# Y-HAPLOGROUP FREQUENCIES IN THE FLEMISH POPULATION

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Gerhard Mertens

## Abstract

The Flemish are the Dutch-speaking population of the northern part of Belgium and make up 60% of the population. Estimated figures for present-day Americans with Flemish roots amount to more than 1 million. We performed a population genetic study on 113 unrelated Flemish males, who were typed for 12 Y chromosome STRs (DYS19, DYS385 a/b, DYS389 I, DYS389 II, DYS390, DYS391, DYS392, DYS393, DYS437, DYS438 and DYS439). With these 12-locus haplotypes, we deduced the corresponding haplogroup using Whit Athey's Haplogroup Predictor. This yielded the following distribution, typical for a population with northwest European origin: Haplogroup R1b 56.6%, Haplogroup I 28.3%, Haplogroup J 6.2%, Haplogroup E3b 4.4%, Haplogroup G 3.5%, and Haplogroup L 0.9%.

## Introduction

The term Flemings (Dutch: *Vlamingen*) is primarily used to refer to the ethnic group native to Flanders (the northern half of Belgium, historically part of the Southern Netherlands), which in total numbers about 6 million people in Belgium (the majority of the 10 million Belgians). In addition, the term also refers to ethnic Flemings in French Flanders (mainly in the Département du Nord of present-day France), in the southern part of the Dutch province of Zeeland known as Zeeuws-Vlaanderen and in other Flemish communities around the world. The Flemings have their language in common with the Dutch, and thus remain relatively well aware of their northern neighbours with whom they have shared significant parts of their history. It is generally believed, based on historical linguistics, that the Flemings mainly descend from the invading Germanic tribes, rather than from the Gaulish tribes who lived in the same region before Roman times. At first sight, Flemish culture is defined by its West Germanic language, Dutch, as opposed to the language and culture of their mostly Francophone compatriots within Belgium.

The Flemish diaspora consists of Flemish emigrants and their descendants in countries such as France, the United States, Britain, Canada, Indonesia, Australia, South Africa and Latin America.

During the 15th, 16th and 17th centuries, when the territory of present-day Flanders was the setting for an impressive economic and cultural boom, many artists and craftsmen sought to introduce their skills elsewhere, particularly in southern Europe. Flemish settlers introduced the first printing presses into Spain and Portugal. The Flemish contribution to the developing and populating of the Azores was so conspicuous that for a long time the archipelago was referred to as the Flemish Islands.

Following in the wake of the explorers, Flemish missionaries such as Pieter van Gent (1480-1572) in Mexico, Joos de Rijcke (1498-1578) in Ecuador, Ferdinand Verbiest (1623-1688) in China, Constant Lievens (1856-1893) in India, Pierre-Jean De Smet (1801-1873) in the United States, and Jozef de Veuster (1840-1889) in Molokai built a reputation in various overseas countries that continues even to this day.

A combination of a demographic explosion and inadequate economic growth resulted in an emigration from Flanders that started in the mid 19th century and continued up to the First World War. It was something that every family faced sooner or later. Not only did it involve the so-called lower classes of the population, but also non-lower-class people, who found a future overseas in teacher-training colleges and colleges of engineering and agriculture. Louis Cruis, for example, was a Flemish engineer who led expeditions to lay down the boundaries of Brazil and the city limits of the capital, Brasilia.

The destination of the majority of Flemish emigrants was France. There are an estimated 1,250,000 people with a Flemish surname in France. The Nord and Pas-

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de-Calais departments, however, were parts of historic Flanders before France annexed the region in 1656.

In the United States and Canada today, there are more than 1 million Americans who clearly have Flemish roots. In Michigan, the *Gazette van Detroit* is still published by Flemings in Dutch and English (Wikipedia, 2007).

To improve our knowledge of the paternal origins of the Flemish people, we undertook a population genetics study on a representative sample of Flemings. The resulting Y-STR data provide a means to estimate the frequency of the major Y chromosome haplogroups.

## Methods

Buccal swabs were collected from 113 unrelated Flemish males, representing the alleged fathers from paternity cases. Flemish identity was determined by family name and place of birth. Informed consent was obtained, allowing us to use the data for population genetic studies, albeit anonymously.

