**A Guide to Understanding Your DNA Test**

A **chromosome** is a structure found in the nucleus of a cell that contains genetic material. Humans have 23 pairs of chromosomes, 22 pairs of autosomes and one pair of sex chromosomes. Chromosomes consist of long chains of protein molecules that are arranged in a very particular order. There are four different proteins molecules or nucleotides that make up the chromosome. The proteins include Adenine (A), Thymine (T), Guanine (G), and Cytosine (C).

**Nucleotides** are structural components of our genetic code. Each nucleotide is composed of a **nucleoside** (Adenosine, Cytidine, Guanosine, or 5′-Methyluridine) and a phosphate bond. A nucleotide forms a single unit of our DNA.

**DNA**, **D**eoxyribo**n**ucleic **a**cid, is the genetic code that makes each of us a unique individual. Humans inherit about one half of their genetic code from each of their parents. Our genetic code then holds the story of our heritage that has been passed down through the generations.

A **base** is a unit or building block of DNA. Adenine (A), cytosine (C), guanine, (G), and thymine (T) are the four primary bases in DNA. The order of bases is the sequence of DNA.

A **base pair** (bp) is two complementary nucleotides on opposite strands of DNA. Base pairs are measured using metric units.

* 1 base pair = 1 base pair (bp)
* 1,000 base pairs = 1 kilo-base (kb)
* 1,000,000 base pairs = 1 mega base (Mb)

**Autosomal DNA** is DNA from one of our chromosomes located in the [cell nucleus](http://www.familytreedna.com/faq/answers.aspx?id=21#753). It generally excludes the [sex chromosomes](http://www.familytreedna.com/faq/answers.aspx?id=21#780). Humans have 22 pairs of autosomal chromosomes and one pair of sex chromosomes, for a total of 23 pairs of chromosomes.

One of the two **sex chromosomes**, X and Y. The Y-Chromosome passes down from father to son. Females do not receive it. As the Y-Chromosome is passed on through the paternal line, it is valuable for surname based genealogy studies.

A **locus** is a specific location in your genetic code. In a genetic map of our DNA, the locus tells us where to find any base. Each locus is named sequentially so that on chromosome 15 locus 26039212 comes after locus 26039211. The plural of locus is loci.

An **allele** is a genetic variant at a specific point, locus, in our genetic code.

A **marker** is a physical location (locus) on the chromosome. The term is often used colloquially in genetic genealogy to refer to a short tandem repeat (STR). For example, “The Y-DNA67 test is a panel of 67 markers.”

**Short Tandem Repeat (STR)** - A short DNA motif (pattern) repeated in tandem. ATGC repeated eleven times would give the marker a value or allele of 11.

**Single Nucleotide Polymorphism (SNP)** - A SNP, Single Nucleotide Polymorphism, is a change in your DNA code at a specific point.

A **haplotype** is the set of values for a set of DNA values. For example, the result of the Y-DNA12 test for one person is their haplotype. Two individuals that match exactly on all markers have the same haplotype.

A **haplogroup** is a major branch on either the maternal or paternal tree of humankind. Haplogroups are associated with early human migrations. Today these can associated with a geographic region or regions.

A **clade** is a group of related individuals.

A **subclade** is a minor branch of the human genetic trees. This may be either the Y-Chromosome tree or the mitochondrial tree. Subclades are more specific to a location or population group than the major branches (haplogroups).

There are two meanings of **Genetic Distance**.

1. Genetic Distance is the number of differences, or mutations, between two  
   sets of results. A genetic distance of zero means there are no differences in  
   the results being compared against one another, i.e., an exact match. This is  
   the meaning when comparing Y-Chromosome DNA or mitochondrial DNA.
2. For autosomal DNA comparisons, genetic distance may refer to the size of a  
   DNA segment. The genetic distance is then the length of the segment in  
   centiMorgans.

An **exact match** is when two people have exactly the same results for all markers or regions compared.

**What does each short tandem repeat (STR) marker mean?**

By themselves, Y-Chromosome DNA (Y-DNA) short tandem repeat (STR) markers from a Y-DNA test do not have any particular meaning. The value of testing Y-DNA STR markers comes from creating a Y-DNA signature (haplotype) with them and comparing that Y-DNA signature to others in a database. They are useful for genetic genealogy because your Y-DNA signature distinguishes your paternal lineage from others. They can then be used with Family Tree DNA’s comparative database to discover genealogical connections or historic ancestry.

