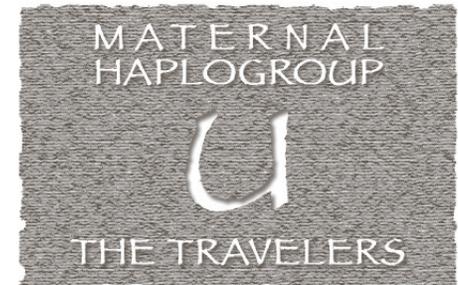


MATERNAL LINEAGE TEST RESULTS FOR EDWARD BENEDICT GODWIN

Your DNA test results show that you belong to Maternal Ancient Ancestry haplogroup *U*, The Travelers.



This map shows the migration pathways of your ancient ancestors, the Travelers, haplogroup *U*. Your ancient ancestors probably lived and migrated far and wide, through western Europe, Mongolia, India and north

and northwest Africa. Along with revealing ancestral history, your results may also be used to eliminate certain hypothesized genealogical links. See page 2 for more details.

YOUR HAPLOTYPE

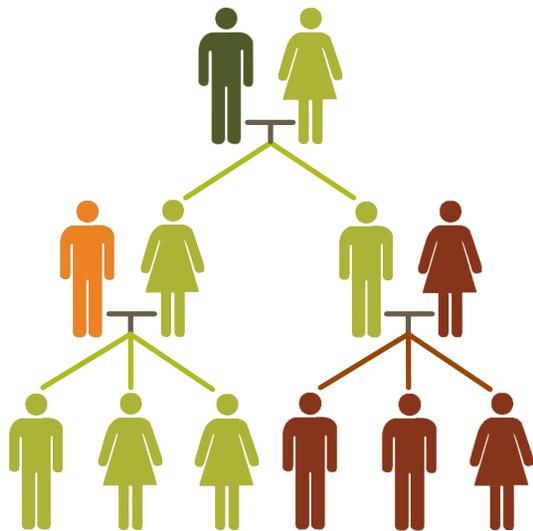
Location	Reference mtDNA	Your mtDNA
73	A	G
263	A	G
272	A	G
315.1	:	C
16256	C	T
16270	C	T
16291	C	T
16399	A	G
16519	T	C

PART I: AN EASY EXPLANATION OF YOUR RESULTS

mtDNA Results—How They Vary

At first glance, the data that makes up your test results may not mean much to you. It's a lot like looking at the whorls on the pad of your finger tip, or the intricate pattern of a snowflake under a microscope. But your results are a special bit of information that may hold the answer to some of your ancestral mysteries.

To determine your Maternal Ancient Ancestry Haplogroup, we took a look at a circle of your DNA known as mitochondrial DNA (mtDNA). You can learn more about the function and genetics of mito-



We inherit mtDNA from our mothers. Here the line of mtDNA inheritance is represented by color.

chondria in Part II, Digging Deeper (page 4). Unlike chromosomal DNA, which contains the vast majority of an individual's genetic information, mtDNA is a special sort of DNA. Because mtDNA is not passed from the sperm to the egg during fertilization, our mtDNA comes only from our mother. Thus, your mtDNA results will be consistent among the members of your direct maternal line. In other words, your mtDNA results will be the same for your mother, her mother, your siblings, and so on. However, it's important to note that both men and women have mtDNA.

To understand where the letters and numbers which make up your test results came from, imagine your mtDNA as a circular ribbon. When we're doing your test, we travel down that ribbon, pull up to certain locations and compare your mtDNA sequence at those locations to a reference sequence (established arbitrarily by research scientists). Each location we look at is either "A", "T", "C", or "G", corresponding to the four components of DNA code. If your sequence is different from the reference, we make a note of it. That sequence difference is always unique to your DNA, and the combination of the differences allow us to match you to a haplogroup. Take a look at page 4, in Part II, Digging Deeper, for a more advanced explanation of your test results.

The results table on your certificate has three columns. The first column, labeled "Location," indicates the names of the locations where we found

Location: A Particular Place in the mtDNA Code	Reference mtDNA: The Reference Base at this Location	Your mtDNA: Your Genetic Code at this Location
Location	Reference mtDNA	Your mtDNA
250	T	C

differences in your mtDNA sequence. The second column, labeled "Reference mtDNA" describes the genetic code at that location on the mtDNA of a standard reference sequence. All Maternal Ancient Ancestry Haplogroups are defined in comparison to this one universal reference, established arbitrarily by the original research scientists who sequenced human mtDNA. The third column, labeled "Your mtDNA", shows the differences in your mtDNA when compared with the reference. If you belong to the same haplogroup as the reference, you may not see any data at all.

