A Gentle Introduction to Genetic Genealogy

by David A. Pike

Introduction

A decade ago the big excitement in genealogy was the advent of the internet and the ability to use it to correspond with other genealogists as well as to electronically search through a growing number of online genealogical databases. Today genetic testing is the latest tool in the genealogist's toolbox. As with any new innovation that is in its early stages, many people will be unfamiliar with this new technology. The hope with this article is to impart some understanding of what genetic testing can (and cannot) reveal about our ancestry, while at the same time attempting to avoid complex jargon that is apt to leave most genealogists more bewildered than informed.

To get started it is important to know that while most of our DNA results from a complicated mixture of our father's and mother's DNA, there are a few types of DNA that are not subject to this mixing. These are the parts that determine gender (which we will refer to as xDNA and yDNA) and also a special type of DNA called mitochondrial DNA (abbreviated as mtDNA). It is precisely these non-mixing parts of our DNA that have genealogical application, because the genetic signatures for these portions of our DNA remain virtually the same from one generation to the next. To date xDNA analysis is not generally available, so we will limit our discussion to yDNA and mtDNA.

mtDNA and Maternal Ancestry

Each and every one of us has mtDNA. The nature of mtDNA is such that we inherit it only from our mothers, who in turn inherited their mtDNA from their mothers, and so forth. Expanding this inheritance pattern for a few more generations, we realise that the mtDNA we each possess has been passed along like a family heirloom from generation to generation along our direct maternal line. Those of use who are women may ultimately pass this legacy on to our own children. However, those of us who are men are incapable of passing mtDNA on to our children.

So how can this benefit a genealogist? Well, let's consider a fictitious but illustrative example: suppose that Alice traces her direct maternal line (i.e. her mother's mother's ... mother's mother) back to a Martha Hobbs (Hobbs being Martha's maiden name) who was born in Ditcheat, Somerset in the 1830s. Meanwhile Bob has traced his direct maternal line back to a Susanna Hobbs who was also born in the 1830s. Alice and Bob have speculated that Martha and Susanna might be sisters, but they have had no luck in finding any helpful information in any of the records they have searched.

Alice and Bob, since they are both looking at their direct maternal lines, can each have their mtDNA analysed. This will enable them to learn the genetic signatures that mark their respective maternal lines of ancestry. If these signatures do not match one another, then they have evidence

that their direct maternal lines do not meet up with a common foremother. Knowing that this is so is valuable information since it means that Martha and Susanna could not have been sisters.

On the other hand, what if Alice and Bob's mtDNA signatures do match each other? Then they learn that their direct maternal lines do converge with a single woman. However, the identity of their common foremother is not revealed. It could be that Martha and Susanna were sisters. But it could also be that they were cousins, such as would have happened if Martha's and Susanna's mothers were sisters who happened to marry two men by the name of Hobbs. So although Alice and Bob cannot confirm their suspicions about Martha and Susanna being sisters, they can conclude that they are related (they being not just Martha and Susanna, but also Alice and Bob).

Tracing our maternal ancestors is an inherently difficult task. Women typically adopted their husband's surname, so unless we can find a marriage record we may not be able to learn a woman's maiden name. In some old records the challenge is compounded by baptismal records that neglect to mention the mother's name at all! Although mtDNA will not by itself tell us the names of our foremothers, it can help to guide us towards elusive records. Imagine a slightly different scenario in which Alice and Bob had never even heard of one another (which could be the case if Bob simply did not know where his Susanna was from prior to her getting married in Bristol in the 1850s), but were put in touch by being notified of matching mtDNA signatures. They could both benefit immensely by then sharing the genealogical information that they have separately collected.

yDNA and Paternal Ancestry

Unlike mtDNA, which we each possess, yDNA is only present in men. The nature of yDNA is that a son inherits it from his father, who inherited it from his father, and so forth. What this means is that each man carries a legacy that has been passed down through his direct paternal line of ancestry. If a man has no sons, then his yDNA will not be passed on to future generations (no matter if the man has many daughters).

