



[CLIENT]
SmithDNA1701 DE1704205
11 January 2017

DNA Discovery Plan

GOAL

Create a research plan to determine how the client's DNA results relate to his family tree as currently constructed.

The client's long-term goal, outside the scope of this research plan, is to continue to build his family tree.

Background Information from the Client

The client has begun to create a family tree using traditional research methodologies. He has also taken a DNA test and expressed concern that his ethnicity results include Scandinavian ancestry while his family tree as it now stands includes no signs of Scandinavian heritage.

Autosomal DNA Inheritance

Each individual inherits half of their autosomal DNA from each of their parents. Beyond that, the amount of DNA shared in common is only approximate due to a random process called recombination which shuffles the DNA each generation. Each individual will inherit about 25% from each grandparent, 12.5% from each great-grandparent and approximately half the previous amount for each subsequent generation. Although two first cousins will have both inherited 25% of their DNA from each of their common grandparents (50% in total) they will have inherited a different 25%. Therefore, first cousins will typically only share about 12.5% of their DNA in common.

Autosomal DNA test results are composed of two elements: ethnicity admixture results and genetic cousin match lists. Ethnicity admixture results analyze mutations and segments of DNA and determine in which populations those mutations and segments are most often found. Genetic cousin match lists calculate the number, location, and size of segments of DNA that different individuals share in common. Based on the number, size, and location of segments, the relationships between test subjects and their genetic cousins are estimated.

While genetic cousin match lists are the most useful element of DNA test results in genetic genealogy research, ethnicity results can be helpful in some limited circumstances.

Ethnicity Admixture Results

Broad ethnicity categories are easier to distinguish than narrow ones. The differences between Asian vs. European vs. African DNA are clear; the differences between British, Scandinavian, and Western European DNA are less clear. Isolation leads to genetic diversity whereas gene flow leads to decreased genetic diversity. For example, individuals with predominately British ancestry often exhibit high percentages of Scandinavian admixture due to the ancient influence of Viking and Norman invasions. Individuals with Western European ancestry similarly exhibit high percentages of admixture from the British Isles because of historic population movements.

The client's high ethnicity estimate from Scandinavia does not align with the client's current family tree. However, ethnicity results are continually refined through expansion of DNA reference populations and better identification of population specific markers. The ethnicity results could be due to a lack of refinement on the testing side, or perhaps additional research on the family tree is needed to verify that connections are correct. A second opinion could also be obtained through additional DNA testing elsewhere.

DNA Match Lists

Though ethnicity results can be helpful in some situations, the most useful part of DNA test results are genetic cousin match lists. In the client's match list are several close genetic cousins. We reviewed his top matches to determine how they might be related.

The client's top match, [LIVING], shares 108 centimorgans on 5 segments of DNA with the client. Centimorgans are a measure of genetic recombination and communicate the likelihood that two points will be separated by recombination in a generation of ancestry. The more total centimorgans two individuals share, the more likely they are to be closely related to each other. Some levels of shared DNA are indicative of specific levels of relationship or at least are more likely for certain levels of relationship than for others. For example, the amount of DNA shared between second cousins is distinct from the amount of DNA shared between first cousins or half siblings. On the other hand, the amount of DNA that fourth cousins share might be the same as the amount of DNA that eighth cousins share. Closer relationships have stronger and unique ranges of shared cMs. More distant relationships are more ambiguous in their observed ranges.

Based on the amount of DNA that the client shares with [LIVING], we would expect that they are related at the level of second cousins once removed to third cousins once removed, with third cousins being the most likely level of relationship.¹ We reviewed the family tree

¹ Paul Woodbury, "Centimorgan and Segment Probability Calculator," proprietary calculator of Legacy Tree Genealogists, centimorgan calculations 6.5% at 6 generations, 39.9% at 7 generations, 29.9% at 8

that [LIVING] has created and discovered that he descends from members of the Tompkins family, including one Matilda E.S. Tompkins who was born in 1858 in Green county Arkansas and who resided in her later years in Sharpe County, Arkansas.²

In the tree provided by the client, we observe that he is a descendant of Fannie Maude Tompkins who was born in 1894 in Arkansas and who was married in Sharpe County. It is possible that [LIVING] is related to the client through the Tompkins family. If this is the case, then it would serve to confirm the client's relationships to these documented ancestors on his paternal side. During future research, additional investigation should be performed to determine the relationship between the client and [LIVING].