Your mtDNA haplotype results are useful only for our database to match you with a Maternal Ancient Ancestry Haplogroup. Your test results don't tell you (or us!) anything about your hair color or other personal characteristics. The way we use DNA is very different from what you may have seen on TV or heard about in the past. If you're interested in learning more about the science behind the test, read Part II of this packet, Digging Deeper.

PART I: AN EASY EXPLANATION OF YOUR RESULTS

Genealogy—Meaning for the Maternal Line

Your results can be the final answer to certain genealogical puzzles. As mitochondrial DNA is inherited directly from our mothers, there are certain relatives who will always have the same results as you do. If there is a possible relative with whom you think you share a maternal link, you can compare mtDNA results. We can't determine whether you are related more recently than 5,000 years ago, but if you have even one difference, you can be certain you are not related.

Matching to Other Test Participants

Our database automatically compares your results with all other participants. Your Maternal Lineage results will show your closest maternal matches as well as how you differ from those matches.

Even over many, many generations mtDNA does not change much, so it's possible to have a "perfect" match with someone, belong to the same Maternal Ancestral Group and still not be related in a close familial way. However, any differences between your results and those of another participant indicate that you are definitely *not* related. The most common genealogical application of these results is to eliminate the potential link to an individual with whom you thought you had a direct maternal link.

If you're interested in contacting a maternal ancestry match, you can use the secure Ancestry.com

Connection Service to protect your email address. You may be contacted by someone as well. An opportunity to collaborate with other participants depends on the level of participation you designate online. You may elect to share only your contact name with others or remain entirely anonymous. These preferences are available under "My Account".

Our database is growing, so you may discover even more maternal comparisons and matches when you visit in the future.

Your Ancient Ancestors—Where It All Started

Around 100,000 years ago, a single group of humans began dividing and migrating to form genetically isolated populations throughout the world. Over generations, the new populations' genes became slightly different from the original group and from each other. Some of those differences were random, while others provided genes for characteristics which let groups thrive in their specific environments. A few of these random differences appear in your mtDNA sequence and allow us to associate you with a Maternal Haplogroup—described by a letter and in some cases followed by a number.

We determine your specific haplogroup by comparing your mtDNA sequence to a reference. The differences we find are usually similar or identical to the differences between a known haplogroup and the reference, so we can assign you to that haplogroup.

Haplogroups are usually associated with regions of the world, ancient peoples, and migrations, going back tens of thousands of years. By telling you a little bit about the people associated with your haplogroup, we give you clues to the life and times of your ancient ancestors. You may enjoy reading *The Seven Daughters of Eve*, by Brian Sykes, which offers a rich tale of all of our most ancient maternal ancestors.

Haplogroup U, The Travelers

You belong to the Travelers, haplogroup *U*, which emerged around 60,000 years ago, not long after the first modern humans left Africa. Because the Travelers are so old, they've had many descendants who migrated to new areas and formed subgroups. As our DNA test and matching conventions progress, we may be able to match you to a *U* subgroup. For now,



A depiction of King Rama, a popular deity in south and southeast Asia.

PART I: AN EASY EXPLANATION OF YOUR RESULTS

we'll tell you more about a few of those groups.

One group of the Travelers, *U2*, originated in the Near East about 45,000 years ago. Today's highest rates of *U2* are concentrated in southern and southwestern Asia, except for one (*U2e*) which expanded into Europe with some of the first humans to migrate in that direction and can still be found there.

Notable rates of *U2* can be found in areas spanning the subcontinent, from the northern Indian state of Uttar Pradesh to Sri Lanka, an island off of the southeastern Indian coast. Uttar Pradesh played a

significant role in ancient Indian history as Hindu studies, general culture and religion are believed to have developed in the Indo-Gangetic plain, a region that takes up a good portion of the state. Traditional Uttar Pradesh dance and music is highly valued by the culture and very distinct. Your ancient ancestors may have been familiar with *kathak*, a classical dance style which is closely tied to the region's epics and mythology.

Over 1,300 miles away, ancient Sri Lanka was believed to be progressive in many ways, establishing

the first hospital in Mihintale. Sri Lanka is also thought to be the first Asian nation under female rule, over 2,000 years ago.

Another subgroup of the Travelers (*U2c*) are found at notable rates along the eastern coast of India and among the Sindhi of southern Pakistan. The Gujarati in northwestern India have a high population of the *U2a* group in their population. The Himalayas and deserts bordering India may have ultimately prevented a significant movement of these subgroups of Travelers out of Asia.

