Finding our DNA Family

With

Family Tree DNA's Family Finder

SUMMARY VERSION

Part 1

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Parents and Children

In Family Finder children show they **share** 100% of their parent's DNA segments. Here is an example from the Family Finder chromosome map showing a child-to-parent match on chromosome 1,

Notice (except for the dark spots which represent the sections ignored) the whole diagram is colored red meaning there is a complete match. If the child were compared to both parents at the same time the map would look like this for chromosome 1,

This child, a daughter, completely matches her parents, the mother red and her father blue. Why is this? Because she, and all of us, has a pair of chromosomes, each set being homologous with each other (meaning they are the same in structure and function). There are two of them forming a pair. One of them is from her father and the other one is from her mother. We inherit our chromosomes from both parents and they form a pair of 23 chromosomes; there are actually 46 if counted separately.

One of the pair of chromosomes matches each parent, and in this case, one color matches each parent for the same reason.

When people expect parents to match their children by 50% they could visualize it as a side-by-side 50% like this….

… not a start to finish 50% like this diagram:

Remember either lineage could show up on the same chromosome map page because the test matches either half of the chromosomes to one parent or the other.

Family Finder is only looking at the DNA the child inherited, not the amount inherited plus the amount not inherited. As far as it's concerned the entire DNA is not a 100% of the parent's DNA, its 100% of one lineage, paternal or maternal and that's different.

It might be easier to see this if Family Finder had two chromosome maps, a maternal map and a paternal map like the following but it doesn't.

It can't because Family Finder (and similar type tests) cannot determine when it is reading maternal or paternal segments so it uses **one map to display either lineage**.

Whether we look at one page, or two pages, or two comparisons on the same page, one side is paternal and one side is maternal. A 100% match to each lineage (one side colored red or blue here) is the same as 50% of both lines.

Interestingly enough, although a child receives all of his or her DNA from the parents, it is only half of the parent's; **the other half is not inherited.**

This sometimes confuses a person because a 100% match is not equating to a 50% inherited amount. People expect to see the map showing a 50% match like the side-by-side half and half picture of page 2. **That's not the case. The map is not the amount inherited, it is the amount shared.** 100% is the amount **shared** which is 50% of the amount **inherited**. The parents have twice as much in other words. Every part the child has will match with something of the parents' DNA.

The reason Family Finder shows either parent, as a complete match is because Family Finder is a half by identical by descent test.

Half Identical by Descent Testing

To understand what half identical by descent (IBD) tests are, let's look at what they test for.

There are about 3 billion base pairs in our DNA and about 10 million Single Nucleotide Polymorphisms (SNPs) that can be found in them. SNPs are the places where differences such as hair color, eye color and many other things can be found. They are the places we can detect variations in the sequences of DNA.

Parents will pass down certain traits, genes, or variations if you will to their descendants. The SNPs of an ancestor can be found in the descendants. Family Finder works by finding shared SNP results.

Here is a list of two SNPs with the reference SNP id, chromosome, its position and its alleles listed:

Chr	RSid	Position	Son
22	rs5748756	15807664	**AC**
22	rs1981707	15809384	CT

Notice each SNP, like rs5748756 above, has two values or two alleles. The letters "**AC**" for example are the alleles for the first SNP listed above.

There are two alleles per SNP because we have a pair of chromosomes (paternal and maternal). The test does not know which allele is paternal and which is maternal**; it actually has no way of knowing.** Alleles are not listed in order of lineage either. The key is that there are two alleles not one.

In this case **one allele came from the son's father and one from the son's mother**, we don't know which one unless we look at the father and/or mother's SNPs as well and compare them.

Notice in the small example below that some alleles are inherited and some are not.

Chr	RSid	Mother	Father	Son	Uninherited
22	rs5748756	AA	AC	AC	AA
22	rs1981707	TT	CT	CT	TT
22	rs11914222	TT	TT	TT	TT
22	rs5994105	GG	GG	GG	GG
22	rs5748761	TT	CT	CT	TT
22	rs9618948	GG	GT	GT	GG

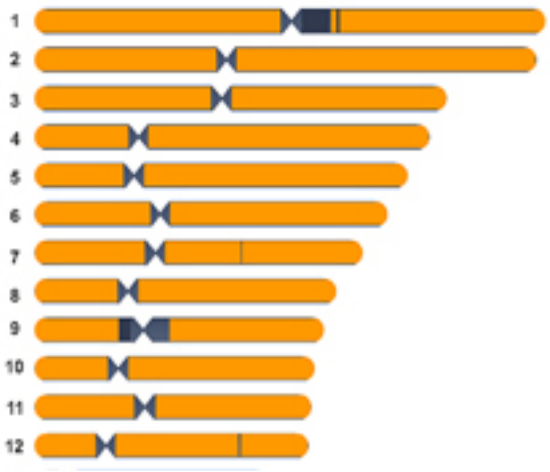
We see that at least one allele will match between father and child or mother and child.

