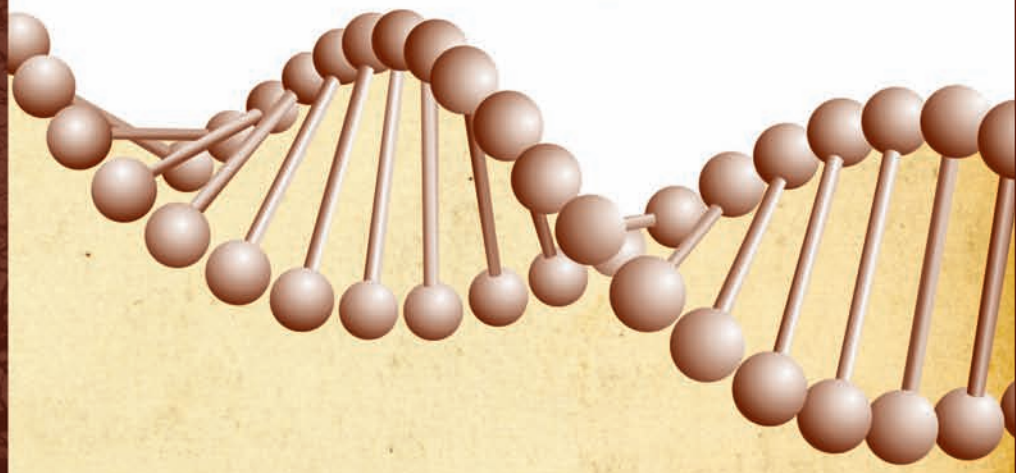
Ancestry

DNA Testing | Results Manual



Lineage DNA Testing

Maternal and Paternal Lineage Tests

This Results Manual walks you through the basics of DNA, what your results mean, plus additional information and resources for you to use!

Ancestry by DNA™

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Introduction

Welcome to your ancient heritage!

The purpose of this manual is to serve as a reference source for questions you may have about ancestry DNA testing in general, as well as the results you received and what they mean.

In This Manual

We'll go over some DNA basics and information on human evolution and history, followed by a discussion of the lineage testing services we currently offer. We also provide some resources at the end of this manual, should you wish to do further research on your own.

Each day, scientists around the world are further refining what we know today about ancestral genetics and worldwide human migrations. The results we give you are great tool in your voyage as you learn more about your ancestors and where they came from.

Your Results Package

In addition to this manual, your results include a frameable certificate listing your haplogroup—your genetic "family name"— and a short description including when and where your haplogroup originated. It also includes the DNA information that we used to assign your haplogroup. You may be able to use this information in some public discussion boards and databases for further research. A list of these resources is included at the end of this manual.

Your haplogroup is typically represented by a capital letter, as in the common European mitochondrial haplogroup, **H**. Tested individuals may belong to this major haplogroup, or one of its subgroups. Subgroups are represented by the capital letter followed by a number, and further subgroups have additional letters and numbers, for example, H1, H1b, and so on. If you belong to a subgroup, you also belong to the major group.

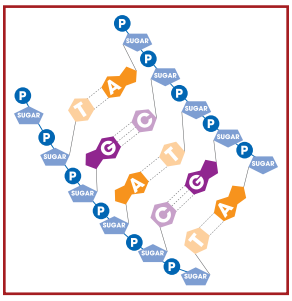
An extended description of your major haplogroup is also included with your certificate. It contains additional information on different populations that are members of your haplogroup, including historical anecdotes and famous people, if any, whom you may be distantly related to.

DNA Basics

This chapter reviews some basic information about DNA biology and inheritance. As you may know, DNA is the genetic material found in all living things. Each cell in your body contains a full copy of the genetic material, which encodes all your body's structure and functions.

DNA is most often represented as a double helix. In the cell, the DNA helix is found in tightly coiled and packaged units called **chromosomes**. If all of the DNA inside a cell is stretched out and placed end to end, you would have a long, double-stranded helix that is about 3 meters in length.

The DNA helix looks like a twisted ladder. The two sides are composed of the four bases: adenine (A), thymine (T), guanine (G), and cytosine (C), and the rungs of the ladder represent hydrogen bonds that



connect specific pairs of these molecules together: A–T and G–C.

The arrangement of these molecules, called the DNA sequence, spell out the instructions for our physical characteristics and body functions. These instructions are found in units called **genes**. Not all of the DNA sequences code for genes. In fact, the majority of your cell's DNA is found in non-coding regions—they are thought to serve other purposes, which include regulating gene activity as well as providing structural support and protection. Many of these non-coding regions happen to contain markers (specific DNA sequences) that are useful for human identification and lineage studies.

Types of DNA Used in Lineage Testing

When discussing lineage DNA testing, we often refer to two types of DNA in your cells. The first is the **Y chromosome,** used in paternal lineage testing, and the second is mitochondrial DNA, used in maternal lineage testing. These two types of DNA are discussed further below.

As you may know, humans have a total of 46 chromosomes in the nucleus of each cell. These chromosomes come in pairs: we inherit one copy each of Chromosomes 1 through 22 from our father and mother. This first group of chromosomes are called autosomes. The second group, the sex chromosomes, also come in pairs. Males inherit one Y chromosome from the father and one X chromosome from the mother. Females, on the other hand, inherit two X chromosomes, one from their mother and one from their father.