The subgroup *U2e* has been found in populations united by the Indo-European language family in Pakistan, Tajikistan and Turkmenistan and among the Kalash, Shogun and Kurds. Your ancient ancestors may have thus played a notable role in the spread of agriculture, which is sometimes correlated with this linguistic family. *U2e* also expanded into Europe with some of the first humans to migrate in that direction and can still be found there.

The Udmurts, many of whom still occupy the heavily coniferous land of their ancestors in present-day Russia, are yet another *U2e* population of Travelers. Patterned weaving and artistic woodwork are part of a distinct Udmurtian craft tradition. Many Mordvians living near the Volga River and other populations near the Ural mountains are also Travelers.

The *U4* subgroup of Travelers emerged around 25,000 years ago, destined to be influenced by the



Your maternal ancient ancestors traveled this path—settling for various periods of time at points along the way.

PART II: DIGGING DEEPER

Ice Age, during which populations were pushed southwards, towards the Mediterranean. After the Ice Age ended, the group expanded into present-day Russia, near the Ural Mountains and Volga River basin, as well as central Asia and eastern Europe.

It's believed that a population of Magyars introduced *U4* to present-day Hungarian populations along with their language, many years ago. Traditional Hungarian mythology was possibly informed by that original group of Magyars, and tells of a tree of life, connecting the lower, middle and upper worlds. Gods, goddesses, the sun and the moon all occupy the upper world, while humans and a few mythological creatures occupy the middle world. These creatures include mermaids, an old lady who controls the wind (*Szélanya*), a dragon (*Sárkány*), giants (*Óriások*) and others. According to tradition, you may ask three wishes from the angelic *tündérek*. The underworld is a place for both the wicked and the aggravating—even fleas live there in the traditional Hungarian underworld.

About a third of the Kalash peoples living in the region between Pakistan and Afghanistan are Travelers, and belong to *U4*, indicating that their ancient ancestors probably came from the west. Nature plays a significant role in the Kalash polytheistic belief system, which has been compared with that of the Greeks. The Kalash also believe they are direct descendants of Alexander the Great's army.

The appearance of the Traveler subgroup *U8a* in

Basque populations indicates that their ancestors may have arrived in Iberia around 30,000 years ago. A unique modern day population, the Basque people self-identify as a discrete ethnic group in north-central Spain and southwestern France. Early Basque culture was basically democratic and their pre-Christian religion was formed around a superior female goddess, Mari. A rich mythology of Basque creatures and characters includes imps, giants, dragons, soothsayers and other nature-based deities. Traditional Basque cuisine was dictated by the mountains and sea surrounding Basque country. Lamb, fish and beans are typical ingredients of a Basque meal. The lan-



A Basque bowling game.

guage associated with the Basque people is *euskara*, which linguists believe exists in a family by itself, and is not related to English or other western European languages.

PART II: DIGGING DEEPER

What is mtDNA?

Mitochondrial DNA, or mtDNA, is a unique kind of DNA. While most of our DNA is contained in the nucleus of our cells as chromosomes, mtDNA and the mitochondria associated with it exist pretty much on their own, floating around inside the cell and outside of the nucleus. Mitochondria act like teeny-tiny organs in the cell, in fact, they are sometimes called organelles. A cell can have hundreds or thousands of mitochondria producing and regulating energy, and in fact, we couldn't survive without them. It's thought that the mitochondria once lived on their own, like bacteria. At some point during evolution, our cells incorporated mitochondria into their own physical and functional make up, somewhat like swallowing a super helpful parasite. In any given individual, mtDNA is the same from cell to cell. Because mitochondria still replicate on their own, they need their own special DNA, which exists in a loop (unlike the strands of chromosomal DNA).

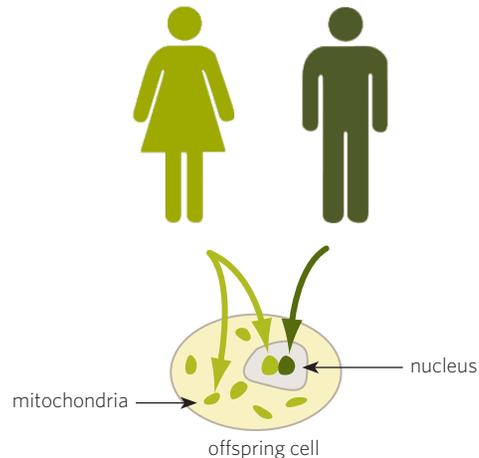
PART II: DIGGING DEEPER

mtDNA—Thanks, Mom!