The test is only looking for **one out of two** alleles to match; in fact that is why it is called a half identical by descent test. **Half of the alleles are identical because they descended from a common ancestor**. The other half of the alleles is from the other parent.

Half identical matching is when the father's "C" matched half of the son's "AC" and when the mother's "A" matched the other half of the son's "AC". Half of his "AC" alleles is identical to each parent therefore he matches his parents in a half identical by descent test.

Chr	RSid	Mother	Father	Son	Uninherited
22	rs5748756	AA	AC	AC	AA

Now consider many SNPs matching all in a line, as they would for a parent and child. If we were to color a map of shared segments orange every time a SNP matched between a father and son we could get a solid color across all of the chromosomes, like this:



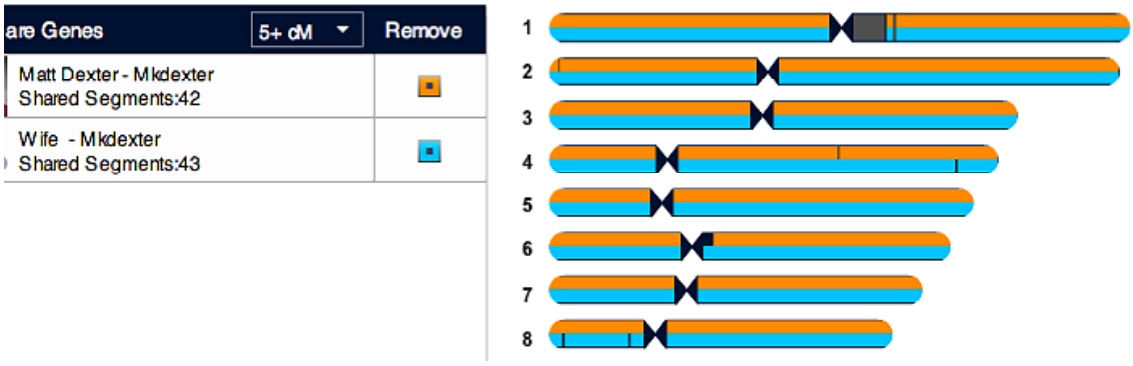
This map has a 100% complete match shown on it because the map counts every one out of two alleles as a match. This map is generated from a one half by descent test. 100% match does not mean 100% of this person's DNA is inherited from the other, it means 100% of at least one out two alleles matches one allele of the other person.

This is why we can see either parent as a full match, or both parents on the same map as complete matches even though only 50% of the DNA came from each. One allele in both tests match.

Here one allele from the father was inherited, that means the son inherited 50% of his father's two alleles (per SNP). This is also true as to how many the son inherited from his mother.

The test does not know which allele is from which parent, it only cares about the fact that at least one allele in each test matches. Comparing the alleles of the SNPs is how Family Finder finds half identical by descent matches. Here is an example of a daughter's match to her parents in Family Finder.

Name	Relationship Range	Suggested Relationship	Shared cM	Longest Block	Known Relationship	Ancestral Surnames (Bolded names match your surnames)
Matt Dexter - Mkdexter	Parent/Child	Parent/Child	3382.92	145.17	Father	Bailey Beckham Carter Copeland Deal
Wife - Mkdexter	Parent/Child	Parent/Child	3377.20	145.17	Mother	Bennett **Burgo** Davis Fletcher Franklin



The reason a child only inherits one allele from each parent is due to recombination of DNA.

Recombined Lineages

Let's look at the fact that two lineages in each parent must become one in the child, the father's two become the child's paternal and the mother's two become the child's maternal.

When the parent's two lineages (paternal and maternal) become one, they do so during a recombination of DNA. Recombination occurs when a gamete (egg or sperm cell) is formed. A parent's paternal and maternal chromosomes actually recombine (mix) and form a new combination (a mixture of the pair) in the gamete cell. Half of the DNA combinations in a child come from each gamete cell that produced it. Two gametes are the basis for the child's pair of chromosomes, one for each half of the pair.

For example, this daughter's father has a paternal purple and a maternal green chromosome 1.

In the daughter, the two were recombined to become the daughter's paternal chromosome 1.

