

Two kinds of DNA are being used for identification in the World Trade Center disaster: nuclear DNA and mitochondrial DNA. Nuclear DNA is a combination of the DNA inherited from your mother and father. You inherit mitochondrial DNA only from your mother.

Nuclear DNA

To obtain a DNA profile for an individual, the Medical Examiner's laboratories attempt to measure the nuclear DNA at no less than 13 positions. These thirteen points (known as markers), along with a marker for gender make up a complete profile. This is the standard profile used for human identification in criminal casework, other disasters (American Airlines Flight 587) and identifying soldiers recovered from Vietnam, Korea and other military conflicts.

Standard DNA profiles are generated from markers that are from 100-400 base pairs in length. You can think of a base pair as one rung on the 3 billion-rung ladder that makes up your DNA. The remains from the World Trade Center that were brought to the Medical Examiner's office were tested for DNA. Unfortunately, more than half of them have not yet yielded a DNA profile sufficient for identification. This is because decomposition, heat and water can break up the DNA, making it difficult to measure a specific marker. So, for example, we may be able to measure 9 of the 13 markers (or even fewer), which is not sufficient for identification (we say it "doesn't make statistics").

Two new technologies, Bode-Plex (pronounced "Bodie Plex") and SNPs (pronounced "snips") may allow us to get a profile from smaller areas of the DNA. Bode-Plex allows a profile to be extracted from a segment of 89-218 base pairs, while SNPs work with segments of 65-85 base pairs. Before these new techniques can be used for human identification, they must be validated by the New York State Department of Public Health, similar to the way in which the FDA approves a new drug for use. Bode-Plex has been validated and has just been introduced to the WTC identification process. SNPs is currently in the validation process and has therefore not yet been used for identification in the World Trade Center project.

Mitochondrial DNA

As Mitochondrial DNA (mtDNA) is inherited only from your mother, it is less helpful in identification than nuclear DNA. It is more robust (due to the fact that there are more copies of it in each cell, it is contained in more cells than nuclear DNA, it is smaller in size, and seems to be more resistant to deterioration), but less specific. Two siblings, for example, who have the same mother, will have the same mtDNA profile.

Mitochondrial DNA has been used for identification purposes in other disasters such as the Swiss Air crash. We are just starting to receive

mtDNA information from Celera Laboratories in Rockville, Maryland. We are not currently using it extensively in the identification process, but we hope to once we obtain sufficient data. We expect to get all the mitochondrial data into our database by early summer, 2003. We already have used some mitochondrial information in the identification process.

Bode-Plex

Bode-Plex is a technique for extracting a nuclear DNA profiles from remains where standard techniques have failed. This technique was pioneered by the National Institutes of Standards and Technology and has been re-worked and is being applied to the WTC identification process by Bode Technologies, a forensics laboratory in Springfield, Virginia. Bode-Plex has never been used before in human identification -it was developed specifically for WTC and validation was completed in September.

Bode-Plex data are now being used by the Medical Examiner's for World Trade Center identifications. Initial estimates lead us to expect to receive around 2,000 profiles per month from Bode Laboratories. Bode-Plex data have already led to identifications that never would have been made otherwise and will assist extensively in linking additional remains to people who already have been identified. We are retesting all of the remains that did not yield a profile sufficient for identification along with all the family samples and personal effects. Bode-Plex is a modification of the normal DNA process and was therefore easier to validate.

SNPs

SNPs stands for Single Nucleotide Polymorphisms. Unlike Bode-Plex, which is a variation on the standard DNA profiling technique, SNPs is a radical departure from the standard process and has not yet been validated for human identification. Initial validation studies of the SNPs technique have proven inconclusive and it is taking much longer for it to be validated than was anticipated. Once in place, it is hoped SNPs will assist in the identification of remains that were previously unidentifiable. We don't currently know when SNPs will be validated. The first pilot testing of WTC samples is promising.

Virtual Profiles

One of the ways Bode-Plex can help with the process is by providing an incomplete profile that can be combined with an existing incomplete profile to create what is known as a virtual profile. The DNA profile is made up of a series of numbers, measurements of repeating patterns at 13 separate markers. Sometimes, though, because of issues such as decomposition, we are unable to get the entire sequence of numbers from remains. Certain parts of the code may drop out. However, if we combine the parts of the code that different techniques produce, we can create a "virtual profile." Using this virtual profile (a profile made up of combined profiles), we can

determine the entire DNA sequence for the remains and identify them. These virtual profiles can be used to identify remains that otherwise would have remained unidentified.

The Medical Examiner's office is committed to identifying as many of the World Trade Center victims as science will allow. Our WTC operations are funded through FEMA and are not impacted by government cutbacks in the city or state of New York. We know that our process will continue for at least another year and in all likelihood, much longer. Families who have any questions about the DNA process or about the identification process in general should call our WTC hotline at 212-447-7884, 9:00 am -5:00 pm, seven days a week.