

# The Basics of Genetic Genealogy and Testing

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Of course, we are all curious about where we come from, or we would not be genealogists! It is no wonder then that many people are merely curious about their presumed ethnic breakdown. While the ethnic breakdown will vary depending on the testing company, it is a good general guide to where your DNA originated.

Whatever the reason, many people turn to DNA testing, hoping it will answer all their questions. Sometimes you do find the answers in the DNA. Often, you end up with more questions than you started! However, there are two truths to testing.

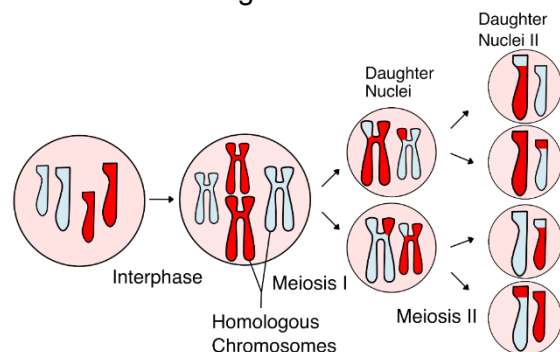
A word of caution. Don't test unless you want to know. DNA can uncover deeply buried family secrets. Some of these secrets can be humiliating, shameful or painful to other members of the family. Realize that not everyone may be as curious as you. You will need to respect the privacy concerns of other members of your family if you uncover something surprising.

Also, it is just a tool. Use it as you would another document to aid in your search for your family history. DNA can help, it can also confuse, just like a census record that makes no sense. When used in conjunction with paper genealogy, it can open doors you did not know.

## **What is autosomal DNA?**

There are 22 pairs of non-sex chromosomes located in the nucleus of the cell of genetically healthy humans. The sex chromosomes (X and Y) are the 23rd pair of chromosomes and determine if you are male (XY) or female (XX), resulting in 46 total chromosomes. They are numbered 1 – 22 and arranged primarily by size. The combination of genes on the chromosomes, however, are not the same for each person and is what makes you and me a genetically unique organism.

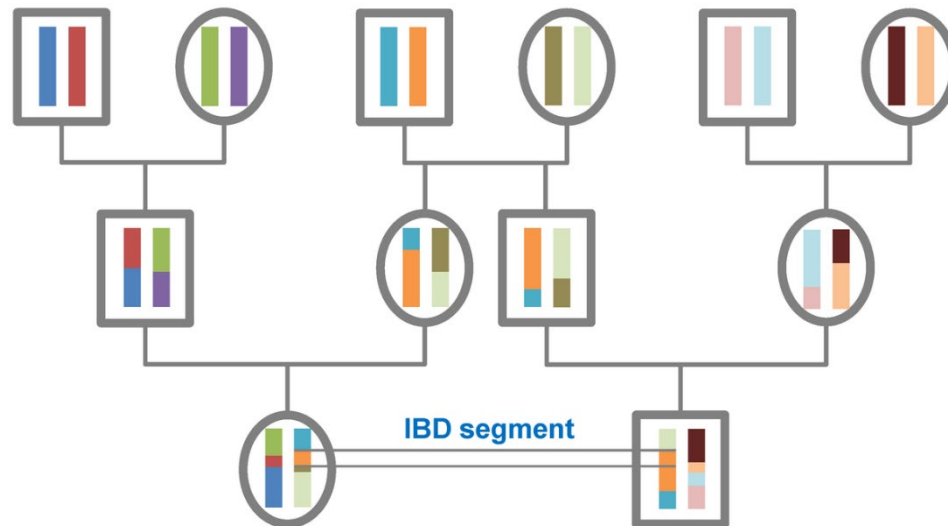
To pass on our genetic material, our cells must replicate and divide themselves. Then the process of recombination occurs. Recombination is also called crossing over and occurs when the chromosomes exchange genetic material with each other. The "arms" of the chromosomes inherited from the person's mother and father touch at multiple points over the length of the chromosome and then trade DNA. Wherever they touch a connection is made, and segments of the chromosome are exchanged. Through this process, new combinations of chromosomal DNA are created, making each of us a unique individual.



*Image from Wikimedia Commons*

Finally, in this process, the cells divide again into cells that only contain one half of the information needed to create a new person. These cells are called gametes. One gamete from the father and one from the mother eventually combine to create a new chromosomally unique individual.