**Y-DNA Genetic Distance**

When talking about two or more Y-Chromosome STR (short tandem repeat) haplotypes, genetic distance is the total number of differences, or mutations, between two sets of results. In general, it is found by summing the differences between each STR marker.

For example, kit B291 and B125 have allele values of 29 and 28 respectively at DYS389-2. This is a difference of 1 {29-28= 1}. Because this is the only difference in their Y-DNA12 profiles (haplotypes) their genetic distance is 1.

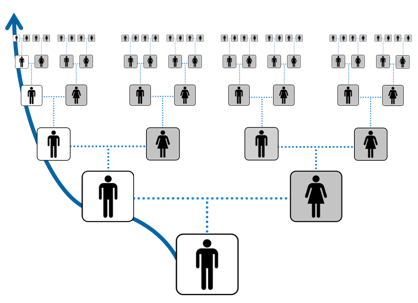
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example: Genetic Distance = 1** | | | | | | | | | | | | | |
| Kit | Surname | Hg | D Y S 3 9 3 | D Y S 3 9 0 | D Y S 1 9 | D Y S 3 9 1 | D Y S 3 8 5 | D Y S 4 2 6 | D Y S 3 8 8 | D Y S 4 3 9 | D Y S 3 8 9 | 1 | D Y S 3 9 2 | D Y S 3 8 9 | 2 |
| B291 | Didmoe | L | 12 | 23 | 14 | 10 | 17-18 | 11 | 12 | 11 | 12 | 14 | 29 |
| B125 | Didmoe | L | 12 | 23 | 14 | 10 | 17-18 | 11 | 12 | 11 | 12 | 14 | **28** |
| B322 | Ditmee | L | 12 | 22 | 13 | 10 | 17-18 | 11 | 12 | 10 | 12 | 14 | 29 |

In this example, kits B291 and B322 have differences at DYS390, DYS19, and DYS439. The difference for each is calculated {DYS390: 23-22= 1, DYS19: 14-13= 1, DYS439: 11-10= 1}. The differences are added together. The total number of differences the Y-DNA12 haplotypes is 3 {1+1+1= 3 }. Their genetic distance at 12 STR markers is then 3.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example: Genetic Distance = 3** | | | | | | | | | | | | | |
| Kit | Surname | Hg | D Y S 3 9 3 | D Y S 3 9 0 | D Y S 1 9 | D Y S 3 9 1 | D Y S 3 8 5 | D Y S 4 2 6 | D Y S 3 8 8 | D Y S 4 3 9 | D Y S 3 8 9 | 1 | D Y S 3 9 2 | D Y S 3 8 9 | 2 |
| B291 | Didmoe | L | 12 | **23** | **14** | 10 | 17-18 | 11 | 12 | **11** | 12 | 14 | 29 |
| B125 | Didmoe | L | 12 | 23 | 14 | 10 | 17-18 | 11 | 12 | 11 | 12 | 14 | 28 |
| B322 | Ditmee | L | 12 | **22** | **13** | 10 | 17-18 | 11 | 12 | **10** | 12 | 14 | 29 |

**Paternal Lineages**

Your direct paternal lineage is the line that follows your father’s paternal ancestry. This line consists entirely of men.



Y-DNA follows the direct paternal line.

Your Y-Chromosome DNA (Y-DNA) can trace your father, his father, his father’s father, and so forth. It offers a clear path from you to a known, or likely, direct paternal ancestor.

DNA Matching for Family History  
  
Your Y-DNA may help you find genetic cousins along your direct paternal line. Planned comparisons are the best choice. To set up a planned comparison, select two men who you believe share a direct paternal ancestor. Have both men take a Y-DNA test. If they match exactly or closely, then the DNA evidence supports the relationship. If they do not match, the result is evidence refuting the relationship. When you discover a match outside of a planned comparison, you can still find your common ancestor with matches. To do so, use your known paternal genealogy. For each match, look first for a shared surname if you come from a culture where surnames have followed paternal lines. Then look for common geographic locations on the direct paternal line. Work through each of your ancestors on this line as well as their sons, their sons’ sons, and so forth. Comparing genealogy records is vital when using Y-DNA matching to help you in your research. You need to enter all that you know about your direct paternal line in your myFTDNA account.

