

Genetic Genealogy 2: *So, I Tested my DNA; Now What?*

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INTRODUCTION:

Genetic genealogy – especially *DNA testing for ethnic origin* – has become wildly popular. Yet, for millions of people, the ethnicity estimates don't match their family history, and cousin-finding tools seem complex and confusing. This discussion seeks to explain and simplify the next steps for using your DNA for greater insights and successful family research.

DNA TESTING BASICS:

- 3 types of DNA tests: autosomal (at-DNA), mitochondrial (mt-DNA) and Y-chromosome (Y-DNA) (*see image A*).
- Of these, at-DNA is the least expensive, most popular and generally most genealogically useful DNA test.
- The top DNA test labs are: AncestryDNA, FamilyTreeDNA, MyHeritage, 23andMe and LivingDNA (*see resource Links*).
- at-DNA (1) provides ancestral ethnicity estimates, and (2) identifies others with whom you share a recent ancestor.
- at-DNA reflects your whole pedigree, but only the last 150 years; at-DNA halving & shuffling washes-out earlier ancestors.
- DNA testing can have privacy implications: law enforcement or others can gain access to your DNA test results.
- Artifact DNA testing of hair brushes, envelopes and stamps is becoming possible, though not always successful.
- DNA is contributory evidence; it tells whether 2 people share an ancestor, but **not** exactly who or when.
- Traditional “paper research” is **always** required to place DNA cousins accurately within family trees.

DISAPPOINTING ETHNIC ESTIMATE RESULTS; the “Horoscope” of DNA Tests:

- Each DNA lab uses different DNA markers and reference populations to reach different ethnicity conclusions.
- Country-level ethnicity estimates are most inconsistent, but broad regional estimates tend to be more valid.
- Your ethnicity test will often not match paper research, your siblings' test results or even yourself at different labs.
- If your parents have vastly different geographic origins, ethnic estimates can be helpful to family research, otherwise, despite all the flashy ads, ethnicity estimates are muddled, imprecise and rarely useful to genealogists.

AUTOSOMAL DNA TOOL & SKILLS: (*see image B*)

- **BASIC DNA TOOLS** – Each DNA lab's website offers a list of “Cousin Matches” also called a “One-to-Many” analysis, where the “One” is you, and the “Many” are all the lab's other clients. Labs provide info. about your Matches such as:
 - **cM** - the amount of DNA overlap, measured in centimorgans
 - **Total %** - the amount of DNA overlap, measured as a percentage of total DNA
 - **Largest Segment (cM)** – the length of the longest individual segment of DNA overlap in centimorgans
 - **Number of Segments** – the total count of segments making up the DNA overlap
 - **MRCA (Most Recent Common Ancestor)** – a kinship estimate or number of generations that separate the 2 DNA tests.
- **INTERMEDIATE DNA TOOLS** – Each DNA lab's collection of test results is limited to just their clients. So looking for DNA matches at only one lab is like fishing in a single small pond. To fish in several ponds, don't pay for DNA tests at all the labs, instead import your DNA test results to the websites other labs and to third party for free.
 - First, **consider the privacy issues** - publicly posting your DNA test results has risks. If the tests belong to family members, obtain their consent to more widely display their results. Even if you use an alias, publicly posted DNA results are available to law enforcement and could help them identify a criminal family member.
 - Then, **download your DNA** file from the testing lab to your PC. For step-by-step instructions, Google, “how to download my AncestryDNA” (or other website). It arrives as a “compressed” .zip file. Save to your PC but don't open it.
 - Next, **upload your DNA** to other labs and to DNA analysis websites. For step-by-step instructions, Google, “how to upload my DNA file to MyHeritage” (or other website). With the exception of AncestryDNA and 23andMe, the main DNA labs all allow you to import your DNA test results from other labs for free (*see image C*). Additional sites like www.GedMatch.com offer DNA tools and tree matches. After a GedMatch upload, perform two quality checks: run *DNA File Diagnostic Utility* and *Are Your Parents Related* tools from *GedMatch's* Analysis Tools (*see image D*).
- **ADVANCED DNA TOOLS** – We use *AncestryDNA* and *GedMatch* as popular examples of online resources. This section reviews four key tools that genetic genealogists will find useful. Deploy these four steps in order:
 - **SKILL #1: ONE-TO-MANY ANALYSIS** – finds a list of matches between your DNA test results and the collection of DNA tests at your DNA testing lab. AncestryDNA's “Confidence Scores” (*see image E*) are typical of how labs characterize the quality of your matches. The online display of One-to-One matches varies among DNA test repositories:
 - **GedMatch** Matches are in a **Table** with column titles such as, *Kit #, Gender, Name, Total cM and Largest Segment*.
 - **AncestryDNA** Matches are in a **List** including *Name or Alias, Gender, Match Confidence and Probable Kinship*.