For example, also this daughter's mother has a paternal blue and a maternal orange chromosome 1.

In the daughter, the two were recombined to become the daughter's maternal chromosome 1.

The daughter's new chromosome 1 pair will look like this when compared to her grandparents; her paternal on the top and her maternal below it:

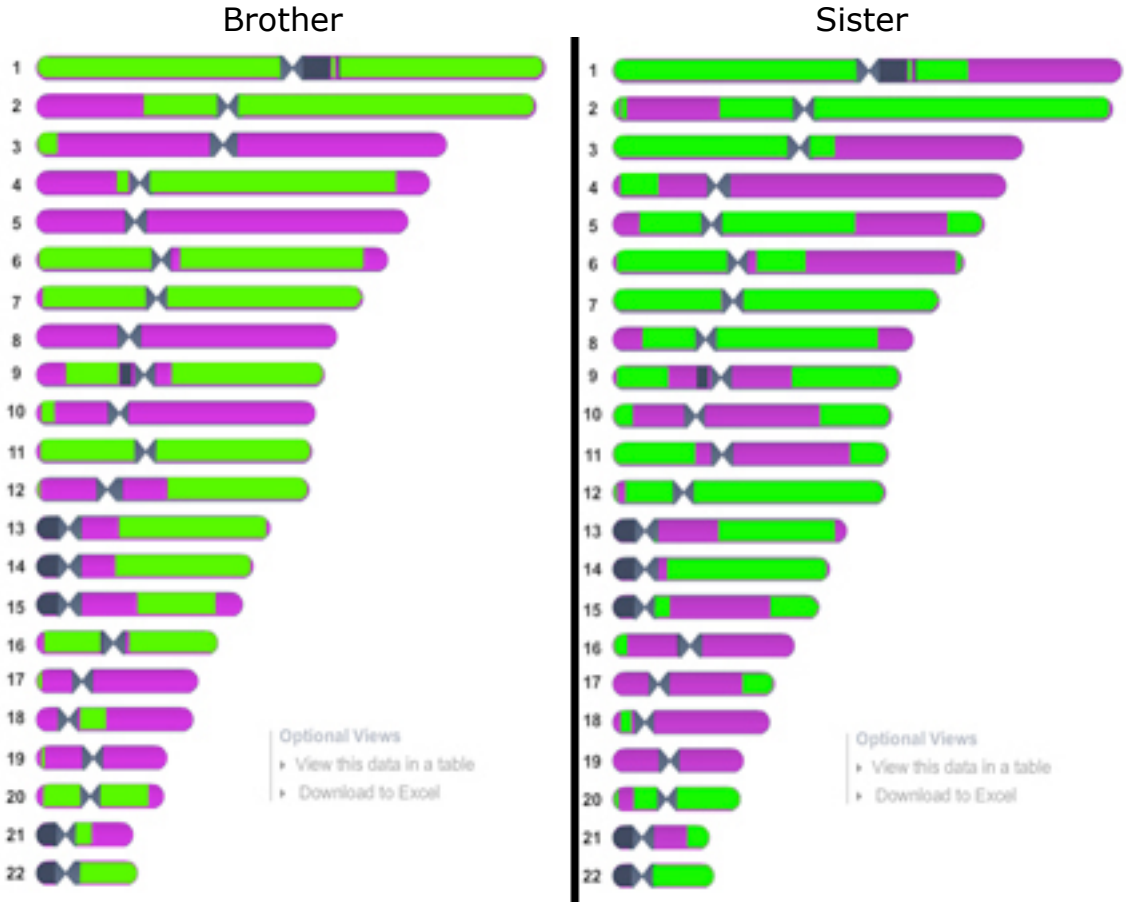
This daughter's chromosomes were made up from parts of each grandparent's DNA. Recombination took some and left some in the parents to form a new unique mixture in the child. Recombination is responsible for this unique ancestral mixture of her past.

Looking at the daughter's entire maternal and paternal map we would see the following:

Some segments were passed down almost intact like 14 blue, and 7 green. When entire segments are passed down they make it easier for persisting pieces to remain. More speculative matches will come from these types of segments because they didn't break anything up from the prior generation.