The Science of Your Direct Paternal Line  
  
Your Y-Chromosome is a sex chromosome. Sex chromosomes carry the genetic code that makes each of us male or female. All people inherit two sex chromosomes. One comes from their mother and the other from their father. You and other men receive a Y-Chromosome from your father and an X-Chromosome from your mother. Men and only men inherit their father’s Y-Chromosome. Thus, it follows the same path of inheritance as your direct paternal line. Paternal line DNA testing uses STR markers. STR markers are places where your genetic code has a variable number of repeated parts. STR marker values change slowly from one generation to the next. Testing multiple markers gives us distinctive result sets. These sets form signatures for a paternal lineage. We compare your set of results to those of other men in our database. The range of possible generations before you share a common ancestor with a match depends on the level of test you take. A match may be recent, but it may also be hundreds of years in the past.

Probability that your common ancestor lived no longer than this number of generations ago.

The wide range in the test results does not prevent those results from being useful. You can use this clear paternal line to provide evidence to support a relationship. You first trace two or more male lineage descendants of a single man utilizing traditional genealogy research. The descendants then test their Y-DNA. If they match, it is evidence that supports the relationship. Not matching exactly or closely disproves the relationship. We report your STR marker results as the measured number of repeats for each marker. In the example below, the marker DYS393 has 12 repeats.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Marker** | DYS393 | DYS39 | DYS19 | DYS391 | DYS385 | DYS426 |
| **Value** | 12 | 23 | 12 | 10 | 16–16 | 11 |

Over many generations, the number of repeats in each STR marker changes. The number of repeats may go up or down. These changes create the signatures for individual lines. This process is random. It is not possible to predict that any one marker will change between any set of generations. We do know though how often on average these random changes happen. Thus, we can estimate how closely related two men are by using the similarity of their results.

**Expected Relationships with Y-DNA STR Matches**

The expected relationship between you and your Y-Chromosome DNA (Y-DNA) match is dependent on both the number of markers you have tested and the genetic distance. The chart below shows the interpretation of your relationship at each testing level (Y-DNA12, Y-DNA37, etc.) for relevant genetic distances.

For example, if you and your match have both tested at the Y-DNA37 level and are a 36/37 match this is a genetic distance of one. You are then considered tightly related.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Y-DNA12** | **Y-DNA25** | **Y-DNA37** | **Y-DNA67** | **Y-DNA111** | **Interpretation** |
| **Very Tightly Related** | N/A | N/A | 0 | 0 | 0 | Your exact match means your relatedness is extremely close. Few people achieve this close level of a match. All confidence levels are well within the time frame that surnames were adopted in Western Europe. |
| **Tightly Related** | N/A | N/A | 1 | 1-2 | 1-2 | Few people achieve this close level of a match. All confidence levels are well within the time frame that surnames were adopted in Western Europe. |
| **Related** | 0 | 0-1 | 2-3 | 3-4 | 3-5 | Your degree of matching is within the range of most well-established surname lineages in Western Europe. If you have tested with the Y-DNA12 or Y-DNA25 test, you should consider upgrading to additional STR markers. Doing so will improve your time to common ancestor calculations. |
| **Probably Related** | 1 | 2 | 4 | 5-6 | 6-7 | Without additional evidence, it is unlikely that you share a common ancestor in recent genealogical times (1 to 6 generations). You may have a connection in more distant genealogical times (less than 15 generations). If you have traditional genealogy records that indicate a relationship, then by testing additional individuals you will either prove or disprove the connection. |
| **Only Possibly Related** | 2 | 3 | 5 | 7 | 8-10 | It is unlikely that you share a common ancestor in genealogical times (1 to 15 generations). Should you have traditional genealogy records that indicate a relationship, then by testing additional individuals you will either prove or disprove the connection. A careful review of your genealogical records is also recommended. |
| **Not Related** | 3 | 4 | 6 | >7 | >10 | You are not related on your Y-Chromosome lineage within recent or distant genealogical times (1 to 15 generations). |

**If somebody doesn’t match me at 12 markers, how can they match me at a higher testing level?**

Aside from their having matching turned off at the Y-DNA12 level, someone might match you at a higher testing level but not Y-DNA12 because the genetic distance is more than the amount allowed for Y-DNA12 but not the higher level.

