Genetic Genealogy Journey

Targeted Testing for Autosomal DNA

by Debbie Parker Wayne, CG[SM], CGL[SM]

In the last column, we used several techniques to analyze Joyce's autosomal DNA and her matches with Ryan, Bob, and Gina, who share a common ancestor. We compared family trees; analyzed the total amount of shared DNA; used a matrix tool to determine which of these matches share DNA In Common With (ICW) each other; and used a chromosome browser to display one chromosome where some of the cousins share overlapping segments. Targeted testing and triangulation are two techniques that may provide more evidence to answer our genealogical question about the relationship between Joyce, Ryan, Bob, and Gina.

Likelihood of Cousins Sharing atDNA

Our first question may be why Gina does not match Ryan on the Matrix and ICW list if they share Samuel and Mary Parker as ancestors. There could be an error in the pedigree chart of one or the other or both. Thorough documentary research may confirm or refute the accuracy of the trees.

We must also consider that some cousins do not inherit the same segments of DNA from an ancestor and therefore, are not listed as matches. Random inheritance and recombination can result in children inheriting different DNA segments from parents. Grandchildren can only inherit DNA their parents inherited from the grandparents. After a few generations, cousins may share large segments of DNA from any given ancestor or may share little or no DNA from a particular ancestor.

Table 1 documents the current likelihood of cousins sharing a detectable amount of DNA to be listed as matches by testing companies. Search a company's website or the ISOGG Wiki to find the most current percentages.[1] As we learn more about DNA sharing, companies modify their matching algorithms and the threshold used to determine a match. As companies change algorithms, the likelihood of detecting a cousin in the database may change.

As shown in table 1, companies predict a ten to thirty-two percent chance that fifth cousins will share a detectable amount of DNA. This means there is a ninety to sixty-eight percent chance two test-takers will not be listed as a match in the company database even though they really are fifth cousins. This is not an error, it is just a fact due to random recombination and inheritance of DNA with the matching thresholds applied by the companies. Seeing many more fourth and more distant cousins on a match list seems to contradict these sharing likelihood predictions. However, since most of us have many more fifth cousins than second cousins, we are likely to see many more matches who are fifth cousins.

[1] "Cousin Statistics," *ISOGG Wiki* (http://isogg.org/wiki/Cousin_statistics).

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Table 1. Likelihood of detectable amounts of shared DNA with a cousin (%)			
Relationship	23andMe[a]	AncestryDNA[b]	Family Tree DNA[c]
Closer than second cousin	100	100	>99
Second cousin	>99	100	>99
Third cousin	~90	98	>90
Fourth cousin	~45	71	>50
Fifth cousin	~15	32	>10
Sixth cousin or greater	<5	<11	<2

a. "The Probability of Detecting Different Types of Cousins," 23andMe, 23andMe Customer Care (https://customercare.23andme.com/hc/en-us/articles/202907230-The-probability-of-detecting-different-types-of-cousins).

b. "Should Other Family Members Get Tested?," AncestryDNA (http://dna.ancestry.com/); page available when logged in: access DNA matches page > click question mark in upper right > click article link .

c. "What is the Probability That My Relative and I Share Enough DNA for Family Finder to Detect?," Family Tree DNA, Family Tree DNA Learning Center BETA (https://www.familytreedna.com/learn/autosomal-ancestry/universal-dna-matching/probability-relative-share-enough-dna-family-finder-detect/).

Based on the information in table 1, it is not unusual for fourth cousins Ryan and Gina to share no detectable amount of DNA even if both have an accurate family tree naming Samuel and Mary Parker as their only common ancestral couple. It is also possible one or both trees are inaccurate. Gina shares DNA with Joyce and Bob. Joyce and Bob share DNA with Gina and Ryan. But so far, only the pedigree charts point to Samuel and Mary Parker as a possible couple from whom the shared DNA was inherited. It may be that Joyce is related to Ryan and Bob through common ancestors Samuel and Mary Parker, but Joyce is related to Gina through a yet-to-be-identified common ancestor. Gina may have a different common ancestor that links her to Bob than the ancestor that links her to Joyce. The data available lends itself to several interpretations. More data may lend more credence to a particular interpretation just as happens with documentary evidence.

Triangulation and targeted testing are two methods that should provide more evidence for the relationship question. A future column will cover triangulation. Targeting more test-takers known to be descendants of the focus ancestor or ancestral couple will provide more evidence both for the triangulation process and for analysis without triangulation.

Targeted Testing

Most researchers will need to be financially prudent when targeting relatives, especially if the relative cannot pay for the DNA test himself or herself. When trying to answer a question about a particular ancestral couple, we focus on their descendants. For example, when the genealogical question is focused on second-great-grandparents, test one or more cousins who share only this ancestral couple. A first cousin, one removed or a third cousin in the correct ancestral line both

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meet this criteria. A chart naming all known descendants of the focus couple will help locate test candidates. A deep and accurate family tree is important to determine whether there are other shared ancestors as this will affect the DNA analysis.

Testing living cousins in the generations closest to the focus couple will usually result in more shared DNA with a DNA match. The living cousin in the generation closest to the focus couple may not be the oldest living ancestor. Many families have women in several generations giving birth resulting in uncles and aunts younger than a nephew or niece. The aunt or uncle is a better atDNA test candidate than the niece or nephew. When locating potential DNA test-takers age is less important than number of generations from the focus couple.