There are two approaches to recognizing which matches are most meaningful:

✚ **GedMatch** focuses on Matches with any **DNA segments > 7 cM**, though we suggest you adjust to 10 cM.

✚ **AncestryDNA** focuses on Matches with **total overlap of at least 30 cM of shared DNA**.

Note: GedMatch's Table of *One-to-Many Matches* can be copied & pasted into a PC spreadsheets for off line use.

- **SKILL #2: ONE-TO-ONE ANALYSIS** – next, both **AncestryDNA** and **GedMatch** provide tools to allow exploration of individual Matches to find shared surnames, geographic locations and family tree branches – even DNA segments.

✚ **GedMatch** allows *One-to-One* analysis by clicking on an individual within your *One-to-Many Table*.

✚ **AncestryDNA** allows *One-to-One* analysis by clicking on an individual within your *One-to-Many List*.

When *One-to-One* Matches seem promising, but the matching person has no visible surnames or trees, there are strategies to find the nature of your matching person's family connection. Try each of the following:

✚ No tree at AncestryDNA or GedMatch doesn't mean that a tree can't be found; check Ancestry.com.

✚ No tree at AncestryDNA or GedMatch may indicate a very private genealogist; reach-out carefully; directly, or through by the DNA labs, you can message your *One-to-One* DNA Matches to compare your research notes.

✚ No tree at AncestryDNA or GedMatch may indicate a newbie genealogist; be prepared to mentor them.

✚ Even without a tree, *Chromosome Browsers* analyze shared DNA segments & can help indicate a family branch.

✚ The DNA Painter tool can further identify likely relationships based on cMs of shared DNA (*see Image F*).

- **SKILL #3: TWO-TO-ONE ANALYSIS** – next, both **AncestryDNA** & **GedMatch** provide *Two-to-One* tools to produce a list of Matches (the "One" of *Two-to-One*) who share DNA with both you AND a relative ("the "Two" of *Two-to-One*):

✚ **GedMatch** produces a *Two-to-One* analysis by clicking on the *People Who Match 1 or Both of 2 Kits* tool.

✚ **AncestryDNA** produces *Two-to-One* analysis by clicking on *Compare* icon in any of the *One-to-Many* Matches.

Placing these *Two-to-One* Matches accurately within your family tree, requires several next steps:

✚ **First**, by selecting 2 individuals who are **related, and 1 or are more generation apart** as the "Two" in the *Two-to-One* analysis, you can infer the family branch of individuals of the Match List; the "Ones." For example, a "Two" consisting of a mother & son will produce 2-to-1 matches that are from the son's maternal side and not from his paternal side. If the Match is an unknown, this tool eliminates 50% of kinship possibilities and narrows the focus of traditional research that is needed to reach more specific placement of the 2-to-1 match in your family tree.

✚ **Second**, perform a *One-to-One* analysis (described above) on the unknown match from the *Two-to-One* match list. Look for shared surnames, geographic locations, family trees and DNA segments to further identify the match.

✚ **Third**, if the relationship is still clear, use DNA Painter to identify the most likely relationship(s) based on the amount of DNA overlap (cM). This should further narrow potential branches and tree landing spots.

✚ **Fourth**, even more relationship insights can be gained from the use of a *Chromosome Browser*, combined with *Spreadsheet* tracking and sorting tools. This is the next skill, below.

SKILL #4: CHROMOSOME BROWSERS & SPREADSHEETS – Finally, these analytic tools can help unravel otherwise insurmountable Match mysteries. Only **GedMatch** is helpful here, because **AncestryDNA** has no chromosome browser:

✚ **First**, from within **GedMatch** open your *One-to-Many* Match Table.

✚ **Second**, copy & paste **GedMatch's** *One-to-Many* Match Table into a spreadsheet on your PC, then create new columns to track: **Shared Surnames, Shared Locations, Likely Branch, Probable Kinship** and, if you're very ambitious: **Segment Starting Point, Segment Ending Point, Segment Length (cM)** – note: these three Segment columns need to be created for each of your 22 autosomal chromosomes (= 66 additional columns).

✚ **Third**, select any of your individual Matches from your *One-to-Many* Table by clicking on the "A" link in their Detail column within the table's Autosomal area. This opens a settings page for a *One-to-One* Table. Select the "*Position Only*" option to produce a Table of segment overlap data without the chromosome graphics.