For example, kit B193 has mismatches with kit B175 at DYS393 and DYS385. Each mismatch has a genetic distance of one for a total genetic distance of two. This is more than the amount allowed for a Y-DNA12 match. However, they do not have additional mismatches on the Y-DNA13-25 panel. Therefore, the genetic distance for their Y-DNA25 match is also two. As a genetic distance of two is within the limit for Y-DNA25 matching, they will show as matches in that category.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example: Genetic Distance of Two** | | | | | | | | | | | | | | | | | | | | | | |
| Kit | Surname | Hg | D Y S 3 9 3 | D Y S 3 9 0 | D Y S 1 9 | D Y S 3 9 1 | D Y S 3 8 5 | D Y S 4 2 6 | D Y S 3 8 8 | D Y S 4 3 9 | D Y S 3 8 9 | 1 | D Y S 3 9 2 | D Y S 3 8 9 | 2 | D Y S 4 5 8 | D Y S 4 5 9 | D Y S 4 5 5 | D Y S 4 5 4 | D Y S 4 4 7 | D Y S 4 3 7 | D Y S 4 4 8 | D Y S 4 4 9 | D Y S 4 6 4 |
| **B193** | Sypline | I-M170 | **12** | 24 | 14 | 10 | **14–14** | 11 | 14 | 11 | 12 | 11 | 28 | 17 | 9-10 | 11 | 11 | 25 | 14 | 19 | 30 | 14-15-15-16 |
| **B175** | Sypline | I-M170 | **13** | 24 | 14 | 10 | **14–15** | 11 | 14 | 11 | 12 | 11 | 28 | 17 | 9-10 | 11 | 11 | 25 | 14 | 19 | 30 | 14-15-15-16 |
| B132 | Sypline | I-M170 | 13 | 24 | 14 | 8 | 14–14 | 11 | 14 | 11 | 12 | 11 | 28 | 17 | 9-10 | 11 | 11 | 25 | 14 | 19 | 30 | 14-15-15-16 |

**If two men share a surname, how should the genetic distance at 37 Y-Chromosome STR markers be interpreted?**

In cultures where surnames are passed from father to son, there is additional evidence beyond a DNA match that two men who share a surname are related. Y-Chromosome DNA (Y-DNA) test results should be interpreted based on both this information and the actual results.

|  |  |  |
| --- | --- | --- |
| **Genetic Distance** | **Relationship** | **Interpretation** |
| 0 | Very Tightly Related | A 37/37 match between two men who share a common surname (or variant) means they share a common male ancestor. Their relatedness is extremely close with the common ancestor predicted, 50% of the time, in 5 generations or less and over a 95% probability within 8 generations. Very few people achieve this close level of a match.  All confidence levels are well within the time frame that surnames were adopted in Western Europe. |
| 1 | Tightly Related | A 36/37 match between two men who share a common surname (or variant) indicates a close genealogical match. Very few people achieve this close level of a match, and it is within the range of most well-established surname lineages in Western Europe.  It’s most likely that they matched 24/25 or 25/25 on a previous Y-DNA test, and the mismatch will be found within DYS576, DYS570, or CDY. |
| 2 | Related | A 35/37 match between two men who share a common surname (or variant) means they share a common male ancestor. The mismatch is likely within the range of most well-established surname lineages in Western Europe.  It is most likely that you matched exactly or closely on previous Y-DNA tests and the mismatch is within DYS439 or DYS385, DYS389i, 389ii, DYS458, DYS459, DYS449, DYS464, DYS576, DYS570, or CDY. |
| 3 | Related | A 34/37 match between two men who share a common surname (or variant) means they share a common male ancestor. The relationship is likely within the range of most well-established surname lineages in Western Europe.  It is most likely that they matched exactly or closely on previous Y-DNA tests, and the mismatch is within DYS439 or DYS385, DYS389i, 389ii, DYS458, DYS459, DYS449, DYS464, DYS576, DYS570, or CDY. |
| 4 | Probably Related | A 33/37 match between two men who share a common surname (or variant) means they may share a common male ancestor. This relationship should be confirmed with additional testing.  The only way to confirm the relationship is to test additional family lines and to find where the mutations took place. By testing additional family lines you can find the person in between. This ‘in betweener’ is essential for you to find. |
| 5 | Possibly Related | A 32/37 match between two men who share a common surname (or variant) means that they may be related within the genealogical time frame, but additional evidence is needed to confirm the relationship.  If several or many generations have passed since the suspected common ancestor, it is possible that these two men are related. That would require that each line had experienced separate mutations and line would have experienced at least two mutations. The only way to confirm is to test additional family lines and find where the mutations took place. By testing additional family members you can find the person in between each of you. This ‘in betweener’ becomes essential for you to find, and without him the possibility of a match exists, but further evidence must be pursued. |
| 6 | Not Related | A 31/37 match between two men who share a common surname (or variant) means that they are not likely to be related within the genealogical time frame. The common surname is a coincidence.  If there is a strong family tradition of a relationship, it is distantly possible that these two men are related. That would require that each line had experienced separate mutations and line would have experienced at least two mutations. The only way to confirm the relationship is to test additional family lines and find where the mutation took place. By testing additional family members you can find the person in between the two men. This ‘in betweener’ becomes essential for you to find, and without him a genealogical relationship is unlikely. |
| >6 | Not Related | The two men are totally unrelated within the genealogical time frame on their direct paternal line. Their shared ancestry is deeply anthropological and dates to the common African heritage of the human race. |

