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Your DNA Autobiography

Colleen Fitzpatrick, PhD gives us a primer on how DNA can assist you in your genealogy research

Genealogists are familiar with the value of reference materials such as biographies and online databases. A will or probate record, for example, can provide detailed information that is important in researching a family tree. However, written records are not always accurate. For example, census records can contain misspelled names, mistaken family relationships, and incorrect ages.

DNA on the other hand, can only tell you if two people are related, it cannot tell you how. DNA can also provide an estimate of how far in the past their common ancestor lived, but cannot tell you who that ancestor was. DNA and written documentation are complementary. The strengths of one are the weaknesses of the other. Together they make a powerful set of tools for the modern genealogist.

What is DNA?

Your DNA is the *biochemical* equivalent of your autobiography. A good autobiography will tell someone all he needs to know about your life. In analogy, if someone could "read" your DNA, he'd know all about your *biochemistry*.

A book is written using symbols we call letters of the alphabet. In English, there are 26 letters that are grouped together in words to convey meaning. DNA is composed of four letters of a biochemical alphabet known as adenine (A), guanine (G), thymine (T) and cytosine (C). The letters of this bio-alphabet are actually large molecules that combine to form words that convey meaning in a *biochemical* sense.

Just as an autobiography may be divided into sections called chapters, DNA is divided into sections called "chromosomes". And just as each chapter tells a different part of your life story, each chromosome tells a part of your *biochemical* story.

The analogy between a book and DNA breaks down here. If a typo appears in a chapter, it will usually not prevent a reader from making sense out of the text. But a typo or mutation in a DNA biochemical chapter can be fatal to an organism. Fortunately, chromosomes come in pairs, so that if there is a mutation in one member of the pair that endangers the well-being of the organism, it has a second chance for survival if the other chromosome of the pair is healthy.

Mutations Can be Useful to Genealogists

When a book is copied, either by hand or by retyping it into a word processor, copy-errors are made. Likewise, when a cell divides and DNA must copy itself so that the two daughter cells each has its own copy of the genome, a typo might occur causing a copy to differ from the original. Fortunately, just as the spell-check of a word processor corrects most of the typos in a text, DNA has a biochemical "spell-check" that compares the copied DNA with the original, and in most cases, repairs any mutations that have occurred.

However, spell-checks are not foolproof, and sometimes typos make it into the copied version of a text. For example, a

spell-check will not catch the use of *block* in the place of *black*. If a mistake is left uncorrected, it will be present in any future copies of the manuscript.

DNA is the same way. Occasionally, a typo or a mutation gets past the genetic spell-check, resulting in a mutation that is not repaired. If the cell that carries the mutation is a sperm or an egg cell, and the sperm or egg cell is involved in fertilization, and the fertilized egg results in a child, the child will have that mutation. Once the mutation is present, it will be included in any future copies of the genome, and carried forward by future generations of the family.

The greater the number of copies that are made of a manuscript, the higher the probability that errors will occur. Likewise, the greater the number of generations that pass in a family, the more likely mutations will occur in the family's genome.

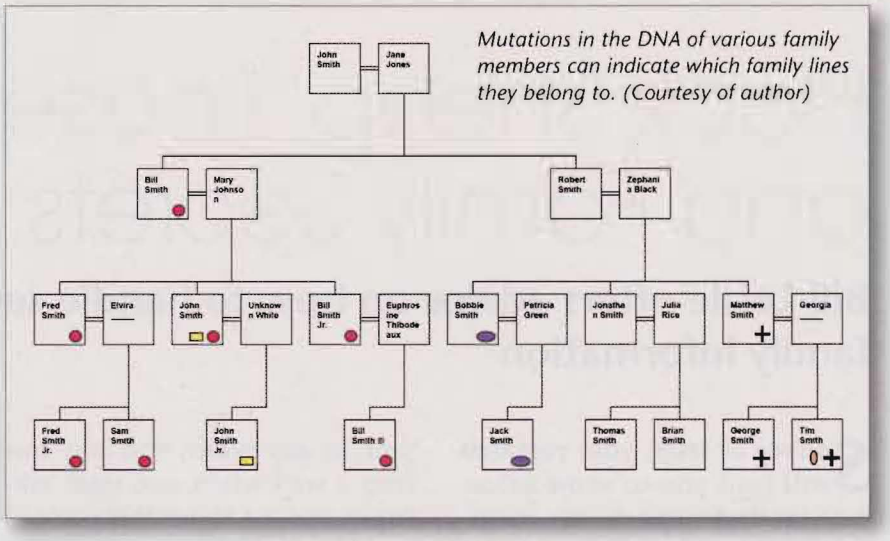
In the reverse sense, noticing how many mutations have occurred in a certain family line can give you an idea of how many generations had to pass for them to appear. This provides an estimate of how long ago the person with the mutations shared a common ancestor with a family member who does not have them. A genealogist does not have to dig up dead people to use DNA to obtain information about his ancestors. He can use the DNA results of living family members to deduce information about the DNA of family members who died long in the past.

DNA Research in Genealogy

Scholars use a similar method to compare old manuscripts. To assess how many original versions of a manuscript existed, they don't compare text, they compare typos. Each time a scribe copied a manuscript, he added his characteristic mistakes to the text. The next scribe copied these mistakes not knowing they were errors, adding his own typos to the text, and so on down through the manuscript generations. Manuscripts that share the same copy errors came from the same original version. If two manuscripts are almost identical, there probably have not been many copy-generations since their common manuscript-ancestor. If two manuscripts are somewhat the same, but have several differences, they probably had a common ancestor in the more distant past. If two manuscripts have a large number of differences, they probably do not have a common manuscript-ancestor.

Likewise, in genetic genealogy, if two people have the same DNA profile (called haplotype), they likely share a common ancestor in the recent past. If two people are close, but not exact matches, they probably share a common ancestor in the more remote past. If two people have many differences, they do not share a common ancestor, at least in a genealogical time period.

In this way, mutations are useful for sorting out which people in a surname group are related, and can provide an estimate of how long ago their common ancestor was around. Occasionally, genetic genealogy reveals a so-called non-paternity event, where someone descends from an ancestor who was not genetically related to his legal family, due to an adoption, a name change, or an illegitimacy. Even so, when combined with geographical and historical information, genetic genealogy can reveal information otherwise impossible to obtain, and can lead you down exciting paths in your search for your family story. FC



Mutations in the DNA of various family members can indicate which family lines they belong to. (Courtesy of author)

COLLEEN FITZPATRICK, PhD is a well-known forensic genealogist who lectures and writes widely on DNA. Colleen's first book ***Forensic Genealogy*** has become a classic, a must-have for professional and casual genealogists alike. She is also the co-author of ***DNA & Genealogy and The Dead Horse Investigation: Forensic Photo Analysis for Everyone.***