Because the Y chromosome is inherited through the paternal line, from father to son, relatively unchanged through several generations, it is possible to perform a **Paternal Lineage Test** by examining the Y chromosome. The X chromosome does not present the same advantage for female lineage, since a woman's X chromosomes comes from both her father and mother. A female cannot trace her paternal lineage using her own DNA; she would have to request her brother or father to take the test to learn about her paternal lineage.

The second type of DNA is **mitochondrial DNA**, abbreviated **mtDNA**. This form of DNA is found in multiple copies inside the cell, but outside the nucleus. Regardless of whether you are male or female, all of your mitochondrial DNA comes from your mother. During conception, only the male nuclear genetic material enters the egg. As such, the fertilized egg only contains mtDNA from the mother. It is due to this

maternal mechanism of inheritance that we are able to trace the maternal ancestry line for both male and females using mtDNA.

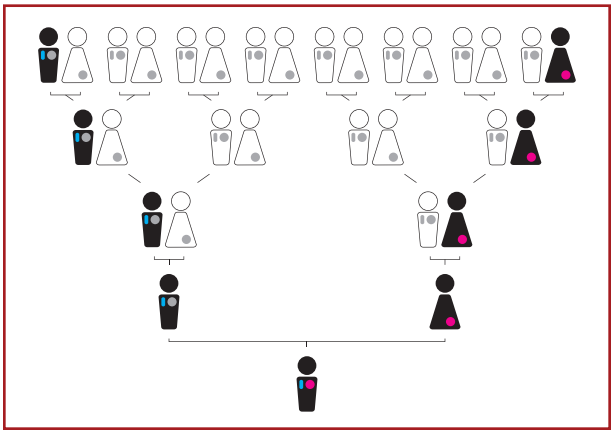
Haplogroups, Defined

Throughout this manual, we will be referring to the word *haplogroup*. A haplogroup is a group of people sharing the same genetic characteristics, and therefore the same lineage. For most, this lineage goes back tens of thousands of years, so that people of the same haplogroup would have had a common ancestor 20,000 or even 60,000 years ago.

Haplogroups are associated with a geographical and historical point of origin. During ancient times, the human race started migrating out of its common ancestral homeland in East Africa. As groups of people settled in Europe, Asia, and beyond, small changes in their DNA occurred, allowing them to form genetically distinct populations. These eventually came to be called haplogroups, and your haplogroup is a record of your ancestors' early settlements around the world.

Because the two types of DNA, mitochondrial and Y chromosomal DNA, allows us to trace both sides of our ancestors' story, haplogroups are assigned for both mitochondrial and Y DNA. These are alphabetical in nature, although a maternal haplogroup does not necessarily correspond with the paternal haplogroup of the same name. (For example, mtDNA Haplogroup A does not denote the same population and origins as Y-DNA Haplogroup A.)

Limitations and Other DNA Testing



It is worth noting that maternal and paternal lineage testing traces the unbroken lines on your father's and mother's side, and does not give information about the genetic contribution of spouses on either side. For example, a paternal lineage test may tell you about where your father's father came from, but not about your grandmother's heritage on your father's side. A maternal lineage test will tell you about your mom's mother, but not about her father's ancestry.

To get a fuller view of your heritage, it would be beneficial to test those members of your family who may not be in your direct maternal or paternal lineage. Also, another test that we offer is the Ancestry*by*DNA™ test, which gives you percentage values based on testing many markers across your autosomal DNA (your non-sex chromosomes). It scans for markers associated with different populations and gives you an approximation of your ancestral makeup as a result of inheritance within the last few generations. This type of test does not look at direct relationships—it does not tell you which side of your family a particular percentage, say the Indigenous American percentage, may come from. Rather, it gives percentage values based on world population statistics matching the markers to world geographic locations. For more information about Ancestry*by*DNA™ testing, please visit our website at *www.ancestrybydna.com.*

The Story of the Human Race

Where did we come from? Today we are in an era of rapid intercontinental travel, where people can reach the other side of the world in less than 30 hours of air travel. However, the story of human migration goes back about 125,000 years ago, when the first modern humans made their journey out of Africa, into Asia, Europe, and beyond. Wherever they settled, human populations accumulated small changes in their DNA that marked their presence at these times and places—these are the DNA markers that we bear today.

Pre-Human History

Archaeologists and anthropologists generally accept that the first hominids, or proto-humans, existed as far back as 7 million years ago in Africa. It was not until 2 million years ago when a new species emerged in the same place. Dubbed *Homo erectus*, members of this species were about as tall as modern humans, with a more muscular build. They made axes and cleavers out of stone, and they could communicate. However, their facial features were quite different from that of modern humans: flat noses, a thick bone ridge above their eyes. They were in the right place at the right time—one of the Earth's periodic ice ages had come to an end, and the world became a warmer, damper place where life could abundantly flourish. The wide availability of food enabled this species to migrate quickly, and groups of *H. erectus* traveled in all directions, most notably into Asia, where a member of this species, the "Java Man," is found. Further fossils have been found in China, Spain, and Georgia (north of the Caucasus mountains).