**Y-DNA Step-mutations**

When comparing the results of Y-Chromosome STR (short tandem repeat) tests, the difference between the two values at a marker is the Y-DNA genetic distance or the step-mutation count. That is, a one-step mutation means that the count for a single STR has changed by one. A two-step mutation means that the count for a single STR has changed by two.For example, when comparing kit B193 and kit B173, the STR marker DYS393 has changed from 13 to 12. The difference between 13 and 12 is 1 {13-12= 1.}. This is considered a single or one-step mutation.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example: One-Step Mutation** | | | | | | | | | | | | | | |
| Kit | Surname | Hg | D Y S 3 9 3 | D Y S 3 9 0 | D Y S 1 9 | D Y S 3 9 1 | D Y S 3 8 5 a | D Y S 3 8 5 b | D Y S 4 2 6 | D Y S 3 8 8 | D Y S 4 3 9 | D Y S 3 8 9 | 1 | D Y S 3 9 2 | D Y S 3 8 9 | 2 |
| **B193** | Sypline | I1 | **12** | 24 | 14 | 10 | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |
| **B173** | Sypline | I1 | **13** | 24 | 14 | 10 | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |
| B132 | Sypline | I1 | 13 | 24 | 14 | 8 | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |

In this example, kit B193 has a DYS391 value of 10 and kit B132’s value is 8. The difference between 10 and 8 is 2 {10-8= 2.}. This is then considered a two-step mutation.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Example: Two-Step Mutation** | | | | | | | | | | | | | | |
| Kit | Surname | Hg | D Y S 3 9 3 | D Y S 3 9 0 | D Y S 1 9 | D Y S 3 9 1 | D Y S 3 8 5 a | D Y S 3 8 5 b | D Y S 4 2 6 | D Y S 3 8 8 | D Y S 4 3 9 | D Y S 3 8 9 | 1 | D Y S 3 9 2 | D Y S 3 8 9 | 2 |
| **B193** | Sypline | I1 | 12 | 24 | 14 | **10** | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |
| B173 | Sypline | I1 | 13 | 24 | 14 | 10 | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |
| **B132** | Sypline | I1 | 13 | 24 | 14 | **8** | 14 | 14 | 11 | 14 | 11 | 12 | 11 | 28 |

**If two men share a surname, how should the genetic distance at 67 Y-Chromosome STR markers be interpreted?**

In cultures where surnames are passed from father to son, there is additional evidence beyond a DNA match that two men who share a surname are related. Y-Chromosome DNA (Y-DNA) test results should be interpreted based on both this information and the actual results.