Like the rest of your genetic makeup, your mtDNA is determined at conception. A human egg cell is many times larger and contains thousands more mitochondria than a human sperm cell, in which mitochondria are concentrated in the tail. When the two cells fuse they create a single fertilized cell, a zygote, and virtually all its mtDNA is from the egg.

Determining Haplogroup—Circular Data

To determine your Maternal Ancient Ancestry, we look at the DNA sequence, or code, in two mtDNA regions, known as the Hypervariable Region 1 and 2 (HVR1 and HVR2). You may know that DNA is made of building blocks called *bases*. Specifically, DNA is comprised of four bases: Adenine (A), Cytosine (C), Guanine (G), and Thymine (T). Those four bases line up to create a code, much like the kind of code computer programmers use. Even though HVR1 and HVR2 are made up of DNA, these two regions serve a strictly structural purpose for the loop of mtDNA; they give proteins inside the cell a place to stick to the loop. Because HVR1 and HVR2 are structural and don't code for anything important, they can contain a lot of "mistakes" or variations in the bases that make up their code, without having any effect on the life of the organism in which they exist. The way a sequence of mtDNA varies at certain locations in HVR1 and HVR2 lets us associate that mtDNA with a haplogroup.



mtDNA is contained in discrete cell organelles, the mitochondria, which are already in the egg at the time of conception.

Comparing to a Standard—Revised Cambridge Reference Sequence

As we've mentioned before, we determine your haplogroup by comparing the sequence of your mtDNA with a reference. You may be wondering how the standard was established and what goes on during the comparison. Scientists at Cambridge University sequenced the mtDNA of a random anonymous individual over 25 years ago. The sequence is called the Cambridge Reference Sequence (CRS).

The scientists figured out every single DNA base that makes up the mtDNA code, which turned out to be 16,569 bases long. About 10 years ago scientists used updated laboratory techniques to re-sequence

the same mtDNA, and established the Revised Cambridge Reference Sequence (RCRS).

So, how do you compare? Most of the 16,569 bases are exactly the same from person to person, but the few differences give us enough information to make things interesting. The differences between two mtDNA sequences are based on something the science world calls SNPs, Single Nucleotide Polymorphisms. This just means that a single base position in one sequence is different from a single base position in the next sequence. If part of your mtDNA sequence reads ATCGACT and that same part of the RCRS sequence reads ATCAACT, then the fourth base is the SNP. Your Ancestry.com mtDNA test results show each SNP, by comparing the "mtDNA Reference" (RCRS) sequence to your mtDNA sequence. You'll see an A, C, G or T at each location. That specific base pair indicates the SNP—the difference in your mtDNA sequence and the RCRS sequence. In some cases the difference we're looking at is the addition or deletion of a base pair (instead of a replacement), then you'll see a line instead of a letter in your results.

What if you don't have any differences? It just so happens that when the scientists chose an individual at random to establish the CRS standard, they chose someone who belonged to one of the most common haplogroups in Europe. So quite a few people discover that they have no differences in their mtDNA

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sequence compared to the CRS sequence. You won't see any locations or SNP base pairs spelled out in your results. This just means you were an exact match to the standard CRS sequence and belong to the same haplogroup as the individual whose DNA was used to establish the standard.

Genealogy—Making DNA Testing Meaningful

As we've mentioned before, mtDNA testing is very valuable for unlocking clues about your ancient ancestors. It can also be a powerful genealogical tool to eliminate possible relations through the maternal line. If you're looking for another way to use DNA testing for genealogy, you can take a Paternal Lineage, Y-Chromosome DNA test. This test can reveal possible familial connections which are more recent than the matches you find with an mtDNA test. Although only men can give a DNA sample for Y-Chromosome testing, a woman can still trace her paternal lineage using a DNA sample provided by a brother, father, or another paternal relative (for example, a male cousin) and she can treat these Y results as if they were her own.

If you submit a DNA sample for a Y-Chromosome test, your results will include possible participant matches as well as an estimate of the Most Recent Common Ancestor (MRCA) that you share with your matches. An ancestor match of "approximately 550 years ago" could mean you shared a great-great-

great-great-great-great grandfather.

When you find a match using your Y-chromosome test results, you can contact your genetic cousins and compare family trees using the secure Ancestry.com Connection Service to protect your email address. If you're fortunate, our common ancestor analysis will narrow your search to a time frame, and together, you and your genetic cousin will discover the ancestor who joins your two family trees.

Still Have Questions?

If you have questions about your results or the science behind our tests, our website's live chat and email features allow you to contact us directly. For more information, visit dna.ancestry.com and the Ancestry.com Learning Center to see videos about our services.