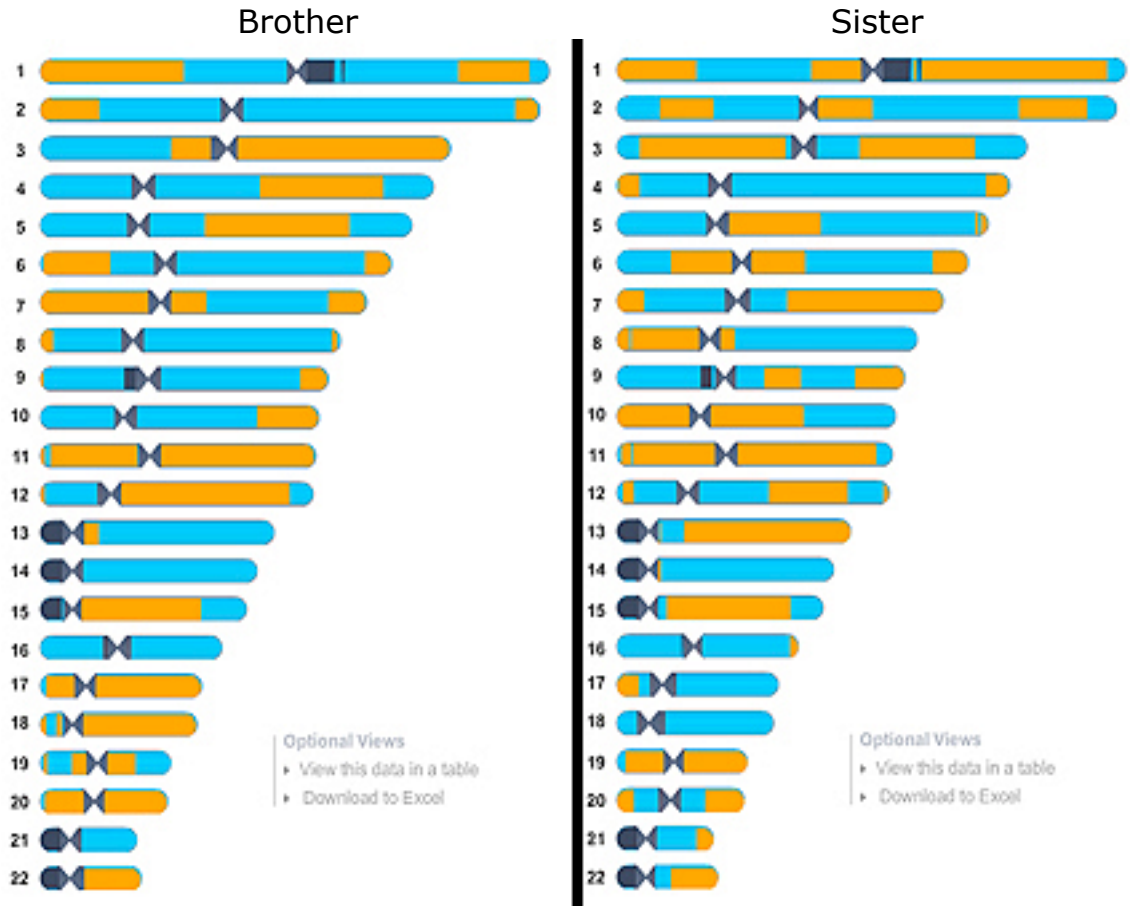
Variations of DNA Mixtures

People have different mixtures of their ancestry due to recombination. People with the same parents, even the same grandparents will have different DNA recombination mixtures. The following is an example using two siblings:



The purple is the paternal grandfather and the green is the paternal grandmother. The two children do not map to all of the same locations when compared to the same grandparents. Recombination is responsible for the difference between them; here the same parents but different unique mixtures

Here are the same brother and sister again, compared to their maternal grandp



The blue is the maternal grandfather and the orange is the maternal grandmother. Once again the children have unique maps on both lines, paternal and maternal.

Siblings differ in looks, hair color, eye color, etc., because their DNA has different combinations of their ancestors'. These differences are actually the reason they have differences in their Family Finder match lists too. Sometimes they will match the same cousins and sometimes they won't. All of these differences, making them unique, are a result of DNA recombination.

Siblings

Siblings form the basis of cousin matches. Siblings share some DNA in common from both lineages.

The sister compared to her grandparents, maternal and paternal:

The brother compared to his grandparents, maternal and paternal:

Notice the many differences between the segments in various positions; again DNA recombination. This is the reason siblings do not completely match each other's DNA; they have different combinations of their ancestors' DNA. The half each one inherited has a little different combination of the previous in it, in other words.

Now here is the map of the two siblings compared to each other, it is the map Family Finder reports when comparing these two siblings.

Doing some research we see that their sibling comparison came from the following composite (maternal/paternal) maps.

Some DNA segments they share and some they don't of both sides. The missing segments are ones they don't share. The ones they do share are the basis for all of the descendant cousin matches to follow.