|  |  |  |
| --- | --- | --- |
| **Genetic Distance** | **Relationship** | **Interpretation** |
| 0 | Very Tightly Related | A 67/67 match between two men who share a common surname (or variant) means they share a common male ancestor within the genealogical time frame. Their relatedness is extremely close.  All confidence levels are well within the time frame that surnames were adopted in Western Europe with the common ancestor predicted, 50% of the time, in 3 generations or less and with a 90% probability within 5 generations. Very few people achieve this close level of a match. |
| 1 or 2 | Tightly Related | A 65/67 or 66/67 match between two men who share the same surname (or a variant) indicates a close relationship.  It is most likely that they matched 36/37 or 37/37 on a previous Y-DNA test. Very few people achieve this close level of a match. All confidence levels are well within the time frame that surnames were adopted in Western Europe. |
| 3 or 4 | Related | A 63/67 or 64/67 match between two men who share the same surname (or a variant) means that they are likely to share a common ancestor within the genealogical time frame. The common ancestor is probably not extremely recent, but is likely within the range of most well-established surname lineages in Western Europe.  It is most likely that they matched 24/25, 36/37 or 37/37 on previous Y-DNA tests and mismatches are within DYS458, DYS459, DYS449, DYS464, DYS576, DYS570, and CDY. |
| 5 or 6 | Related | A 61/67 or 62/67 match between two men who share the same surname (or a variant) means that they may to share a common ancestor within the genealogical time frame. The common ancestor is probably not recent, but may still be within the range of most well-established surname lineages in Western Europe.  It is most likely that they matched 24/25, 36/37 or 37/37 on previous Y-DNA tests. Mismatches are within DYS458, DYS459, DYS449, DYS464, DYS576, DYS570, and CDY. |
| 7 | Probably Related | A 60/67 match between two men who share the same surname (or a variant) means that they may share a common ancestor within the genealogical time frame.  Because of the volatility within some of the markers this is about the same as being 11/12 and it is most likely that they matched 23/25 or 24/25 or 33-34/37 on previous Y-DNA tests. If they test additional individuals they will most likely find that their DNA falls in-between the persons who are 7 apart demonstrating relatedness within this family cluster or haplotype.  If several or many generations have passed, it is likely that these two lines are related through distant family lines. The only way to confirm the relationship is to test additional family lines and to find where the mutations took place. By testing additional family members you can find the person in between them. This ‘in betweener’ is essential, and without him the possibility of a match exists, but cannot be confirmed. |
| 8 or 9 | Only Possibly Related | A 58/67 or 59/67 match between two men who share the same surname (or a variant) means it is possible but unlikely that they share a common ancestor within the genealogical time frame. If you test additional individuals you may find the person whose DNA results falls in-between the persons that are 8 or 9 apart demonstrating relatedness within this family cluster or haplotype.  It is most likely that they did not match 24-25/25 or 35-37/37 in previous Y-DNA tests.  If several or many generations have passed, it is possible that they are related through other family members. The only way to confirm or deny the relationship is to test additional family lines and find where the mutation took place. By testing additional family members, you may find the person in between. This ‘in betweener’ is essential. Without him only the distant possibility of a match exists. |
| 10 or 11 | Not Related | A 56/67 or 57/67 match between two people means they are not related within the genealogical time frame. The odds greatly favor that the two men have not shared a common male ancestor within thousands of years. |
| >11 | Not Related | The two men are totally unrelated within the genealogical time frame on their direct paternal line. Their shared ancestry is deeply anthropological and dates to the common African heritage of the human race. |