In genetic genealogy, we are looking for Identical By Descent (IBD) segments on the chromosomes. These segments help determine how two, or more, people are related. The more DNA segments you share, especially if they are large (higher than 10cm) usually the closer you are genetically related.



*Image from ISOGG Wiki*

### **The X-Chromosome**

The inheritance pattern of the X-Chromosome is exciting and can be a gold mine of information when you receive a genetic match on it. Men (XY) inherit their X-Chromosome intact, without recombination, from their mother. This X is a combination of the 2 X-Chromosomes she inherited, one from her father and one from her mother. Since a man only has one X, he passes it intact to his daughters, giving them the ability to see large amounts of genetic information from her paternal great grandparents.

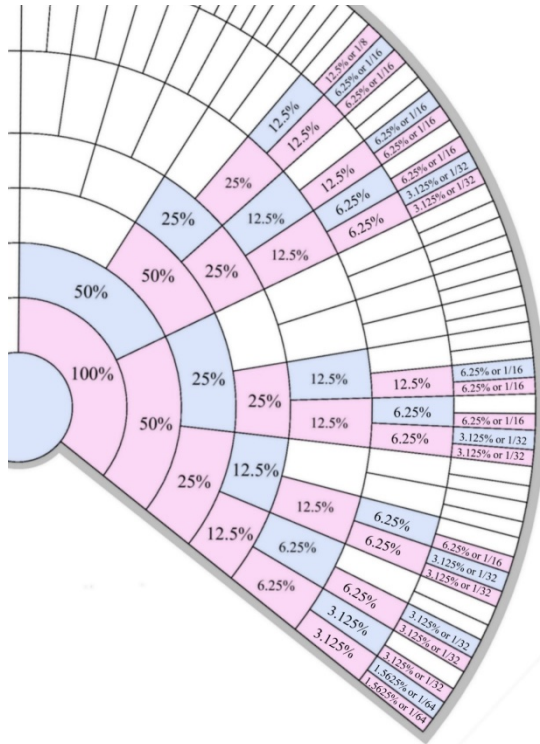


Image courtesy of Blaine Bettinger

Women (XX) inherit one intact X from their father, passed through him from her paternal grandmother, and one recombined X from her mother. They then give one recombined X-chromosome unto their children, both boys and girls. The percent of DNA you have in common from parent to child is shown here in the following chart. If you match someone on their X-chromosome, and they are male, you now know you are looking for ancestry in their maternal line. That is 50% of the family tree will not be looked at now! However, if they match you on the X-Chromosome and another autosome you have determined the line you are descended from so you can drill down to an even more specific set of ancestors.

Just like in atDNA inheritance, you will lose DNA segments with each recombination. The further back in time you go, the less in common you will share with your ancestors.

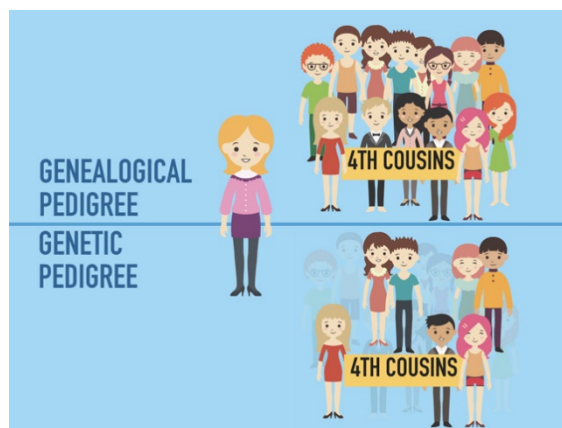
### **Ethnicity and atDNA**

Using your atDNA to find out where in the world your DNA originated from is a fun and exciting side

effect of finding your cousins. We all want to know if there is something hidden in our DNA and the surprises that come up when our ethnicity is shown through a testing company can be fascinating. We need to remember though that these results are only estimates, called biogeographical estimations or admixture. Ethnicity is determined through a multi-step process briefly outlined below.

**Importance of Reference Populations:** A biographical estimation is created by a computerized comparison of personal DNA segments to DNA segments of populations from around the world (called a reference population). The more diverse a company's reference population, the better it is for their consumers. If a company has a small reference population sample they will be severely limited with the results they can offer. For example, if they only have data for European populations the results will be meaningless for anyone who has African or Asian ancestry. Major global testing companies are continuously updating and adding reference populations as they become available so your results will be the best possible.