The client's next three genetic cousins in his match list share between 70 and 83 centimorgans of DNA. Based on this amount of sharing, we expect them to be related in the range of second cousins once removed to fourth cousins. Two of them do not provide information regarding their family trees, and though one does have a fairly extensive family tree, we find no immediate connections between her tree and that of the client. During future research, these individuals might be contacted to determine how they are related to the client.

RESEARCH PLAN

- **Step 1: Determine the Relationship between the Client and [LIVING].** Knowing that [LIVING] shares enough DNA to be a second cousin once removed, third cousin or third cousin once removed to the client, we can now search for a common ancestor among the great-grandparents and second great-grandparents of him and the client. If common ancestors are found, then the genetic relationship between the client and [LIVING] will serve as confirming evidence of the client's relationship to those most recent common ancestors.
- **Step 2: Correspond with the Client's Closest Genetic Cousins.** For those genetic cousins who have not yet attached family trees to their test results, they should be contacted through the DNA test messaging system to request information about their family trees and to request their collaboration in determining the nature of their relationship to the client. The information they provide may save many hours of research.
- **Step 3: Construct "Quick and Dirty" Family Trees for Genetic Cousins Who Decline to Collaborate.** Sometimes genetic cousins do not respond to requests for collaboration, or they decline to provide information. In these cases, it can still be possible to determine how they may be related to the client by constructing "quick and dirty" trees for them. Since the main focus of these efforts is to identify the potential ancestral lines through which they may be related, it is advisable to first depend on

generations, 17.7% at 9 generations, 4.1% at 10 generations, segment calculations 1.9% at 6 generations, 34.5% at 7 generations, 46.7% at 8 generations, 13.7% at 9 generations, 3.0% at 10 generations.

² [LIVING 1], "XXXX Web Site," Matilda E S Tompkins, *Member Family Trees*, <https://www.XXXX.com>, subscription database, accessed January 2017.

easily obtainable information, such as compiled records, public family trees, and other easy-to-obtain genealogical records. During this stage, complete citations and in-depth discussion of each genealogical connection is not necessary. Once likely common ancestors or relatives have been identified, primary sources might be sought, discussed and cited to document the proposed relationship.

Gedmatch.com

Gedmatch.com is a free third-party website which accepts autosomal DNA transfers from several major testing companies. They provide a host of tools for analyzing ethnicity, connecting with additional genetic cousins at other DNA testing companies, and performing in-depth analysis on shared segments, relatives and groups of relatives. By transferring to Gedmatch.com, we will be able to calculate the client's ethnicity percentages with several additional calculators offering multiple viewpoints for interpretation. Each calculator utilizes different reference populations and different population categories. Through this we will also be able to connect with additional genetic cousins from the client's family and thereby confirm or refute specific lines of the client's tree as proposed.

- **Step 4: Transfer Test Results to Gedmatch.com.** By transferring the client's test results to Gedmatch.com we will be able to perform additional advanced analyses using his results.
- **Step 5: Calculate Ethnicity Admixture Percentages Using Gedmatch Calculators.** Gedmatch.com provides several sets of ethnicity calculators which can be used to obtain additional insight into ethnicity admixture. We recommend performing analyses with the chromosome painting view and utilizing the Eurogenes K12 and K36 calculators.
- **Step 6: Collaborate with Genetic Cousins at Gedmatch.** By transferring to Gedmatch.com the client will connect with individuals who have tested at other testing companies and who have also transferred their test results there. These individuals should be contacted to determine how they are related to the client. For those who do not respond, traditional research might be performed to create "quick and dirty" trees of their ancestry.
- **Step 7: Organize Genetic Cousins by Relationship.** Once relationships have been identified with a sufficient number of genetic cousins, the client's match list can be organized based on the relationships of these individuals to more distant relatives. We can use this to identify the likely ancestral origins of shared DNA with distant relatives and guide correspondence with those individuals.

Targeted Testing

Unlike other types of genealogical records, DNA test results are constantly changing. The DNA test results that a test subject has today may be different from the ones available tomorrow. The ethnicity estimates provided today could be updated based on future discoveries. As a result, in genetic genealogy research there is a delicate balance between waiting for additional matches and pursuing research on current test results. Nevertheless, the process of waiting for test results need not be a passive effort.

