

THE DEVELOPMENT OF A DNA BIOCHIP FOR USE IN FORENSIC DNA ANALYSIS

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The biochip created by the Biochip Technology Center at Argonne National Laboratory and their sister laboratory, the Englehardt Institute of Molecular Biology (Moscow, Russia) is being developed for use in forensic DNA typing. The biochip is called a MAGICChip™ (Micro Arrays of Gel-Immobilized Compounds on a Chip). This is a collaborative effort between the Biochip Technology Center at Argonne National Laboratory and the Illinois State Police Research and Development Laboratory.

DNA biochips are pieces of glass about the size of a microscope slide and contain thousands of DNA tests in the platform of minute polyacrylamide gel pads. This "laboratory on a chip" may eventually allow for the portability of DNA analysis possibly even to the crime scene. Like computer chips, which perform millions of mathematical operations per second, DNA biochips can perform thousands of biological reactions in a few seconds. MAGICChips™ have been used to test for strains of tuberculosis, breast cancer genes and biological warfare agents. In addition, a biochip containing thousands of genes is being utilized in the discovery of drugs for the treatment of many different diseases.

The goal of this project is to implement this new technology in the analysis of mitochondrial DNA (mtDNA) for use in human remains cases and forensic cases that contain only hairs (without root or follicular material) as the physical evidence. Mitochondrial DNA sequencing is currently being validated in the Illinois State Police Research and Development Laboratory. This technology is of interest in forensic science for several reasons. First, mtDNA is present in large amounts in all cells. This means that only a small amount of sample is needed for successful analysis. Second, human mtDNA is maternally inherited, only the mother's mtDNA type is passed down to the children. Therefore, all individuals within a family that are related through the mother will share the same mtDNA type. This is important when the DNA analyst is trying to identify human remains. If a known sample from a close relative (mother, father, or sibling) is not available for nuclear DNA testing, a maternal relative can be used as a reference sample for mtDNA testing.

The technology behind the creation of the MAGICChip™ will be discussed. All aspects of this technology are covered by patents.