Because the range of *H. erectus* was widespread, it has been argued that modern humans, *Homo sapiens*, evolved from this species. However, DNA evidence suggests otherwise. It is now believed that the *H. erectus* eventually died out within the past 500,000 years. Although there is some evidence that a member of *H. erectus*, the Neanderthal Man, may have coexisted with modern humans, it is believed that all humans today genetically trace back to the first *H. sapiens* who evolved in Africa sometime between 400,000 and 130,000 years ago.

Homo sapiens, the "Knowing Man"

Like its predecessors, *H. sapiens* was confined to its ancestral homeland for a long time. The Sahara had once again become a desert, forming an impenetrable barrier to the outside world. Then, about 125,000 years ago, earth temperatures warmed and the Sahara became green once more, this time for several thousands of years. Humans migrated north, possibly crossing the river Nile to the Egyptian coast into modern-day Israel and Lebanon, following the Mediterranean coast. As another cycle of cold and dry temperatures took place, food and shelter became scarce for the humans who left Africa, and it is possible that these humans died out themselves.

A second wave of migration out of Africa took place when favorable conditions returned some 40,000 years later. These humans reached Arabia from the northern edge of the Horn of Africa. The DNA of modern-day humans can be traced back to these individuals—they are the group from which all of today's non-African population descends.

Timeline of Human Migration

The timeline of human migration presented below is consistent with DNA evidence. Your very own DNA contains evidence of this migration, and your results give you an insight into your ancestors' role in human history.

170,000 B.C.E.	Modern humans arise in East Africa
160,000 B.C.E.	Humans spread into southern and western Africa
125,000 B.C.E.	The first modern humans leave Africa, arriving on the Mediterranean shore.
90,000 B.C.E.	*Homo sapiens* settle China.
85,000 B.C.E.	A second wave of migration of humans spread along the coastal regions and reached Java within 10,000 years.
65,000 B.C.E.	Humans migrate northward into Europe
50,000 B.C.E.	The Cro-Magnon people are the earliest *H. sapiens* to settle Europe.
40,000 B.C.E.	Ancestors of Australian aborigines arrive on the Australian continent.
25,000 B.C.E.	*Homo sapiens* in Europe show artful skill with their cave paintings.
20,000 B.C.E.	The first humans cross the Bering land bridge into North America.
18,000 B.C.E.	The peak of the last Ice Age, when Europeans retreated to 4 refuges areas: Iberia, Ukraine, Siberia, and the Balkans.
15,000 B.C.E.	Humans may have reached South America by boat.
10,000 B.C.E.	The Earth warms up, and Europe is repopulated. Agriculture spreads there.

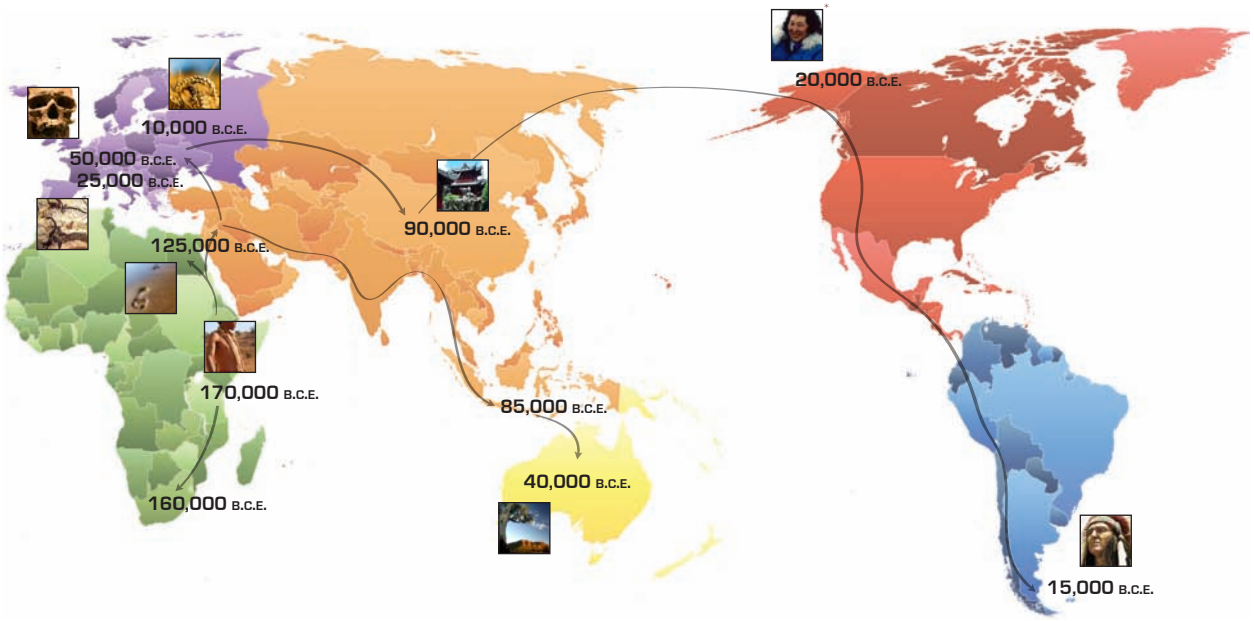


*Photo credit: Inuit grandmother by Angsar Walk, Creative Commons Attribution ShareAlike 2.5.