DNA was extracted using the Qiamp DNA kit (Greenspoon et al, 1998). DNA was amplified using the Power Plex®Y kit following the manufacturer's instructions. This kit coamplifies 12 short tandem repeats (STR) of the Y chromosome, including the markers defined as the "European minimal haplotype" (Gill et al, 2001) (DYS19, DYS385 a/b, DYS389I, DYS389II, DYS390, DYS391, DYS392 and DYS393), plus two loci (DYS438 and DYS439) added to this panel by the SWGDAM (Lee et al, 2004), and DYS437. Amplification products were subsequently analysed by capillary electrophoresis on an ABI 3100 Genetic Analyzer (Mansfield et al, 1998). Alleles were named according to the recommendations of the DNA Commission of the International Society for Forensic Genetics (Bär et al, 1997).

For each of these 12-marker haplotypes, the corresponding Y haplogroup was deduced using Whit Athey's Haplogroup Predictor version 5 (2006).

## Results

The table in the **Appendix** shows the 105 different 12-locus Y-STR haplotypes observed in the sample of 113 Flemings. Of these, 99 haplotypes occurred once, 4 haplotypes were counted twice, and 2 haplotypes were observed in three males.

Concerning the reliability of the haplogroup estimates, the Haplogroup Predictor yielded a median "score" of 67, with a standard deviation of 18. This implies a generally good "fitness" score. Indeed, values above 50

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indicate a "good" fit, while values between 20 and 50 indicate a "fair" fit, according to the program's author. Using the Baysian approach, *a priori* taking into account the northwest European origin of this population, the median posterior probability for the predicted haplotype is 100% (!), with a standard deviation of 5.6%. Another illustration of this issue is the fact that 95 of the 113 Bayesian haplogroup probabilities exceeded 99%.

**Table 1** and **Figures 1 and 2** give the distribution of haplogroups in the sample of 113 Flemish men. The most frequent haplogroup, as is true for all of northwest Europe, is Haplogroup R1b—56.6% of the total. The next most frequent haplogroup at 19.5% was I1a, while third was I1b2a (formerly known as I1c), again in agreement with previous estimates in neighboring populations. Haplogroups E3b, G2, I1b1b, J2a1b, J2a1k, J2b, and L were observed in small numbers (representing 1-5% each). Haplogroups E3a, G5, H, I1b1 (x I1b1b), I1b2 (x I1b2a), J1, J2a1 (x J2a1b, J2a1k), K2, N, Q, and R1a were included in the analysis, but were not detected in the sample. Note that when the haplogroup count in a sample is observed or expected to be only a few, then there is little statistical significance in finding one, two, or three haplotypes in that haplogroup, or in not finding it at all in the sample. This may explain the fact that not a single case of haplogroup R1a was observed in this population sample of modest size.

## Table 1 Distribution of Y-haplogroups in 113 Flemings

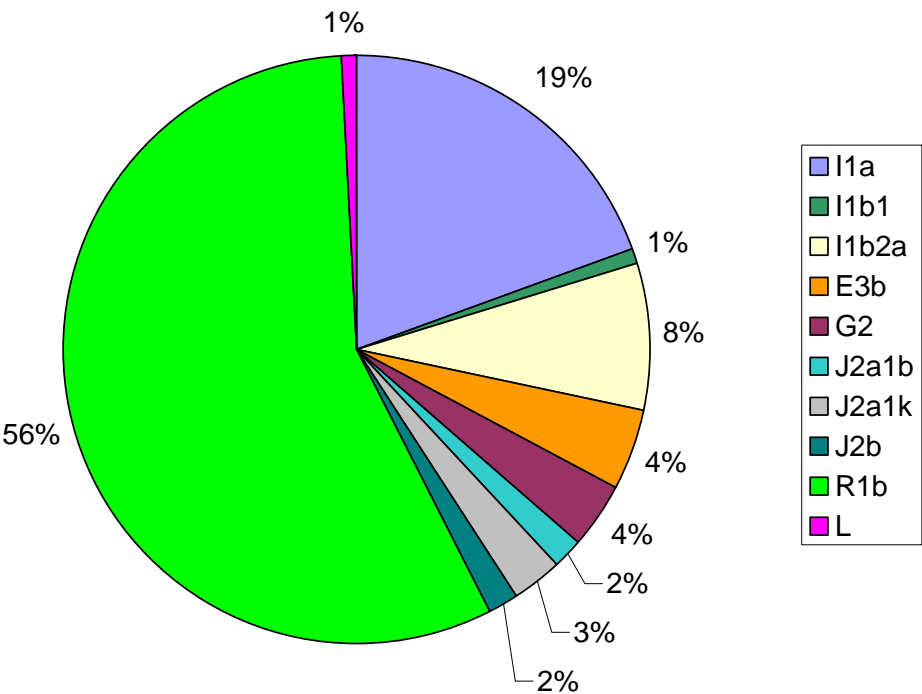| Haplogroup | Number | % |
|---|---|---|
| E3b | 5 | 4.4 |
| G2 | 4 | 3.5 |
| I1a | 22 | 19.5 |
| I1b1 | 1 | 0.9 |
| I1b2a | 9 | 8.0 |
| J2a1b | 2 | 1.8 |
| J2a1k | 3 | 2.7 |
| J2b | 2 | 1.8 |
| L | 1 | 0.9 |
| R1b | 64 | 56.6 |
| | 113 | 100 |