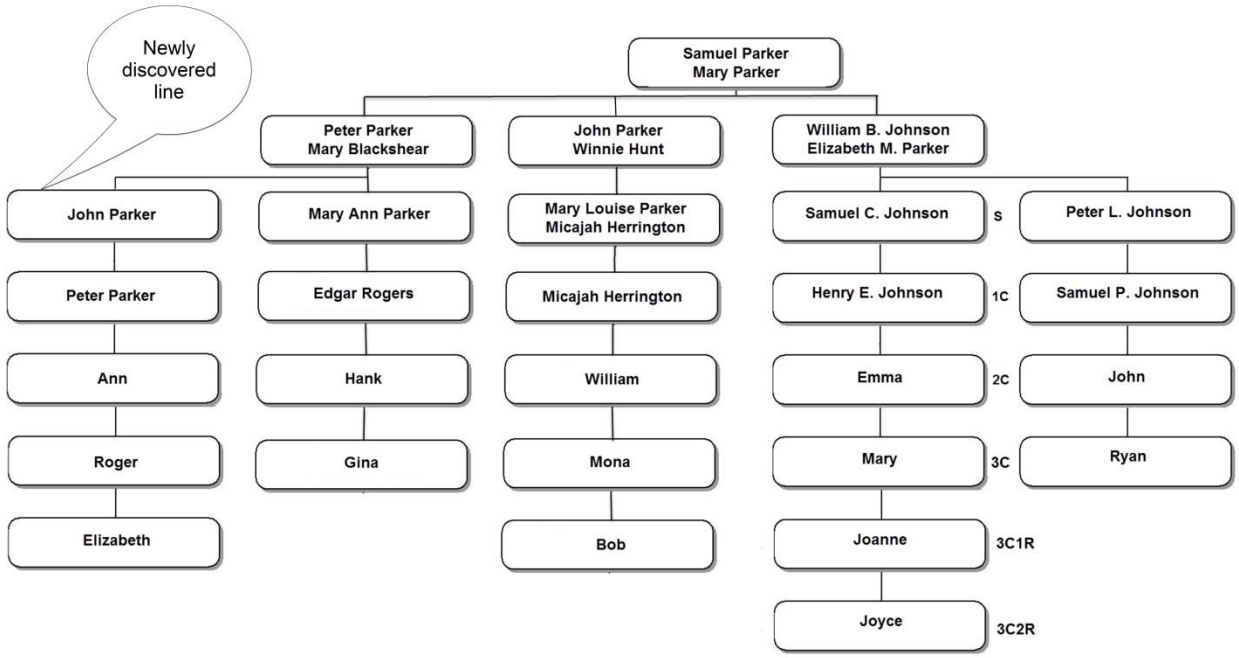

Figure 1.

As shown in figure 1, Samuel and Mary Parker are the focus couple. So far, we have seen results of four test-takers (Joyce, Ryan, Bob, and Gina) descended from three children of Samuel and Mary. To form a targeted test plan our first step might be to search for all living descendants of Samuel and Mary Parker. Each vertical line in the figure represents a point where other descendants might be found. In figure 1, the leftmost line is a newly discovered line found during our search.

Do Samuel and Mary have other children who have living descendants? Are there other living descendants from the three lines already documented, especially the lines of Peter and John Parker where only one descendant has tested so far? Are those living descendants willing to take a DNA test?

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More than one test-taker from each line of descent from a focus couple with living descendants will likely be more useful. Testing other descendants in the lines of John and Elizabeth Parker will be as useful as testing someone in the newly discovered line descended from Peter.

Where there are multiple living descendants, ideally the earliest in that direct line should be tested. For example, in the newly discovered line in figure 1, Ann, Roger, and Elizabeth are all living. Ann is likely to share more DNA with the other cousins in this tree. Roger and Elizabeth inherited their DNA from Ann so can share no more than Ann shares with the other cousins (unless there is a second common ancestor shared by the spouse of Ann or Roger that is not shown in this chart). If Ann is unwilling to test then Roger should be asked. Elizabeth would be the last choice of the three as she likely shares the least amount of DNA with the other descendants of Samuel and Mary Parker.

If no potential DNA test-takers in the descendants of Samuel and Mary are found, we might look for siblings of Samuel and Mary then trace their descendants. Each generation back in the tree reduces the likelihood of detectable amounts of DNA being shared by the living descendants. At some point the likelihood of no detectable amounts of shared DNA will outweigh the likelihood of useful evidence being found. This point will vary depending on the number of descendants, the random inheritance factors in this specific family, and the importance of the search to the person paying for the DNA tests.

Which relatives are still living and which are willing to take a DNA test will affect a targeted test plan. The total amount of shared DNA and the ICW status of each of these additional test-takers must be analyzed and correlated with the existing evidence.

The farther back it is to the focus ancestral couple the more test-takers will likely be needed to obtain an amount of shared DNA evidence that will be useful. First or second cousins will share more DNA than will fourth or fifth cousins who may not share any detectable amount of DNA.

Conclusion

Test-takers whose ancestral lines include pedigree collapse or endogamous populations—those where cousins married cousins—will have more trouble using this technique. Researchers must also consider the accuracy and depth of each test-taker's family tree. Unidentified or misidentified ancestors increase the likelihood the shared DNA did not come from the focus ancestor under study.

With documentary research, we expand our research to extended family, friends, associates, and neighbors (the FAN club principle made popular by Elizabeth Shown Mills). With genetic genealogy, biological cousins related through *only one* ancestral line can be targeted test-takers whose test results provide evidence to confirm a hypothesized link with a DNA match. Random recombination might have resulted in the target relative not sharing detectable amounts of DNA with a test-taker. Testing multiple targeted relatives in each ancestral line increases the odds of

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finding one who shares DNA with us and with a DNA match. The likely next step in analysis would be triangulation.

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