Maternal Lineage Test

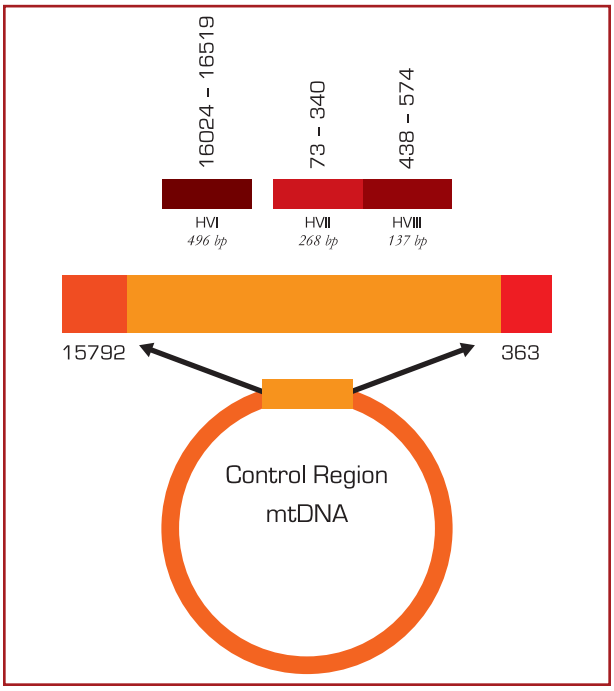
From the DNA Basics section, you learned that the maternal lineage test is based on the fact that mitochondrial DNA is passed strictly from the mother to her children. Certain features of mtDNA make it useful for maternal lineage testing.

About Mitochondrial DNA

Mitochondrial DNA is found in organelles in the cell cytoplasm that are responsible for producing energy for the cell. Called the mitochondria, these organelles possess their own genetic material, mtDNA, that is inherited solely through the maternal line—that is, all sons and daughters inherit their mother's mtDNA. This means both men and women can take the mtDNA test. However, only daughters can pass on their mother's mtDNA to their offspring. Because of this specificity of inheritance, mtDNA is a useful genealogical tool to trace an unbroken maternal lineage, without any influences of spouses, back generations upon generations.

How the Test Works

Like all DNA molecules, mtDNA is made up of a succession of four building blocks known as nucleotides. Each nucleotide is represented by the first letter of their name: A=Adenine, T=Thymine, C=Cytosine, and G=Guanine. The order in which these nucleotides are arranged is called a DNA sequence. When a mtDNA lineage test is performed, our laboratory determines the specific order of nucleotides in several sections of your mtDNA sequence called the hypervariable sequences I, II, and III.



The hypervariable sequences I, II, and III are found in a region of your mtDNA that is called the control region. Unlike the rest of your mitochondrial genome, the control region does not contain any genes that specifies instructions for making proteins or other necessary biological molecules. Instead it contains the signals that direct the expression of the energy-producing mitochondrial genes.

We call the sequences within the control region hypervariable because the rate of mutation is approximately 10 times the rate of nuclear DNA, about one change every 1500 years. This relatively rapid rate of mutation has allowed scientists to identify changes in the mtDNA control region that are unique to ancient people native to a certain geographical region, and to track their descendants throughout the world.

The entire mtDNA portion that we sequence is over 1000 nucleotides in length, and if written out entirely would be a series of letters that would be much longer than this example:

ATTAGGCCGATGACTACTTGGAACCCCCCCTATAGTGACCCCCAAATATAGCGCTACTA

Instead, we assigned each sequenced nucleotide of your mtDNA a unique number to designate its location, and your sequence is then compared to the revised Cambridge Reference Sequence, or rCRS. Differences in your mtDNA sequence as compared to the rCRS, listed in the table section of your ancestry certificate, make up your mtDNA haplotype.

By comparing your mtDNA haplotype to a predictive database, we can assign you to a mtDNA haplogroup. Haplogroups are genetic population groups that are the result of early human migrations, and which can today be associated with certain geographic regions. You may belong to a major haplogroup, represented on your ancestry certificate by a single capital letter, or a descendant subgroup, which is represented by a capital letter followed by a number and possibly a lower case letter. A short description of your haplogroup is provided on the certificate, as well as scientific estimates of when and where your haplogroup arose.

Your Test Results

Your test results comprise a report certificate and a one-page narrative describing your haplogroup. This section describes the certificate in further detail.

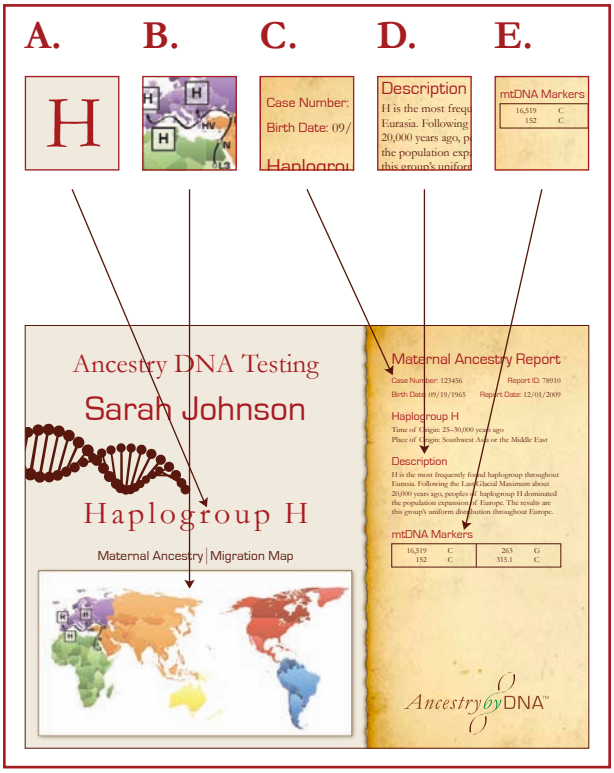
A. Your Haplogroup

B. Your haplogroup's migration map, depicting its journey from the earliest known origins. This may include ancestral haplogroups that gave rise to your own haplogroup.