**If two men share a surname, how should the genetic distance at 111 Y-Chromosome STR markers be interpreted?**

In cultures where surnames are passed from father to son, there is additional evidence beyond a DNA match that two men who share a surname are related. Y-Chromosome DNA (Y-DNA) test results should be interpreted based on both this information and the actual results.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Genetic Distance** | **Relationship** | **Interpretation** | **Related in This Number of Generations or LESS** | | | |
| **Confidence** | | | |
| **50%** | **90%** | **95%** | **99%** |
| 0 | Very Tightly Related | A 111/111 match indicates a very close or immediate relationship. Most exact matches are 3rd cousins or closer, and over half are related within two generations (1st cousins). | 2 | 4 | 5 | 6 |
| 1 | Tightly Related | A 110/111 match indicates a close relationship. Most one-off matches are 5th or more recent cousins, and over half are 2nd cousins or closer. | 3 | 6 | 7 | 9 |
| 2 | Tightly Related | A 109/111 match indicates a close relationship. Most matches are 7th cousins or closer, and over half are 4th or more recent cousins. | 5 | 8 | 9 | 11 |
| 3 | Related | A 108/111 match indicates a genealogical relationship. Most matches at this level are related as 9th cousins or closer, and over half will be 5th or more recent cousins. This is well within the range of traditional genealogy. | 6 | 10 | 11 | 14 |
| 4 | Related | A 107/111 match indicates a genealogical relationship. Most matches at this level are related as 10th or more recent cousins, and over half will be 6th or more recent cousins. This is well within the range of traditional genealogy. | 7 | 11 | 13 | 16 |
| 5 | Related | A 106/111 match indicates a genealogical relationship. Most matches at this level are related as 12th cousins or more recently, and over half will be 7th cousins or closer. This is well within the range of traditional genealogy. | 8 | 13 | 15 | 18 |
| 6 | Probably Related | A 105/111 match indicates a more distant genealogical relationship. Over half of matches will be 9th cousins or closer, and most matches at this level are related as or more recently than 14th cousins.If there is a tradition of a recent genealogical relationship, the best way to confirm it is to test additional family lines. By testing additional family lines you can find the person in between who is a closer match to each of the others tested.This ‘in betweener’ is essential for you to find as their match proves the connection between the more distant matches. | 10 | 15 | 17 | 20 |
| 7 | Probably Related | A 104/111 match indicates a more distant genealogical relationship. Over half of matches at this level are related as 10th cousins or closer. Most matches at this level are related as 16th cousins or more recently.If there is a tradition of a recent genealogical relationship, the best way to confirm it is to test additional family lines. By testing additional family lines you can find the person in between who is a closer match to each of the others tested. This ‘in betweener’ is essential for you to find as their match proves the connection between the more distant matches. | 11 | 17 | 19 | 22 |
| 8 | Only Possibly Related | A 103/111 match indicates a distant cousinship with only a chance of a genealogical relationship. Over half of matches at this level are related as 12th cousins or more recently. Most matches at this level are related as 18th cousins or more recently. The connections here can be highly informative for relationships with historic groups and events.If there is a tradition of a recent genealogical relationship, the best way to confirm it is to test additional family lines. By testing additional family lines you can find the person in between who is a closer match to each of the others tested. This ‘in betweener’ is essential for you to find as their match proves the connection between the more distant matches. | 13 | 19 | 21 | 24 |
| 9 | Only Possibly Related | A 102/111 match indicates a distant cousinship with a chance of a genealogical relationship. Over half of matches at this level are related as 13th cousins or closer. Most matches at this level are related as or more recently than 20th cousins. The connections here can be highly informative for relationships with historic groups and events.If there is a tradition of a recent genealogical relationship, the best way to confirm it is to test additional family lines. By testing additional family lines you can find the person in between who is a closer match to each of the others tested. This ‘in betweener’ is essential for you to find as their match proves the connection between the more distant matches. | 14 | 21 | 23 | 27 |
| 10 | Only Possibly Related | A 101/111 match indicates a distant cousinship with some chance of a distant genealogical relationship. Over half of matches at this level are related as 15th cousins or closer. Most matches at this level are related as 22nd cousins or more recently. The connections here can be highly informative for relationships with historic groups and events.If there is a tradition of a recent genealogical relationship, the best way to confirm it is to test additional family lines. By testing additional family lines, you can find the person in between who is a closer match to each of the others tested. This ‘in betweener’ is essential for you to find as their match proves the connection between the more distant matches. | 16 | 23 | 25 | 29 |
| >10 | Not Related | The two men are totally unrelated within the genealogical time-frame on their direct paternal line. Their shared ancestry is historical or anthropological. | - | - | - | - |