By testing known relatives from a test subject's family tree, it is possible to confirm or refute specific lines of ancestry. We recommend that the client contact and recruit a first cousin from his maternal and paternal ancestry as well as second cousins from each of the families of his grandparents to perform autosomal DNA testing. Having access to the test results of these individuals will help to filter the client's test results. Those who match the client and maternal relatives are likely related through the client's maternal ancestry. Those who are related to the client and his paternal relatives are likely related through the client's paternal ancestry. If any of the tested individuals are not genetic cousins to the client, this will indicate that there is a case of misattributed paternity somewhere in the family lines of either the client or their match.

- **Step 8: Test a Known Maternal First Cousin and a Known Paternal First Cousin.** By testing known members of the client's maternal and paternal family, we can identify the genetic cousins shared in common with these individuals and filter results into maternal and paternal categories. If either of the tested individuals do not match the client, or do not match the client at the expected level of shared DNA, it could be indicative of misattributed paternity.
- **Step 9: Test Known Relatives Through the Ancestry of Each Great-Grandparent.** By testing known relatives from each of these family lines, it will be possible to better identify how genetic cousins are related to the client. Those who match these individuals and the client are likely related through the same ancestral lines as the client's known relatives. If these relatives do not match the client, or do not match at the expected level, this may be indicative of misattributed paternity somewhere in the family of the client or the family of his relatives.

Additional Options

Several companies offer DNA testing for genealogy and each has its own database of reference populations and tested subscribers. To connect with additional genetic cousins who have tested at other companies we recommend "fishing in additional ponds."

In addition to other repositories of autosomal DNA testing, there are different types of DNA tests that can be used for genealogy. The client has already taken an autosomal DNA test, but he might also benefit by performing Y-DNA and mitochondrial DNA (mtDNA) testing as well. Though the client may not have the Y-DNA or mtDNA necessary for exploration of specific research questions, other family members might. Descendants of ancestors of interest might be researched, identified, contacted and invited to perform Y-DNA or mtDNA testing.

- **Step 10: Perform Autosomal DNA Testing at Additional Testing Companies.** By testing in multiple databases, the client will connect with genetic cousins who have only tested at other companies.
- **Step 11: Perform Y-DNA Testing.** The Y-chromosome is the male sex chromosome and is passed from generation to generation in a pattern of direct-line paternal inheritance. Only males inherit a Y-chromosome. Therefore, it follows the same inheritance pattern

as surnames in many western civilizations. This quality is particularly useful for answering questions regarding paternity or shared paternal ancestry. Occasional mutations introduced into Y-DNA help to distinguish different lineages, some of which are ethnically and geographically specific.

🍌 **Step 12: Perform Mitochondrial DNA (mtDNA) Testing.** Mitochondrial DNA is a unique set of DNA passed down from a mother to her children. Both males and females inherit mitochondrial DNA, but only females will pass it on to the next generation. Occasional mutations help to delineate different mitochondrial DNA lineages, some of which are ethnically or geographically specific. Mitochondrial DNA is ideal for answering questions regarding shared direct-line maternal ancestry, and can be useful in determining very specific heritage (such as Native American ancestry) on the direct maternal line.

🍌 **Step 13: Perform Targeted Testing with Y-DNA and mtDNA Tests.** Though the client may not have the Y-DNA or mtDNA of an ancestor of interest, other relatives may. By tracing the descendants of ancestors of interest, we can identify testing candidates who do have the Y-DNA and mtDNA signatures of the ancestors of interest. Testing these relatives can provide additional insight regarding the origins, parentage and ancestry of brick-wall ancestors.

CONCLUSION

Through this session, we have developed a plan for better incorporating the client's test results into his genealogy research. Though ethnicity results can be helpful in some situations, they can be unrepresentative of recent family history. Lists of genetic cousins are much more useful for exploration and confirmation of ancestry. Gedmatch.com can provide additional insight to the client's ethnic admixture and additional connections to genetic cousins. Targeted testing of the client's known relatives will help to filter genetic cousins based on their likely relationships. Finally, testing in multiple databases and performing different types of tests may help to confirm and extend the client's ancestry.

We have enjoyed developing this research plan and look forward to implementing it through research in the future under your direction.

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