C. Your case information and personalized details.

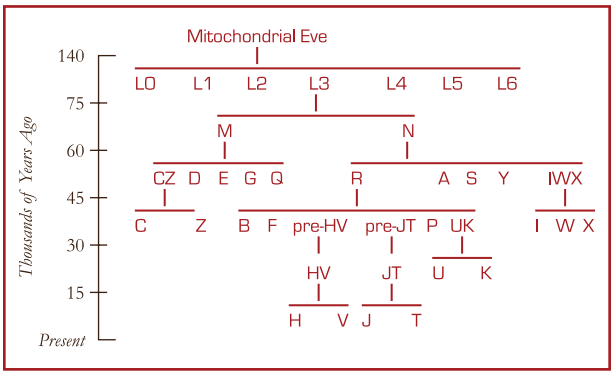
D. Brief summary of your haplogroup

E. Your mtDNA data. The table shows the locations in your mtDNA sequence that deviate from the rCRS, and the nucleotide change. You can use this information in mitosearch.org, a publicly accessible database that allows you to compare your results with that of other registered members.



The Human mtDNA Family Tree

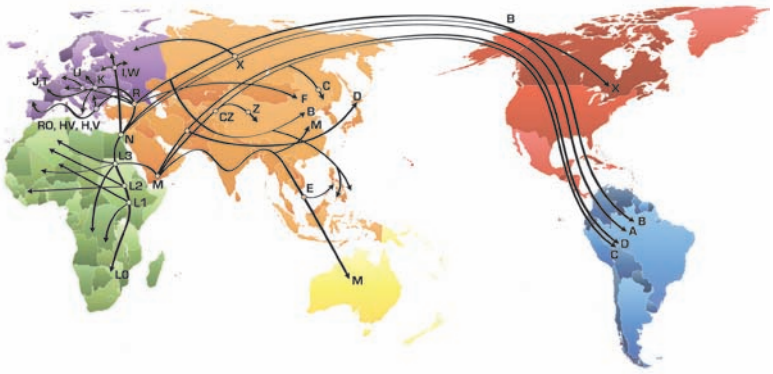
All mtDNA lineages trace back to a common ancestor, sometimes called Mitochondrial Eve, who lived in Africa between 100,000 to 150,000 years ago. Some haplogroups migrated out of Africa about 60,000 to 70,000 years ago, while other lineages remained. The human migration map found on your ancestry certificate traces your ancestors' journey out of Africa to where they eventually settled before the era of rapid trans-continental travel.



Refer to the chart on the top right to see your haplogroup in the context of the human mtDNA family tree. Brief descriptions of these haplogroups are included at the end of this chapter. If you fall into a subgroup, look for only the first letter of your subgroup in the map below.

Migration Map: mtDNA

This map depicts the trail of haplogroup evolution as humans migrated throughout the earth. This map is a general representation based on scientific studies done at the time of printing; it is meant to give you a general idea of where majority of the haplogroup populations are found. In many cases, multiple haplogroups are found along the lines of migration, and haplogroup members are found "off the beaten path."



mtDNA Haplogroup Descriptions

Below are brief descriptions of the major mitochondrial haplogroups.

Haplogroup A is found in Indigenous Americans as well as Asians. Members of this group crossed the Beringian land bridge into North America during the Ice Age.

Haplogroup B is one of the principal East Asian lineages. Members of Haplogroup B also migrated to the Americas between 15 and 20 thousand years ago, becoming one of five mitochondrial lineages identified among Indigenous Americans.

Haplogroup C is a descendant of haplogroup M, one of the two major lineages that migrated out of Africa to populate the rest of the world. It is currently found in northeast Asia, and it is considered one of the founding lineages of the Indigenous American population.

Haplogroup D is the principal East Asian lineage. Notable subgroups include D4, which is prevalent among Central Asian peoples, and D1, which is one of the five haplogroups represented among Indigenous Americans.

Haplogroup E likely arose within the vicinity of northeast Sundaland (Eastern Malaysia) and spread throughout the islands of Southeast Asia, where various sublineages flourished 5-10,000 years ago.

Haplogroup F arose in Central Asia and spread rapidly eastward to become one of the primary mitochondrial lineages in East and Southeast Asia. Its greatest frequency and sequence diversity can be found among coastal Asian populations.

Haplogroup H is the most frequently found haplogroup throughout Eurasia. Following the Last Glacial Maximum about 20,000 years ago, peoples of haplogroup H dominated the population expansion of Europe. The results are this group's uniform distribution throughout Europe.

Haplogroup HV is the ancestral haplogroup to H and V, which dominate the western European lineages today. About 75% of the western European population descends from this haplogroup.

Haplogroup I is widespread throughout Europe, although at relatively low levels (about 2%). It is also found in western Eurasia, and it is believed that early members of haplogroup I moved north across the Caucasus to carry their lineage into Europe during the Old Stone Age.