✚ **Fourth**, copy new information into your PC spreadsheet's row for each match: **Segment Starting Point, Segment Ending Point, Segment Length (cM)** for each chromosome. If you know, add the match's **Shared Surnames, Shared Locations, Likely Branch & Probable Kinship**. For a fee, **GedMatch's** Tier 1 Tools can automate segment matches.

✚ **Fifth**, the Spreadsheet can be sorted by column for commonalities which indicate family branch insights.

Combined with traditional research you can now place previously unknown Matches accurately within your family tree.

CONCLUSION

Though at-DNA testing won't answer all your research questions, by uploading your test results to several DNA labs' websites, you can dramatically increase your chances of finding new cousins with whom to compare notes, share traditional research and unravel the mysteries of your family. And, thanks to these 4 analytic DNA skills, you can more confidently place even unknown cousins within your existing family tree.

RESOURCES

DNA Testing Labs

- www.AncestryDNA.com
- www.FamilyTreeDNA.com
- www.23andMe.com
- www.MyHeritage.com
- www.LivingDNA.com
- www.OnTheEnvelope.com (artifact testing)

DNA Tools Websites

- www.DNApainter.com/cmV4
- www.GedMatch.com
- www.DNAGedcom.com

Genetic Genealogy Online Reading

- www.isogg.org/wiki/Wiki_Welcome_Page
- https://www.gedmatch.com/Using_GEDmatch.php
- <https://www.gedmatch.com/gedwiki/index.php?title=FAQs>
- https://www.gedmatch.com/DNA_for_Dummies.php

Genetic Genealogy Books & e-Books

- The Guide to DNA Testing and Genetic Genealogy*
Blaine T. Bettinger
- DNA Buying Guide: Are you buying the right test?*
Thomas MacEntee
- 23 Best Tips for DNA Testing and Family History*
Mary Eberle, J.D.

A

MAJOR GENEALOGICAL DNA TEST TYPES			
DESCRIPTION	mt-DNA	Y-DNA	at-DNA
DNA Source	Mitochondria	Y Chromosome	Autosomal Chromosomes (44 of 46 chromosomes; all except X & Y)
Location	Cell Cytoplasm	Cell Nucleus	Cell Nucleus
TEST SUBJECTS			
Who can be tested?	Women or Men	Men only	Women or Men
TIME FRAME			
Does DNA get Shuffled?	No	No	Yes, each generation
DNA Stability	Extremely Stable	Stable	Unstable (shuffling and halving each generation)
Looks how far back?	1000s of generations	100s of generations	5-6 generations
Ave. Mutation Rate?	Once every 10,000 years	Once every 800 years	Inconsequential (minimal mutation is overshadowed by shuffling)
Test Type	Anthropological	Genealogical	Genealogical
DNA USES			
Primary Use	Matching to others with a shared ancestor	Matching to others with a shared ancestor	Matching to others with a shared ancestor
Secondary Uses	Migratory Insights	Migratory Insights	Ethnicity Estimates (%) Migratory Insights
LABS & COSTS			
Best Lab	FamilyTreeDNA	FamilyTreeDNA	AncestryDNA
Cost (# of Markers)	\$89 (2 regions) to \$149 (all regions)	\$169 (37 markers) to \$649 (500 markers)	\$59-\$99 (> 700,000 markers)
ACCURACY & CERTAINTY			
Overlap required to demonstrate Kinship	100% (no mismatched DNA markers)	98-99% (2 or fewer mismatched DNA markers)	Anything > 0.5% (as little as 16 cM)
Match Certainty	MRCA Estimated	MRCA Estimated	MRCA Estimated
Ethnicity Accuracy	Moderate	Moderate	Slightly Better

GedMatch DNA Tools

Analyze Your Data

D

DNA raw data

- 'One-to-many' matches
Information: Disappeared kits recovery information
Action: 'One-to-many' recovery no account email matches
- 'One-to-one' compare
- X 'One-to-one'
- Admixture (heritage)
- Admixture/Oracle with Population Search
- Phasing
- People who match one or both of 2 kits **Updated**
- Predict Eye Color
- ★ Are your parents related?
- 3D Chromosome Browser
- Archaic DNA matches
- Multiple Kit Analysis **NEW**
- ★ DNA File Diagnostic Utility
Analyze DNA file upload for potential problems.