Figure 1  Graphical Representation of Haplogroup Frequencies from Table 1
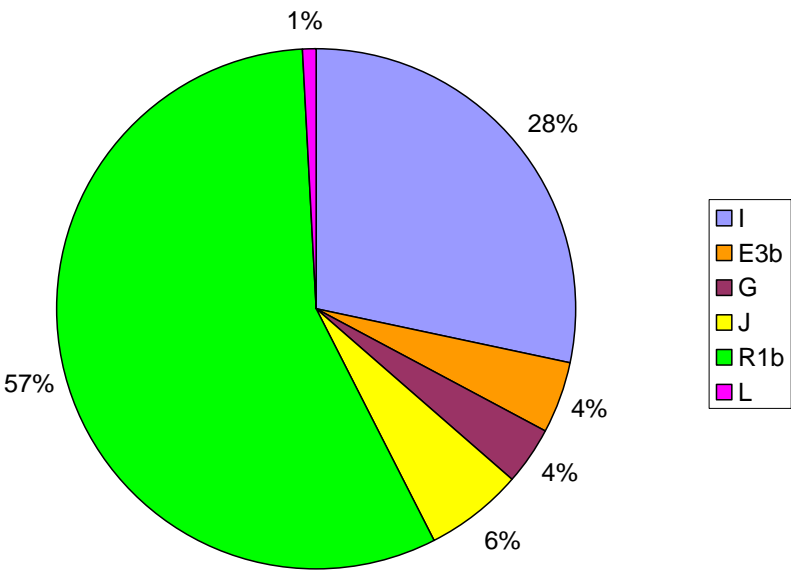


Figure 2  Distribution of Haplogroups Obtained by Lumping Together the Subclades of Haplogroups I and J

## Electronic-Database Information

https://www.hprg.com/hapest5/
                                   Haplogroup Predictor Program