Haplogroup J is one of the four major European-specific haplogroups. It is believed that the spread of haplogroup J into Europe was brought by the first farming and herding societies from Western Asia during Neolithic times (New Stone Age).

Haplogroup K originated in western Asia and spread throughout Europe. Certain lineages are also found in Central Asia and Northern Africa. It is known for its presence in distinct population groups, such as the prehistoric Basques and the Ashkenazi Jews.

Haplogroup L0 is the most ancient haplogroup on the human mtDNA tree. L0 arose about 150,000 years ago in eastern Africa, where the oldest fossils of anatomically modern humans have been found. L0a arose 100,000 years later and was carried to the southeastern part of the continent.

Haplogroup L1 is one of the oldest branches of the maternal family tree, a daughter of the mitochondrial Eve and sister to L0. It is most frequently found in western and central sub-Saharan Africa, and seldom appears in eastern or southern Africa. L1 gave rise to branches L2–L6, with L3 giving rise to all the non-African haplogroups found today.

Haplogroup L2 is a direct descendant of the mitochondrial Eve. It is currently found in 1/3 of sub-Saharan Africans, and its subgroup L2a is the most common mtDNA haplogroup among African Americans.

Haplogroup L3, a daughter of the mitochondrial Eve, was one of the first groups of humans to venture out of Africa, eventually populating the rest of the world. Asian and European haplogroups trace their ancestry to L3.

Haplogroup M members were among the first humans to leave Africa, migrating east along the southern coasts of Asia. Subgroup M1 intrigues scientists with its presence in East Africa; another subgroup, M3, is believed to be native to India.

Haplogroup N is one of the two major lineages from which non-African haplogroups descend. Today, members of this haplogroup are found in many continents around the world.

Haplogroup R is ancient and complex; today its members can be found all over the world. Originating in the Near East, members of haplogroup R spread into Africa, southwestern Eurasia, the Middle East, and Central and South Asia.

Haplogroup T, is a relatively young haplogroup that is considered a founding lineage of the Neolithic period, when humans living in Mesopotamia first developed agriculture. The group is widely distributed, albeit at low frequencies.

Haplogroup U is one of the Europe's oldest and most diverse haplogroups: it predates the expansion of agriculture in Europe. About 10-11% of Europeans and European Americans belong to this haplogroup.

Haplogroup V is a European haplogroup that arose in Iberia (Spain) towards the end of the Ice Age, and spread east and north during the repopulation of Europe.

Haplogroup W is still commonly found in its place of origin, although it is also found in love levels across Eurasia. It is associated with the appearance of the Aurignacian culture during the Upper Paleolithic.

Haplogroup X arose in Southwest Asia, and from there spread to Europe, North Africa, and the Near East. Its subgroup X2 is one of the founding lineages of Indigenous Americans.

Haplogroup Y is associated with Siberian populations, and it is also fond in Japanese, Korean, and some Southeast Asian populations.

Haplogroup Z is found throughout Asia, with higher levels found in Tibet and Siberia, and lower levels in Japan. A subgroup, Z1, is also found among the Finnish Saami, which are thought to have both European and Asian ancestry.

Paternal Lineage Test

From the DNA Basics section, you learned that the paternal lineage test is based on the fact that the Y chromosome is passed from father to son relatively unchanged through several generations. In this chapter, you'll learn about which parts of the Y chromosome we examined to determine your haplogroup.

How the Test Works

Paternal lineage testing starts with a process that amplifies specific areas of an individual's DNA for further examination. These specific areas (also called genetic loci) contain regions of the DNA known as short tandem repeats (STRs)—short, repeating units of DNA. STRs are found across the 46 human chromosomes, and are often used in human identity testing. For paternal lineage testing, we only examine the STRs on the Y chromosome, which have been passed down through the paternal line.

The number of repeating units at each genetic locus on the Y-chromosome is variable between individuals, and is inherited from the biological father. This is reported as your allele size, and is listed on your certificate. Your Y-STR profile is the combination of allele sizes of all the markers tested—this information is entered into a population database to determine which haplogroup you belong to.

Your Test Results

Your test results comprise a report certificate and a one-page narrative describing your haplogroup. This section describes the certificate in further detail.

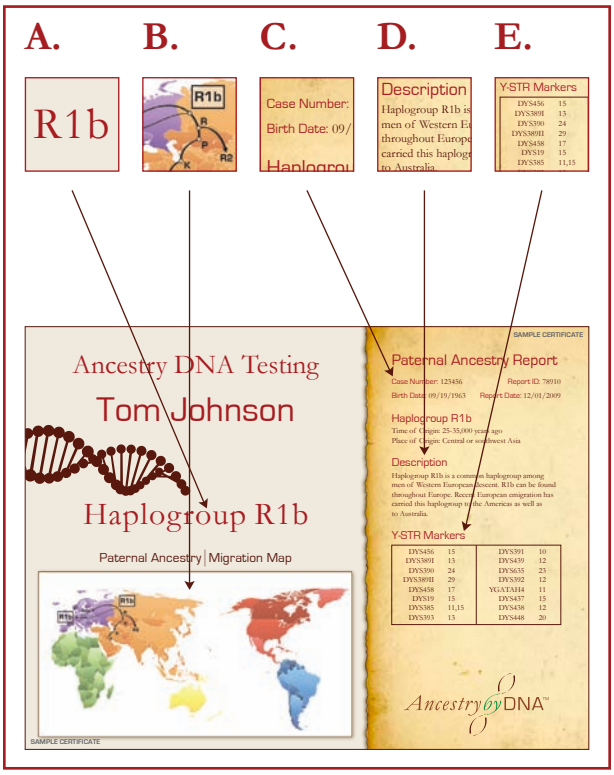
A. Your haplogroup

B. Your haplogroup's migration map, depicting its journey from the earliest known origins. This may include ancestral haplogroups that gave rise to your own haplogroup. Your haplogroup is designated by a shaded box.