Genealogy

- 1 GEDCOM to all
- 2 GEDCOMs
- Search all GEDCOMs
Revised
- GEDCOM + DNA matches


Ancestry.com "potential DNA match"



ancestry Home Trees Search **DNA** Help Extras

← AncestryDNA Home > Member Matches for David Bradford ← 1

★  **Name Obscured for Privacy** [Send Message](#)

Member since 2016, last logged in Aug 4, 2017

 **Predicted relationship: 4th Cousins**
Possible range: 4th - 6th cousins ([What does this mean?](#))

 Confidence: Extremely High  ← 2

75

Amount of Shared DNA

← 3 → **75** centimorgans shared across 5 DNA segments

← 4 → [What does this mean?](#)

DNA LABS THAT ALLOW IMPORTING OF YOUR DNA FILES								
Company	Allows DNA Import?	Import for Free	Imports from 23andMe?	Imports from AncestryDNA?	Imports from FTDNA?	Imports from Living DNA?	Imports from MyHeritage?	Imports from Geno 2.0? **
23andMe	No	n/a		n/a	n/a	n/a	n/a	No
AncestryDNA	No	n/a	n/a		n/a	n/a	n/a	No
FamilyTree DNA	Yes	No*	Yes	Yes		No	Yes	Yes
Living DNA	Yes	Yes	Yes	Yes	Yes		Yes	No
MyHeritage	Yes	Yes	Yes	Yes	Yes	No		No

Confidence Score	Approximate amount of shared centimorgans	Likelihood of a single recent common ancestor
Extremely High	More than 60	Virtually 100%
Very High	45—60	About 99%
High	30—45	About 95%
Good	16—30	Above 50%
Moderate	6—16	15—50%

Shared at-DNA Relationship Calculator (courtesy of Blaine T. Bettinger at <https://dnainter.com/tools/sharedcmv3>)

When an email "Match" is identified by your at-DNA testing lab, this web site uses the amount of shared DNA (measured in centimorgans or cM) to calculate the most likely relationships that may exist between you and your "Match."

KEY TO CHART

Relationship Average Range (low to high) (99th percentile)

Possible Relationship of 2 Individuals

Average cM overlap of known relationships of this type

Range of cM overlap looking at 99% of known relationships of this type

Example: of 99% of known Second Cousins Twice Removed (2C2R), the average overlap is 74 cM, though some have as little as 0 cM, while others have as much as 261 cM

		Great-Great-Grandparent		GGG Aunt/Uncle		GGG Aunt/Uncle		Other Relationships	
Half GG-Aunt/Uncle 187 12 - 383	Great-Grandparent 881 464 - 1486	Great-Great-Grandparent	GGG Aunt/Uncle	GGG Aunt/Uncle	GGG Aunt/Uncle	GGG Aunt/Uncle	GGG Aunt/Uncle	Other Relationships	
Half 1C2R 145 37 - 360	Half-Great Aunt / Uncle 432 125 - 765	Great-Grandparent 1766 1156 - 2311	GGG Aunt/Uncle 123 0 - 283	GGG Aunt/Uncle 123 0 - 283	GGG Aunt/Uncle 123 0 - 283	GGG Aunt/Uncle 123 0 - 283	GGG Aunt/Uncle 123 0 - 283	Other Relationships 6C 21 0 - 86	
Half 2C1R 73 0 - 341	Half 1C1R 226 57 - 530	Parent 3487 3330 - 3720	Great Aunt/Uncle 914 251 - 2108	1C2R 229 43 - 531	2C2R 74 0 - 261	3C2R 35 0 - 116	4C1R 28 0 - 117	6C1R 16 0 - 72	
Half 3C 61 0 - 178	Half 2C 117 9 - 397	Sibling 2629 2209 - 3384	1C 874 553 - 1225	3C 74 0 - 217	4C 35 0 - 127	5C 25 0 - 94	6C2R 17 0 - 75	6C2R 17 0 - 75	
Half 3C1R 42 0 - 165	Half 2C1R 73 0 - 341	Niece / Nephew 1750 1349 - 2175	1C1R 439 141 - 851	3C1R 48 0 - 173	4C1R 28 0 - 117	5C1R 21 0 - 79	7C 13 0 - 57	7C 13 0 - 57	
Half 3C2R 34 0 - 96	Half 2C2R 61 0 - 353	Great Niece / Nephew 910 251 - 2108	2C1R 123 0 - 316	4C2R 22 0 - 109	5C2R 17 0 - 43	7C1R 13 0 - 53	7C1R 13 0 - 53	7C1R 13 0 - 53	
Half 3C3R	Half 2C3R	Grandchild 1766 1156 - 2311	2C3R 57 0 - 139	5C3R 11 0 - 44	7C3R 13 0 - 53	7C3R 13 0 - 53	7C3R 13 0 - 53	7C3R 13 0 - 53	