In all but a few cases, a son inherits his surname from his father, in addition to his yDNA. Not only has this inheritance pattern generally made it easier for genealogists to trace their paternal ancestry, but it also means that yDNA signatures can be associated with particular surnames. There has consequently been a proliferation of surname-based yDNA genealogy projects (now numbering in the thousands). What these projects are doing amounts to conducting genetic censuses of people with particular surnames. People with matching yDNA signatures are related, while those with different signatures (despite having the same surname) are not.

The genealogical applications are plentiful. For example, suppose that Aaron Pike traces his direct paternal ancestry back to Upottery in Devon, while Bill Pike traces his direct paternal ancestry back to the neighbouring parish of Yarcombe. It is not known if their paternal lines are related, so they each get a yDNA test so that they can then compare their yDNA signatures. If the signatures do not match, then they descend from unrelated Pike families. This can actually be a good thing, since it means that Aaron and Bill no longer have to search for the elusive records that show how they are related; such records had eluded them precisely because they are not

related. In contrast, matching yDNA signatures indicate that Aaron and Bill do have common Pike ancestry, meaning that the Pikes of Upottery are in fact related to those of Yarcombe.

Meanwhile, Charles Pike, knowing that his ancestors came from Devon, but not which parish, could benefit from yDNA matches with other Pikes who do know where their ancestors lived. Such matches could put Charles in touch with distant cousins that he otherwise would never have made contact with. Moreover, by discovering which other Pikes share his genetic signature (as well as those that do not) and where these other Pike families are from, Charles can refine his search for his own ancestors in standard historical records.

There are numerous other examples that could be described here, ranging as far as using yDNA to learn more about an adopted (or even illegitimate) forefather's biological family. The guiding rule with yDNA is that no matter whether a son took his father's surname, he most definitely inherited his father's yDNA.

How to Get Started

As with any census, a genealogist can only benefit if his or her family has been enumerated. The difference with a genetic census, as opposed to the more traditional censuses that we are familiar with, is that people who are alive today can avail themselves of genetic testing and thereby have their ancestors enumerated: direct maternal ancestors with mtDNA, and for men (because only men carry yDNA) also their direct paternal ancestors.

As for where to obtain such tests, there are a number of companies that have established themselves as providers of DNA testing for genealogists, such as DNA Heritage, Family Tree DNA, and Gene Tree, to name just a few. The National Geographic Society is also providing genetic testing as part of its Genographic Project. The websites for each of these (which are easily found by doing a search at www.google.co.uk) provide a wealth of information that will help newcomers to the world of genetic genealogy to better understand some of its features. There are also a number of online message boards, fora, and mailing lists where you will find many kind souls that are willing to answer questions and offer guidance. Among these resources is the DNA-NEWBIE forum sponsored by the International Society of Genetic Genealogy (to get to it, follow the ``Yahoo Forum'' link on the ISOGG website at www.isogg.org).

If you are able to join a surname-based project, or a project that encompasses a location where your ancestors lived, then doing so could help to make your experience with genetic genealogy a more rewarding one. Several of the testing companies list these types of projects on their websites. In the event that suitable projects for you do not yet exist, then you should note that there are a number of public websites that you can use to search for other genealogists that have matching genetic signatures, such as www.mitosearch.org for mtDNA signatures and www.ybase.org and www.ysearch.org for yDNA signatures.

About the Author

David Pike has been working on his family history for more than 25 years. In 2004 he began the Pike Surname DNA Project, and it is via his involvement with this project that he has acquired much of his experience with genetic genealogy. The Pike project's website can be easily located via most internet search utilities; Mr. Pike can be reached by email at dapike@math.mun.ca.

Disclaimer: Mr. Pike has no business affiliation with any of the companies that offer genetic testing services.

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