C. Your case information and personalized details.

D. Brief summary of your haplogroup

E. Your Y-STR data. The table shows the Y-STR markers we tested and the allele sizes detected for those markers. The combination of allele sizes is your Y-STR profile tells us what haplogroup you belong to.

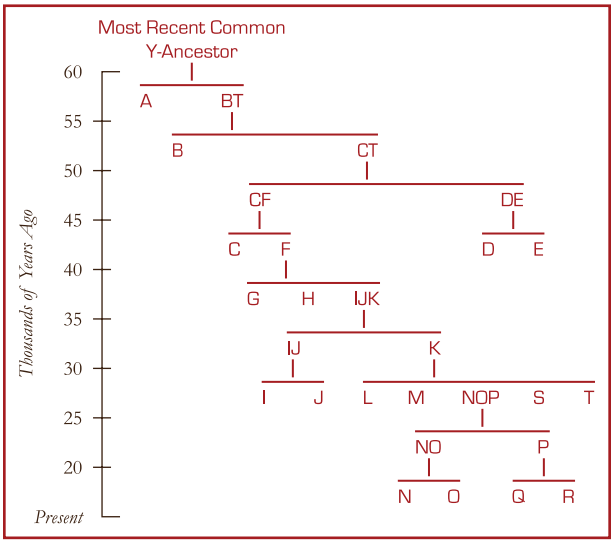


The Y-DNA Family Tree

All Y-DNA lineages trace back to a common ancestor, sometimes called the Y-chromosomal Adam, who lived in Africa about 60,000 years ago. It is considered a counterpart to the mitochondrial Eve, although they lived at different times (100,000 years apart). Researchers have several theories about this discrepancy, including differing mutation rates and the fact that men are able to produce multiple offspring with many women. The main point is that while there were other early humans, there were 2 successful lines, one maternal and one paternal, from whom all modern humans descended. The maternal line that began ~150,000 years ago has remained unbroken, and the uninterrupted paternal line which only began 60,000 years ago.

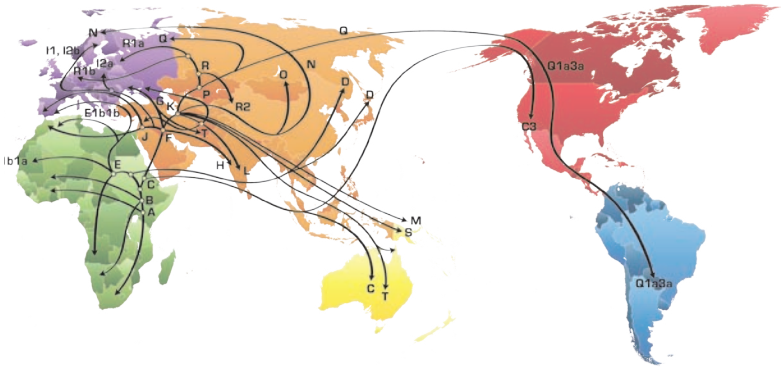
Members of some haplogroups migrated out of Africa about 60,000 to 70,000 years ago, while other lineages remained. The human migration map found on your ancestry certificate traces your ancestors' journey out of Africa to where they eventually settled before the era of rapid trans-continental travel.

Refer to the chart on the right to see your haplogroup in the context of the human Y-DNA family tree. Brief descriptions of these haplogroups are included at the end of this chapter. If you fall into a subgroup, look for only the first letter of your subgroup in the map below.



Migration Map: Y-DNA

This map depicts the trail of Y-DNA haplogroup evolution as humans migrated throughout the earth. It is a general representation based on scientific studies done at the time of printing; it is meant to give you a general idea of where majority of the haplogroup populations are found. In many cases, multiple haplogroups are found along the lines of migration, and haplogroup members are found "off the beaten path." Unlike the mtDNA migration map, not all Y haplogroups neatly trace to the Y-chromosomal Adam. This is partly due to the lack of information and the need for further research, and also partly due to the higher mutational rates found in Y chromosomes compared to mtDNA, which allow scientists to study haplogroups populations within a more limited timeframe.



Y-DNA Haplogroup Descriptions

Below are brief descriptions of the major Y-DNA haplogroups.

Haplogroup A is the most basal and diverse of all Y-chromosome lineages. The group is found almost exclusively in Africa, with high representation among hunter-gatherer societies in Ethiopia and Sudan.

Haplogroup B is an ancient lineage distributed sporadically across the African continent. The group is common among pygmy peoples, as well as hunter-gatherer groups. Just over 2% of African Americans belong to this haplogroup.

