For hundreds of years, genealogical research methods have remained the same; genealogists must spend many hours slogging through all sorts of old records in courthouses, churches, and libraries to glean family information. Now, thanks to recent breakthroughs in genetics, a new tool that provides a twenty-first century dimension to research has been added to our genealogical toolbox.

Most people today are familiar with the initials DNA, if not with the full term, deoxynribonucleic acid, and know too that everyone's DNA is unique. Just in the last few years, it is possible to determine an individual's exact DNA pattern. The public is already familiar with DNA as a tool in criminal investigations due in large part to TV shows such as CSI, in which DNA analysis either clinches the guilt of the criminal or exonerates the wrongly accused.

Today, scientists and non-scientists alike (except for the jury in O.J. Simpson's trial) accept the accuracy of DNA findings. For more than a decade, too, courts also have been using DNA results to determine paternity case results. Using DNA, however, to determine genealogical relationships is its newest use.

Before looking at the genealogical aspects of DNA, let's first briefly review the science of genetics. Every cell in all living creatures contains their DNA. In the human body, except for ova and sperm, the DNA consists of 23 pairs of chromosomes that contain all of the necessary instructions to make a human being. This is accomplished via a 4 letter (chemical) alphabet that currently is in the process of being "decoded" by geneticists. These instructions in the chromosomes contain three billion of these chemical letters that "spell out" tens of thousands of pieces of information. This is why DNA is called the building blocks of life.

The first 22 pairs of chromosomes are always perfect matches; the twenty-third pair, however, may or may not match, because that is the chromosome that determines the gender of the child. If the pair is an X X match, the child is female. If it is an XY combination, the child is male.

That male Y chromosome is most important to genealogists because it is passed down from father to son virtually unchanged for thousands of years. (excluding illegitimacy or adoption, of course!) Thus when men with the same surname take the Y DNA test, kinship, or the lack thereof, can be determined. Mutations (random changes) can occur through the centuries, but geneticists report that the rate is about one every 500 years, and they usually occur at the same several positions on the chromosomes, so those locations mostly can be ignored by genealogists.

Genetic matches ascertain that the men in question with the same surname are related back in time. Exactly how and when still must be determined by the old, plodding research methods.

The lack of a relationship, however, is an absolute. When two males' Y chromosomes don't match, in no way can those men be related. This finding is often as useful to genealogists as a positive finding. In fact, already it is forcing many sloppy researchers to remove people from

their family charts, people with the same surname but who according to their DNA are not related!

There are also other types of DNA tests, some of which can track a woman's genetic background. But since the woman's surname is different in every generation, such tests are not of much use to genealogists.

Many companies now conduct DNA analyses; most, however, are in the paternity suit business and so not useful for genealogy. Several companies offer both kinds of tests, but do not offer the perks of those that specialize in the genealogical aspect. At present, four companies do specialize in genealogy related testing. One of the most popular is Family Tree DNA, established in 2000 to determine the most recent common ancestors (MCRA). It also offers each related family the perk of a free surname web site for their DNA results, plus there is a web page with a chart showing all of the test results of men with that surname grouped according to kinship. (For privacy, no names are listed, just test numbers. However email addresses can be obtained with the men's permission.) This is where I found a large database posted for my Baker family. The online charts are color coded for each group of Bakers that has matching or near matching DNA. As might be expected for so common a name, there are many different unrelated color-coded Baker groups on the site. (They may eventually run out of colors for the Baker groups!)

Kinship is determined by how closely all of the markers (genes) match. More than three mismatches mean no kinship. Two mismatches show a relationship but likely a close kinship between men who lived hundreds of years ago. Four, and soon five levels of tests, are available at present, a 12, a 25, a 37, and a 67 marker test. As each test's number of markers increases, so does the cost. The cheapest, the 12 marker test, is really rather worthless since it compares so few genes. It provides so small a sample that it leaves too many other untested markers that could show many mismatches, thus proving that no relationship exists. Indeed, there are many examples of expanded 12 marker tests that show this to be true. It is recommended that the minimum size test ordered be a 37 marker one.

The big and often difficult question after finding closely matched Y DNA is who was the specific ancestor from whom the person(s) descended? In my case, two male cousins discovered that their Y DNA matched perfectly (as we expected), and the test also showed that they are not quite a perfect match, but are close, to the Bakers related to a Humphrey Baker who came to the Colonies in the mid 1700s. So far dozens of Bakers related to Humphrey via their Y DNA, have been found; our direct ancestor, however, could be a brother, a grandfather, or an uncle, etc. about whom we have no information. Some of the luckier Humphrey's descendants have been able to determine a direct line through their research. Immediately after my cousins' results were posted, I was contacted by about 9 new "relatives" eager to know what Baker information I had. My genealogically focused family members and I continue to search, seeking our ancestors and the ancestors of two men listed in the Humphrey group whose Y DNA matches ours most closely. We need to locate the missing links to our Martin Baker in Colonial Virginia (who later moved to Garrard Co., KY.). But there remains the possibility that the connection may have occurred 250 or so years ago in England. In genealogy, the commonly used rough estimate of a generation is 30 years, so 10 generations

would equal 300 years!

This chart, posted on the Family Tree DNA site, compares two males whose 37 marker tests contain only one unmatched marker. The probability that these men share the same ancestor within a particular number of generations is as follows:

Four generations	56.46%
Eight generations	87.4%
Twelve generations	96.84%
Sixteen generations	99.26%
Twenty generations	99.83%
Twenty four generations	99.96%

Taking the DNA test is quick, easy and painless, but not cheap; usually a 25 marker test costs more than $100. The kit from Family Tree DNA contains a bottle and a simple cotton swab that the recipient swipes against the inside of his cheek; this takes just a few seconds. Then he must put the swab into the airtight container and it into the enclosed mailer. Then it is mailed to Family Tree DNA. For analysis, they use the lab at the University of Arizona.

So far, Family Tree DNA has established databases for more than 4,700 surname groups with more than 74,000 unique surnames, and the list is growing rapidly. More results are posted each week. I have not checked the progress of other surnames, but new tests results are posted for the Baker database every week, and they notify me by e mail whenever one them fits into the Humphrey Baker group.

You may wish to find out if any of those surname groups includes ones that you are researching. Just go to http://www.familytreeDNA.com/ and type in the name. If you find it there, I would guess that it won't be long until you get a family member to take the DNA test.

Ask questions, find help and share tips in SeniorNet's Genealogy Tips discussion .