## References

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# Appendix

## Haplotypes of 12 Y-STR Loci in a Sample of 113 Flemish Males

| Haplo type | n | DYS 19 | DYS 385 | DYS 389I | DYS 389II | DYS 390 | DYS 391 | DYS 392 | DYS 393 | DYS 437 | DYS 438 | DYS 439 | Predicted Haplo-Group |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H1 | 1 | 12 | 11, 14 | 13 | 29 | 23 | 10 | 13 | 13 | 15 | 12 | 13 | R1b |
| H2 | 1 | 13 | 12, 15 | 13 | 29 | 22 | 9 | 11 | 13 | 14 | 10 | 12 | *E3b* |
| H3 | 1 | 13 | 13, 14 | 14 | 30 | 24 | 9 | 11 | 13 | 14 | 10 | 10 | E3b |
| H4 | 1 | 13 | 13, 17 | 13 | 30 | 24 | 10 | 11 | 13 | 14 | 10 | 12 | E3b |
| H5 | 1 | 13 | 16, 17 | 13 | 31 | 24 | 10 | 11 | 13 | 14 | 10 | 13 | E3b |
| H6 | 1 | 13 | 16, 18 | 13 | 30 | 24 | 10 | 11 | 13 | 14 | 10 | 13 | E3b |
| H7 | 1 | 14 | 11, 11 | 13 | 29 | 25 | 10 | 13 | 13 | 15 | 12 | 13 | R1b |
| H8 | 1 | 14 | 11, 12 | 13 | 29 | 23 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H9 | 1 | 14 | 11, 13 | 13 | 28 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H10 | 1 | 14 | 11, 13 | 13 | 29 | 23 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H11 | 1 | 14 | 11, 13 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 10 | R1b |
| H12 | 1 | 14 | 11, 13 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H13 | 1 | 14 | 11, 14 | 12 | 28 | 23 | 10 | 11 | 13 | 16 | 10 | 12 | I1a |
| H14 | 1 | 14 | 11, 14 | 13 | 28 | 23 | 10 | 13 | 13 | 15 | 12 | 11 | R1b |
| H15 | 1 | 14 | 11, 14 | 13 | 28 | 24 | 11 | 13 | 13 | 15 | 12 | 14 | R1b |
| H16 | 1 | 14 | 11, 14 | 13 | 29 | 23 | 11 | 13 | 13 | 14 | 12 | 12 | R1b |
| H17 | 1 | 14 | 11, 14 | 13 | 29 | 23 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H18 | 1 | 14 | 11, 14 | 13 | 29 | 23 | 11 | 13 | 14 | 15 | 12 | 12 | R1b |
| H19 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 10 | 13 | 13 | 15 | 13 | 13 | R1b |
| H20 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 12 | 14 | 12 | 11 | R1b |
| H21 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 14 | 12 | 11 | R1b |
| H22 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 14 | 12 | 13 | R1b |
| H23 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H24 | 2 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H25 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 13 | R1b |
| H26 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 13 | 13 | R1b |
| H27 | 1 | 14 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 15 | 15 | 12 | 11 | R1b |
| H28 | 2 | 14 | 11, 14 | 13 | 29 | 25 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H29 | 1 | 14 | 11, 14 | 13 | 29 | 25 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H30 | 1 | 14 | 11, 14 | 13 | 30 | 23 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H31 | 1 | 14 | 11, 14 | 13 | 31 | 24 | 10 | 13 | 13 | 15 | 12 | 11 | R1b |
| H32 | 1 | 14 | 11, 14 | 14 | 30 | 23 | 10 | 13 | 13 | 15 | 12 | 12 | R1b |
| H33 | 1 | 14 | 11, 14 | 14 | 30 | 23 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H34 | 1 | 14 | 11, 14 | 14 | 30 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H35 | 1 | 14 | 11, 14 | 14 | 30 | 25 | 11 | 13 | 14 | 14 | 12 | 13 | R1b |
| H36 | 1 | 14 | 11, 14 | 14 | 31 | 23 | 11 | 14 | 13 | 15 | 12 | 13 | R1b |
| H37 | 1 | 14 | 11, 15 | 13 | 28 | 23 | 10 | 13 | 13 | 15 | 12 | 11 | R1b |
| H38 | 1 | 14 | 11, 15 | 13 | 28 | 24 | 11 | 13 | 13 | 14 | 12 | 12 | R1b |
| H39 | 1 | 14 | 11, 15 | 13 | 29 | 23 | 11 | 13 | 13 | 14 | 12 | 12 | R1b |
| H40 | 1 | 14 | 11, 15 | 13 | 29 | 23 | 11 | 13 | 14 | 14 | 12 | 12 | R1b |
| H41 | 1 | 14 | 11, 15 | 13 | 29 | 23 | 11 | 14 | 13 | 15 | 12 | 12 | R1b |
| H42 | 1 | 14 | 11, 15 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H43 | 2 | 14 | 11, 15 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H44 | 1 | 14 | 11, 15 | 13 | 29 | 24 | 11 | 13 | 13 | 16 | 12 | 11 | R1b |
| H45 | 1 | 14 | 11, 15 | 13 | 30 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |

| Haplo type | n | DYS 19 | DYS 385 | DYS 389I | DYS 389II | DYS 390 | DYS 391 | DYS 392 | DYS 393 | DYS 437 | DYS 438 | DYS 439 | Predicted Haplo-Group |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H46 | 1 | 14 | 11, 15 | 13 | 30 | 25 | 10 | 13 | 13 | 14 | 12 | 12 | R1b |
| H47 | 1 | 14 | 11, 15 | 13 | 31 | 23 | 11 | 13 | 13 | 16 | 12 | 12 | R1b |
| H48 | 1 | 14 | 11, 15 | 14 | 30 | 24 | 10 | 14 | 13 | 15 | 12 | 13 | R1b |
| H49 | 1 | 14 | 11, 16 | 13 | 29 | 23 | 11 | 13 | 14 | 15 | 12 | 12 | R1b |
| H50 | 1 | 14 | 12, 13 | 14 | 31 | 24 | 10 | 13 | 13 | 15 | 12 | 12 | R1b |
| H51 | 1 | 14 | 12, 14 | 12 | 28 | 24 | 10 | 13 | 13 | 15 | 12 | 11 | R1b |
| H52 | 1 | 14 | 12, 14 | 13 | 28 | 23 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H53 | 1 | 14 | 12, 14 | 13 | 29 | 24 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H54 | 1 | 14 | 12, 14 | 13 | 29 | 25 | 11 | 13 | 13 | 14 | 12 | 11 | R1b |
| H55 | 1 | 14 | 12, 15 | 13 | 29 | 25 | 10 | 13 | 13 | 15 | 11 | 12 | R1b |
| H56 | 1 | 14 | 13, 13 | 12 | 28 | 22 | 10 | 11 | 14 | 16 | 10 | 12 | I1a |
| H57 | 3 | 14 | 13, 14 | 12 | 28 | 22 | 10 | 11 | 13 | 16 | 10 | 11 | I1a |
| H58 | 1 | 14 | 13, 14 | 12 | 28 | 22 | 10 | 11 | 13 | 16 | 10 | 12 | I1a |
| H59 | 1 | 14 | 13, 14 | 12 | 28 | 22 | 11 | 11 | 13 | 16 | 10 | 11 | I1a |
| H60 | 1 | 14 | 13, 14 | 12 | 28 | 22 | 11 | 11 | 13 | 16 | 10 | 12 | I1a |
| H61 | 1 | 14 | 13, 14 | 12 | 28 | 22 | 11 | 11 | 14 | 16 | 10 | 11 | I1a |
| H62 | 1 | 14 | 13, 14 | 12 | 28 | 23 | 10 | 11 | 13 | 16 | 10 | 11 | I1a |
| H63 | 1 | 14 | 13, 14 | 12 | 28 | 23 | 10 | 11 | 14 | 16 | 10 | 12 | I1a |
| H64 | 1 | 14 | 13, 14 | 12 | 29 | 22 | 10 | 11 | 13 | 16 | 10 | 12 | I1a |
| H65 | 1 | 14 | 13, 16 | 13 | 29 | 23 | 10 | 11 | 12 | 14 | 9 | 12 | *J2a1b* |
| H66 | 1 | 14 | 14, 14 | 12 | 28 | 22 | 10 | 11 | 13 | 16 | 10 | 12 | I1a |
| H67 | 1 | 14 | 14, 14 | 12 | 28 | 23 | 10 | 11 | 13 | 16 | 10 | 11 | I1a |
| H68 | 1 | 14 | 14, 15 | 12 | 28 | 22 | 10 | 11 | 14 | 16 | 10 | 12 | I1a |
| H69 | 1 | 14 | 14, 15 | 13 | 30 | 24 | 11 | 14 | 13 | 15 | 12 | 12 | R1b |
| H70 | 1 | 14 | 14, 15 | 13 | 31 | 25 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H71 | 1 | 14 | 14, 16 | 13 | 30 | 24 | 10 | 11 | 12 | 15 | 8 | 12 | *J2a1b* |
| H72 | 1 | 14 | 15, 15 | 14 | 32 | 23 | 10 | 12 | 14 | 14 | 10 | 11 | I1b |
| H73 | 1 | 14 | 16, 16 | 11 | 27 | 23 | 10 | 13 | 13 | 16 | 10 | 11 | L |
| H74 | 1 | 14 | 9, 14 | 13 | 29 | 23 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H75 | 1 | 15 | 11, 13 | 13 | 29 | 23 | 10 | 13 | 14 | 15 | 12 | 12 | R1b |
| H76 | 2 | 15 | 11, 14 | 13 | 29 | 23 | 11 | 13 | 13 | 15 | 12 | 11 | R1b |
| H77 | 1 | 15 | 11, 14 | 13 | 29 | 24 | 11 | 13 | 12 | 14 | 12 | 14 | R1b |
| H78 | 1 | 15 | 11, 14 | 13 | 29 | 24 | 12 | 13 | 13 | 15 | 12 | 12 | R1b |
| H79 | 1 | 15 | 11, 14 | 14 | 30 | 24 | 11 | 13 | 14 | 15 | 12 | 11 | R1b |
| H80 | 1 | 15 | 11, 14 | 14 | 31 | 27 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H81 | 1 | 15 | 12, 16 | 13 | 29 | 24 | 9 | 11 | 12 | 14 | 9 | 12 | J2a1k |
| H82 | 3 | 15 | 13, 14 | 12 | 28 | 22 | 10 | 11 | 13 | 15 | 10 | 11 | I1a |
| H83 | 1 | 15 | 13, 14 | 12 | 28 | 22 | 10 | 11 | 13 | 16 | 10 | 11 | I1a |
| H84 | 1 | 15 | 13, 14 | 12 | 28 | 22 | 10 | 11 | 14 | 16 | 10 | 11 | *I1a* |
| H85 | 1 | 15 | 13, 16 | 13 | 29 | 24 | 9 | 11 | 12 | 14 | 9 | 11 | J2a1k |
| H86 | 1 | 15 | 13, 18 | 12 | 29 | 24 | 10 | 11 | 14 | 16 | 10 | 11 | *G2* |
| H87 | 1 | 15 | 14, 14 | 12 | 28 | 22 | 11 | 11 | 13 | 16 | 10 | 11 | I1a |
| H88 | 1 | 15 | 14, 14 | 12 | 29 | 22 | 10 | 11 | 14 | 16 | 10 | 12 | I1a |
| H89 | 1 | 15 | 14, 16 | 12 | 28 | 24 | 10 | 11 | 12 | 15 | 9 | 12 | J2b |
| H90 | 1 | 15 | 15, 16 | 13 | 30 | 23 | 10 | 12 | 15 | 14 | 10 | 11 | I1b2a |
| H91 | 1 | 15 | 15, 16 | 13 | 31 | 23 | 10 | 12 | 13 | 14 | 10 | 12 | I1b2a |
| H92 | 1 | 15 | 15, 17 | 12 | 28 | 23 | 11 | 12 | 14 | 15 | 10 | 11 | I1b2a |
| H93 | 1 | 15 | 16, 16 | 13 | 31 | 23 | 10 | 12 | 13 | 14 | 10 | 12 | I1b2a |
| H94 | 1 | 15 | 16, 18 | 12 | 27 | 24 | 10 | 11 | 12 | 14 | 9 | 11 | J2b |