Haplogroup C originated shortly after the first migration of modern humans out of Africa. Today the group is most common in eastern Eurasia, East and Southeast Asia, and can also be found among western North American indigenous peoples.

Haplogroup D arose in Asia, and its members migrated along the southern coasts of Asia, ultimately settling in Central and East Asia, but not in the Americas. This haplogroup is distinctive in its geographic differentiation.

Haplogroup E is one of the oldest branches of the human family tree. It arose 55,000 years ago, either in East Africa or Asia. During this time, the very first human migrations out of Africa have just occurred. This haplogroup is very common in Africa today, although a particular sub-branch can be found in Europe.

Haplogroup F is an ancient and widespread haplogroup that today comprises more than 90% of all non-African men. Haplogroup F was one of the first haplogroups of modern humans to develop outside of Africa.

Haplogroup G is relatively young but widely distributed, common in Old World European populations, the Middle East, northern Africa, and Central, South, and Southeast Asia. One subgroup, G2c, is a distinctive genetic marker of Ashkenazi Jews.

Haplogroup H is one of the main genetic hallmarks of India, and its members are believed to be responsible for the first major settlements there around 30,000 years ago. Haplogroup H is also prevalent among the Romani people, or Gypsies.

Haplogroup I is found in 20% of European men today, and comprises several subgroups that are associated with specific geographic regions in Europe.

Haplogroup J is very common in the Middle East and the Mediterranean region, including North Africa and southern Europe. The lineage is divided into subgroups J1 and J2, the latter being associated with Neolithic archaeological sites. Haplogroup K spread from its homeland in southwestern Asia throughout Eurasia. Today the lineage ranges from Australia and Oceania to South Asia, and thence to southwestern Asia and North Africa.

Haplogroup L is most prevalent among certain populations of India and Pakistan. The lineage can also be found at lower frequencies in southern Europe, North Africa, the Middle East, and Central Asia.

Haplogroup M is descended from the Eurasian haplogroup K. Haplogroup M is characteristic of Southeast Asian populations, and some have associated it with the development of rice agriculture in that region.

Haplogroup N arose in Southeast Asia, or possibly eastern Eurasia. This haplogroup is distributed somewhat sporadically from China to northeastern Europe, reaching its highest concentrations in certain Siberian populations.

Haplogroup O is specific to East Asia. Its subgroups O1 and O3 are typical of Chinese populations, while O2 is distributed sporadically from South to East Asia.

Haplogroup P and its major descendant groups, Q and R, are represented in many Western Europeans, Indigenous Americans, and Central Asians. Today the descendants of these related lineages can be found throughout Eurasia and the Americas.

Haplogroup Q is common among Siberian native populations. Approximately 15,000 years ago, the lineage spread to the New World, becoming the most widespread patrilineal haplogroup among both North and South American native peoples.

Haplogroup R is a major European haplogroup. Subgroup R1a split off 15,000 years ago, during the peak of the Ice Age. It is found in high frequency and diversity in northern India and eastern Europe. R1b can be found throughout Europe. Recent European emigration has carried this haplogroup to the Americas as well as to Australia

Haplogroup S is characteristic of the highlands of Papua New Guinea, and researchers believe it may have originated there. Geneticists have only recently distinguished haplogroup S from its parent clade, haplogroup K.

Haplogroup T is a rare haplogroup that is most commonly found in East Africa and Western Asia. It is also found in the central and western Mediterranean regions.

Additional Resources

The following resources are provided for further research in the field of genetic genealogy and genealogy research.

Books

Trace Your Roots with DNA: Use Your DNA to Complete Your Family Tree

Megan Smolenyak and Ann Turner, 2004. 256 pages. Published by Rodale Books.

The Seven Daughters of Eve

Bryan Sykes, 2002. 320 pages. Published by W.W. Norton & Co.

The Journey of Man: A Genetic Odyssey

Spencer Wells, 2004. 240 pages. Published by Random House Trade Paperbacks.

Deep Ancestry: Inside the Genographic Project

Spencer Wells, 2006. 256 pages. Published by National Geographic

Websites

The International Society of Genetic Genealogy

http://isogg.org/

Beginners can check out their "For Newbies" section on the left menu and join a listserve to ask questions from fellow enthusiasts in genetic genealogy. Local meetings and events are also held around the country by ISOGG speakers.

Journal of Genetic Genealogy

http://www.jogg.info/

An online journal that publishes articles on topics of general interest to the genealogical community, including mutation rates, geographic patterns in genetic data, information about haplogroups, and mtDNA and Y-chromosomal topics as well as new ancestry DNA testing tools.

The Genetic Genealogist

http://www.thegeneticgenealogist.com

An informative blog discussing current topics in genetic genealogy and ancestry testing; also offers an e-book on interpreting the results of genetic genealogy tests.

The National Genealogical Society

http://www.ngsgenealogy.org/

Find tutorials, research tips, conferences, and publications about the methods used in conventional family research.

Society Hall Directory

http://www.familyhistory.com/societyhall/search.asp

This directory allows you to search for your local genealogical societies by name, city, state, or Zip.

Mitosearch

http://www.mitosearch.org/

An public-access online database of mtDNA sequences where you can find matches and potential relatives.

Ysearch

http://www.ysearch.org/

An public-access online database of Y-STR profiles where you can find matches and potential relatives.

Retrace your ancestors' footsteps.

Ancestry by DNA™