Now that you are well versed in Y-DNA, here is a homework problem to practice on with actual results of two individuals 37 Marker Y-DNA test results:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **First Individual** |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 1 (1-12) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS393** | **DYS390** | **DYS19\*\*** | **DYS391** | **DYS385a** | **DYS385b** | **DYS426** | **DYS388** | **DYS439** | **DYS389I** | **DYS392** | **DYS389II\*\*\*** |  |
| Value | 13 | 25 | 14 | 11 | 11 | 14 | 12 | 12 | 12 | 13 | 14 | 29 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 2 (13-25) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS458** | **DYS459a** | **DYS459b** | **DYS455** | **DYS454** | **DYS447** | **DYS437** | **DYS448** | **DYS449** | **DYS464a** | **DYS464b** | **DYS464c** | **DYS464d** |
| Value | 17 | 9 | 10 | 11 | 11 | 26 | 15 | 18 | 30 | 15 | 16 | 16 | 17 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 3 (26-37) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS460** | **Y-GATA-H4** | **YCAIIa** | **YCAIIb** | **DYS456** | **DYS607** | **DYS576** | **DYS570** | **CDYa** | **CDYb** | **DYS442** | **DYS438** |  |
| Value | 12 | 11 | 19 | 23 | 17 | 15 | 18 | 17 | 39 | 39 | 11 | 12 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Second Individual** |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 1 (1-12) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS393** | **DYS390** | **DYS19\*\*** | **DYS391** | **DYS385a** | **DYS385b** | **DYS426** | **DYS388** | **DYS439** | **DYS389I** | **DYS392** | **DYS389II\*\*\*** |  |
| Value | 13 | 25 | 14 | 10 | 11 | 16 | 12 | 12 | 12 | 13 | 14 | 29 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 2 (13-25) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS458** | **DYS459a** | **DYS459b** | **DYS455** | **DYS454** | **DYS447** | **DYS437** | **DYS448** | **DYS449** | **DYS464a** | **DYS464b** | **DYS464c** | **DYS464d** |
| Value | 17 | 9 | 9 | 11 | 11 | 25 | 15 | 19 | 29 | 14 | 15 | 17 | 17 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panel 3 (26-37) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Marker | **DYS460** | **Y-GATA-H4** | **YCAIIa** | **YCAIIb** | **DYS456** | **DYS607** | **DYS576** | **DYS570** | **CDYa** | **CDYb** | **DYS442** | **DYS438** |  |
| Value | 11 | 11 | 19 | 24 | 16 | 15 | 18 | 18 | 39 | 40 | 12 | 12 |  |

What is the genetic distance between these two individuals?

How closely are they related?

ANSWER:

First Individual Second Individual

|  |  |  |
| --- | --- | --- |
| Locus | DYS# | Alleles |
|  | | |
| 1 | 393 | 13 13 |
| 2 | 390 | 25 25 |
| 3 | 19**\*** | 14 14 |
| 4 | 391 | 11 10 |
| 5 | 385a | 11 11 |
| 6 | 385b | 14 16 |
| 7 | 426 | 12 12 |
| 8 | 388 | 12 12 |
| 9 | 439 | 12 12 |
| 10 | 389-1 | 13 13 |
| 11 | 392 | 14 14 |
| 12 | 389-2 | 29 29 |
| 13 | 458 | 17 17 |
| 14 | 459a | 9 9 |
| 15 | 459b | 10 9 |
| 16 | 455 | 11 11 |
| 17 | 454 | 11 11 |
| 18 | 447 | 26 25 |
| 19 | 437 | 15 15 |
| 20 | 448 | 18 19 |
| 21 | 449 | 30 29 |
| 22 | 464a**\*\*** | 15 14 |
| 23 | 464b**\*\*** | 16 15 |
| 24 | 464c**\*\*** | 16 17 |
| 25 | 464d**\*\*** | 17 17 |
| 26 | 460 | 12 11 |
| 27 | GATA H4 | 11 11 |
| 28 | YCA II a | 19 19 |
| 29 | YCA II b | 23 24 |
| 30 | 456 | 17 16 |
| 31 | 607 | 15 15 |
| 32 | 576 | 18 18 |
| 33 | 570 | 17 18 |
| 34 | CDY a | 39 39 |
| 35 | CDY b | 39 40 |
| 36 | 442 | 11 12 |
| 37 | 438 | 12 12 |

One step between 11-10

Two steps between 14-16

One step between 10-9

One step between 26-25

One step between 18-19  
One step between 30-29  
One step between 15-14  
One step between 16-15  
One step between 16-17  
  
One step between 12-11

One step between 23-24  
One step between 17-16

One step between 17-18

One step between 39-40

The difference is a total of 15 steps of genetic distance. Anything greater than 6 steps on a 37 Marker Y-DNA test means that they are not related.