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DNA and Crime: Identification From a Single Hair

By HAROLD M. SCHMECK Jr.

SCIENTISTS have successfully analyzed traces of DNA from single human hairs in research expected to have important applications in crime detection and many other areas.

"Hairs are one of the most frequently found forms of biological evidence at crime scenes, so their identification can be of considerable forensic importance," said a report in the current issue of the journal Nature. But it is usually impossible to pin down the source of any single hair.

Analysis of DNA, or deoxyribonucleic acid, the substance of the genes, has emerged in recent years as an important aid to solving crimes and for other uses. But there is far too little DNA in a single hair for analysis by conventional means.

Less than 10 billionths of a gram of DNA can usually be recovered from a fallen hair, the report said, yet the most common method of analysis requires several millionths of a gram. Furthermore, the DNA from such a hair is usually degraded so that only small fragments are available for study.

To cope with these problems, the researchers used a relatively new method called the polymerase chain reaction to make millions of copies of a DNA fragment. The copy-making is known as gene amplification and it makes enough DNA available from the fragment being studied to permit analysis. Useful for Other Traces

The report said the same method might be applied to blood or semen when the sample is too small or too poorly preserved to be studied by conventional means.

As used today, the chain reaction method does not permit absolute identification of the source of a piece of DNA, but if analyzed thoroughly the material can be used to determine which of several suspects it might have come from and which suspects could be ruled out. This is essentially how blood types are used in deciding whether a sample of blood may have come from a suspect.

However, DNA typing done with the new method can discriminate with far greater precision than blood typing. Potentially, the typing can approach the precision of a fingerprint, a degree of accuracy already possible with conventional DNA analysis, provided a sufficiently large sample is available.

"This brings us much closer to the goal of associating a hair with a particular individual," said George F. Sensabaugh, professor of forensic science at the University of California School of Public Health in Berkeley.

"Thus far we have typed nearly 100 individual hairs," said the new report from scientists of the Cetus Corporation, a biotechnology company in Emeryville, Calif., and from the University of California.

"We have had success typing from several-month-old fallen hairs in which we fail to detect DNA by chemical means," the report said. Spinoff From Disease Study

Dr. Henry A. Erlich of Cetus said the research began as a medical project aimed at using small samples of DNA from individuals to find those who were particularly susceptible to various diseases.

"The forensic work is actually something of a spinoff because we realized that using amplification we had a very fast, simple procedure for doing genetic typing," he said.

The typing involved in such cases means determining which of several chemical variants of a single gene an individual has. In the research on disease susceptibility, the scientists analyzed a group of genes, the HLA genes, that are important in human tissue typing to match transplant recipients and organ donors.

Typing by the polymerase chain reaction method can be at least partly automated and can be completed in hours, in contrast to the days needed for conventional methods, the report said.

"It is much more informative than conventional blood types because there are many more variants," said Dr. Erlich.

He predicted the techniques used in the analyses of hairs would also be useful in choosing donor organs for transplants, for determining susceptibility, or lack of it, to some diseases and for research in other fields.

Authors of the report with Dr. Erlich and Dr. Sensabaugh were Russell Higuchi of Cetus and Cecilia H. von Beroldingen of the forensic sciences program of the University of California. Body Chemistry of a Mummy

In addition to aiding crime-solving and medical research, the ability to study such small fragments of DNA is expected to prove valuable to biologists, paleontologists and even archeologists. Traces of DNA have been found in ancient human specimens, including at least one Egyptian mummy. The techniques used in the studies of single hairs might shed light on how some aspects of the body chemistry of such ancient people varied, if at all, from people alive today. It could also be used to find clues to the migrations of peoples.

The ability to study genes from fallen hairs might also be useful to biologists and zoologists doing

research in the field, studying the genetics of populations of animals in the wild, for example, without having to capture some for blood sampling.

Before he joined the Cetus Corporation, Dr. Higuchi was a member of a research team at the University of California that tried, with little success, to glean information from DNA samples from a mammoth that had been found, frozen for thousands of years, in the Soviet Union. The new techniques might offer an important approach to studies of that kind, too.

diagram