**Genetic vs. Genealogical Trees:** The most important lesson you can take away is the understanding that you have two distinct, but overlapping, family trees. Your genealogical family tree is all of the “paper” research. The other family tree, your genetic tree, only contains only those who contributed to our DNA. You should be able to see that your genetic family tree will be a smaller subset of your genealogical family tree. There will be people on both, sure, but a majority will be only on one.



*Image courtesy of Diahan Southard*

**How companies compare:** Each company creates its own reference populations and therefore may not be like another company at all. Sometimes it is also due to the process the company puts the segments of DNA through because they have different matching requirements or a whole host of other variables. To show you how one person’s results can vary the images below show my ethnicity results from AncestryDNA, 23andMe, and FTDNA.

I am primarily of European descent, and I have the documents which show that. Although, I have trace amounts of DNA from other countries depending on which company is doing the tested. Now, these could be calculation anomalies (especially the ones at less than 1%), or they could be actual trace amounts of ancestral DNA sifting through. Each company used different reference populations which can also alter the results slightly. Particularly 23andMe, which has a good track record of testing for Native American and African Ancestry. Could the small percent of Asian showing through on their result be that elusive Native American Ancestry my family lore says they have?

## **Resources**

### **Books:**

Aulicino, Emily D. *Genetic Genealogy: The Basics and Beyond*. Author House, 2013.

Bettinger, Blaine. *The Family Tree Guide to DNA Testing and Genetic Genealogy*. Cincinnati, OH: Family Tree Books, 2019.

Kirkpatrick, Brianna, and Combs-Bennett, Shannon. *The DNA Guide for Adoptees*. Self-published, 2019.

### **DNA Blogs / Websites:**

Bettinger, Blaine, **The Genetic Genealogist** <https://thegeneticgenealogist.com>

Christmas, Shannon, **Through the Trees** <https://www.Throughthetreesblog.tumblr.com>

Combs-Bennett, Shannon, **TNT Family History** <https://tntfamilyhistory.blogspot.com>

Cooper, Kitty, **Kitty Cooper’s Blog** <https://blog.kittycooper.com/>

Estes, Roberta, **DNAeXplained – Genetic Genealogy** <https://dna-explained.com>

Kennett, Debbie, **Cruwys News** <https://www.Cruwys.blogspot.com>

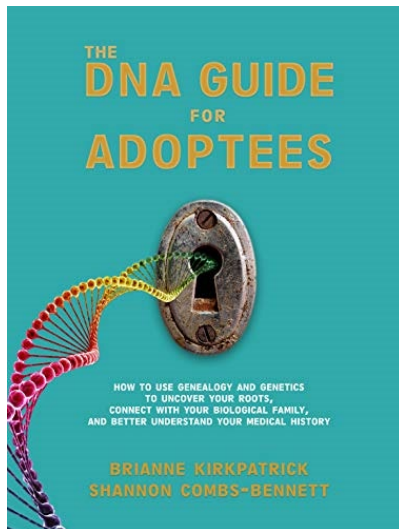
Larkin, Leah, **The DNA Geek** <https://www.thednageek.com>

Moore, CeCe, **Your Genetic Genealogist** <https://www.yourgeneticgenealogist.com>

Russell, Judy, **The Legal Genealogist** <https://www.legalgenealogist.com/>

Southard, Diahan, **Your DNA Guide** <https://www.yourdnaguide.com>

Wayne Debbie Parker, **Deb's Delvings** <https://www.debsdelvings.blogpost.com>



<https://dnaguideforadoptees.com/>

By: Brianne Kirkpatrick and Shannon Combs-Bennett

This book is for you if you have hope that DNA testing might open up the search for information about yourself, your origins, and your future. We've worked hard to compile the resources in this book and explain in plain English how DNA and genealogical records fit together like the pieces of a puzzle. In the chapters that follow, we've created a place for you to turn as you come face-to-face with questions about health, ancestry, biological family, and DNA.

Why this book? As two women active in the genetic genealogy community, our decision to work together on The DNA Guide for Adoptees came from a desire to provide a comprehensive resource about DNA testing that pulls everything into one place. What you learn from testing your DNA can have a profound impact on you, your family members, and even future generations.