disease as a marker.

Using the example of elliptocytosis, a rare dominant trait in which the red blood cell has an elliptical shape, Prof. Talbot showed how the computer can locate genes on a chromosome. With the machine and the dozen or so marker traits known to exist in man, scientists should be able to assign a linkage group on a particular chromosome to one in five of the hereditary traits studied.

As yet, he said, only three linkages have been proven in man. But this is a start on the mapping problem of where genes are located.

In reporting the study, prepared by Dr. Victor McKusick and himself, Prof. Talbot said the computer program could be set up so that a five-generation family can be studied. A major problem that remains is that of collecting family pedigrees, however. Scientists can experiment with fruit flies and mice, Prof. Talbot pointed out, but they have to learn about man's genes by taking family histories.

It may now be possible, the researchers said, to establish an international linkage analysis center where properly collected pedigree data can be studied.

In addition to the scientific challenge of mapping the human germ plasm—a challenge as great as the urge to climb Mt. Everest or go under the polar ice cap in a submarine—there are practical applications to the study. It would be possible to predict the probabilities of a man and wife having children with certain genetic diseases, for example.

Commenting on the significance of being able to map human chromosomes, Dr. H. Warner Kloepfer, professor of medical genetics at the Tulane University Medical School, told SCIENCE SERVICE he was hopeful it could mean the beginning of preventive genetic medicine.

Knowledge of the location of the genes that are involved in inherited disease, together with our growing knowledge of the chemistry of the DNA that makes up the chromosome, go together to give an optimistic picture. It may one day be possible to give "good DNA" to a pregnant woman known to be a carrier of a gene for a specific disease, for example. With our current interest in man's chromosomes, mutations and genes, Dr. Kloepfer predicted that advances would be made in medical genetics at a much faster rate than has been made in the medicine of communicable diseases.

It has taken about one hundred years to reach our present position in preventive medicine where so many diseases are virtually controlled. It will take much less time before we reach a comparable spot in genetic disease, he said.

The current concern with the possible genetic effects of fallout has added to the public interest in the human chromosome, Dr. Kloepfer pointed out. This together with our growing store of knowledge of DNA and our ability to control communicable diseases are hopeful signs, he said.

INSECTS FOR AGRICULTURE— A constant supply of uniform insects is needed in entomology research. At Eli Lilly's new research center for agricultural sciences, near Greenfield, Ind., a researcher raises bean beetle nymphs on bean plants. The insects are used in testing insecticides.

Machines Aid Biologists

COMPUTERS can be a big help to the medical world.

Scientists attending the same symposium, sponsored by the International Business Machines Corporation, discussed the many ways computers are helping the medical researcher—whether he is interested in diagnosing disease, reading an electroencephalogram or figuring out what bacterial might be susceptible to what drugs.

Many complex questions can be solved faster and more accurately with computers than the researcher ever believed possible. Patients' records can be more useful to the doctor. Model situations can be set up, imitating what might happen in the living organism or living cell, so that the researcher can make predictions and test theories.

Dr. G. W. Petrie III of IBM told how special IBM devices have made it possible to give the current status in cancer chemotherapy of an organic chemical. This means, he explained, that it is now possible to make periodic progress reports together with completion reports as tests of individual compounds are finished. The researcher can also look up file entries of compounds with specific characteristics. Then he can select one for continued research.

Currently some 1,200 reports per day are being entered into the RAMAC 305 memory and added to previous test records.

Computers are also helping scientists in their study of a typical nerve system, the pupil of the human eye. A digital computer is being used as a model of the pupil system, Dr. Lawrence Stark of Yale University reported. He estimated that a high-speed computer will enable researchers to compare the model with the "real pupil in real time." This research is still in the developmental stage.

Illustrating the important role of computers in medical research, Dr. James W. Sweeney of Tulane University described one computer center, the first such center in the South to be devoted entirely to university teaching and research.

As director of Tulane Computer Center in New Orleans, Dr. Sweeney outlined his experiences in initiating medical researchers into the mysteries of computer research. Time and "scientific conservatism" complicated the introductory process, he said.

The Tulane medical school staff, as at other universities, found it difficult to take the necessary time to learn about computers. Also some scientists were "against the introduction of computers in the medical research process," Dr. Sweeney pointed out.

However, the Tulane center, in operation for about a year now, is beginning to play an important part typical of other computer centers throughout the nation in experimental medical research and in collecting and recording clinical information.