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| Haplo type | n | DYS 19 | DYS 385 | DYS 389I | DYS 389II | DYS 390 | DYS 391 | DYS 392 | DYS 393 | DYS 437 | DYS 438 | DYS 439 | Predicted Haplo-Group |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H95 | 1 | 15 | 17, 17 | 14 | 31 | 22 | 10 | 12 | 14 | 14 | 10 | 11 | *I1b2a* |
| H96 | 1 | 16 | 11, 14 | 13 | 29 | 23 | 10 | 13 | 13 | 15 | 12 | 11 | R1b |
| H97 | 1 | 16 | 11, 15 | 12 | 28 | 21 | 11 | 11 | 14 | 16 | 10 | 11 | G2 |
| H98 | 1 | 16 | 11, 16 | 14 | 30 | 23 | 11 | 13 | 13 | 15 | 12 | 12 | R1b |
| H99 | 1 | 16 | 12, 13 | 12 | 28 | 22 | 10 | 11 | 13 | 16 | 10 | 11 | I1a |
| H100 | 1 | 16 | 14, 14 | 12 | 29 | 23 | 10 | 12 | 15 | 15 | 10 | 10 | *I1b2a* |
| H101 | 1 | 16 | 14, 17 | 12 | 28 | 22 | 10 | 10 | 14 | 16 | 10 | 12 | G2 |
| H102 | 1 | 16 | 14, 17 | 13 | 30 | 24 | 9 | 11 | 12 | 14 | 9 | 12 | J2a1k |
| H103 | 1 | 16 | 14.2, 16 | 14 | 30 | 23 | 10 | 12 | 13 | 15 | 10 | 11 | I1b2a |
| H104 | 1 | 16 | 15, 15 | 13 | 29 | 23 | 11 | 12 | 13 | 14 | 10 | 11 | I1b2a |
| H105 | 1 | 17 | 12, 12 | 13 | 28 | 23 | 10 | 11 | 13 | 15 | 10 | 12 | I1b1b |

NOTE:  It is sometimes difficult to distinguish G2 from I1a using this 12-marker set, and there were two haplotypes (H84 and H86) that could possibly be either G2 or I1a.  One was called as G2 and one as I1a.  Haplogroup predictions for haplotypes where the Bayesian probability was less than 90% (but all were greater than 60%) are shown in *red* and *italics*