The development of interactive maps to further describe Y and mtDNA haplogroups a new educational tool

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ABSTRACT

Background: Mitochondrial DNA and Y chromosome haplogroup maps can provide visual depictions of the geographical distributions of known haplogroups. 14 peer-reviewed publications were reviewed and a database was developed of 109 different populations each being evaluated for their proportional makeup from any of 18 primary Y haplogroups. Latitude and longitude coordinates for each population were determined from the original location of the samples used in each publication. In the database, haplogroup percentages were assigned to a relevant global geographic coordinate using the Boundary Map feature of Mapview software. Through the global coordinates the haplogroups could be populated on maps with geographical associations. Ultimately, 540 data points were used to create 26 Y haplogroup maps (18 world gradient maps, 7 continental pie maps and 1 world pie map). Utilizing the same method, a database of 96 different mtDNA populations was constructed, each being evaluated for 27 primary mtDNA haplogroups according to 25 peer-reviewed articles. This resulted in 790 data points used in the creation of 34 mtDNA haplogroup maps (27 world gradient maps, 6 sub-continental pie maps and 1 world pie map).

Validation: Data within the newly constructed database were verified against the Haplogroup specifications defined by YCC (Y Chromosome Consortium) for Y haplogroups and PhyloTree for mtDNA haplogroups.

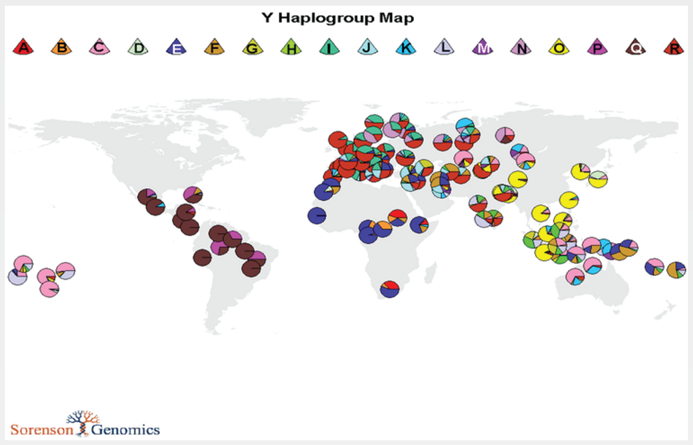
Map descriptions: a) Gradient maps were developed to exhibit the approximate geographical distribution of a specific haplogroup using representative color intensity; b) Continental/sub-continental pie maps were created to show the percent makeup of each haplogroup in association with other haplogroups for a specific region; c) World pie maps were created to demonstrate the percent makeup of each haplogroup in association with other haplogroups for the entire world.

Features: Special features were designed to allow viewers to navigate the maps without the need of returning to the home map. 1) Clicking map graphics to view corresponding gradient maps; 2) Clicking the title or space between letters allows one to observe the world pie map; 3) When viewing the world pie map, users can select continental/sub-continental areas to view continental/sub-continental pie maps.

Conclusion: This educational tool provides 60 data-dependent maps of Y and mtDNA haplogroups with convenient navigation features.

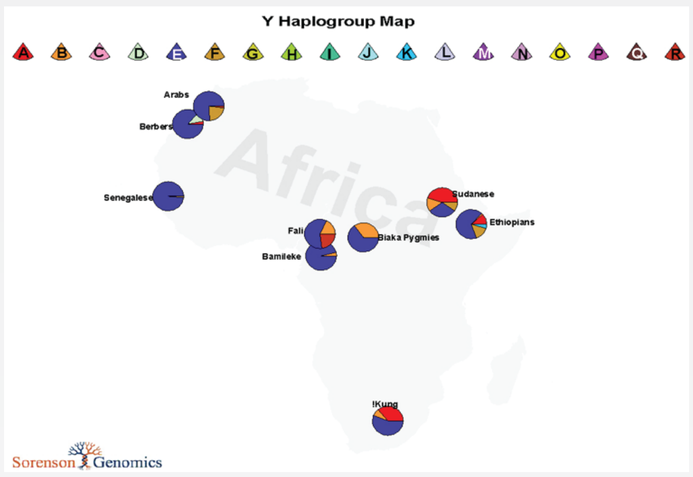
Y Haplogroup Maps

Figure 1: World pie map demonstrates the % makeup of each haplogroup in association with other haplogroups for the entire world



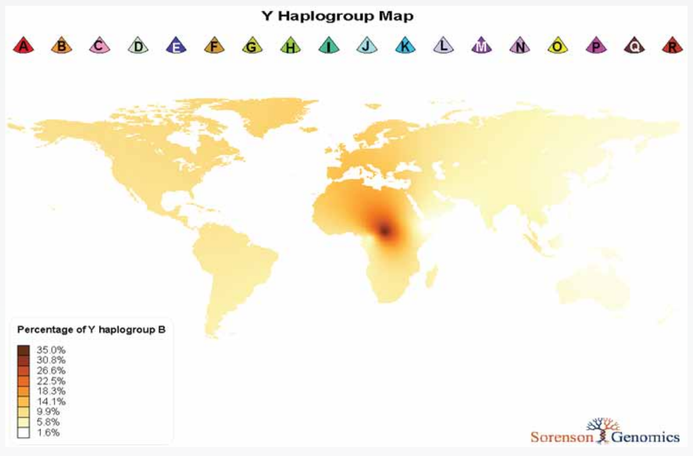
Features: Click continental/sub-continental areas to observe continental/sub-continental pie maps; Click a letter to view the corresponding haplogroup gradient map.

Figure 2: Continental/sub-continental pie maps show the % makeup of each haplogroup in association with other haplogroups for the specific region.



Features: Click the title "Y Haplogroup" or space between the letters to observe the world pie map; Click a letter to view the corresponding haplogroup gradient map.

Figure 3: Gradient maps exhibit the approximate geographical distribution of a specific haplogroup using representative color intensity.



Features: Click the title "Y Haplogroup" or space between the letters to observe the world pie map; Click a letter to view the corresponding haplogroup gradient map.

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INTRODUCTION

Mitochondrial DNA and Y chromosome haplogroup maps can provide visual depictions of the geographical distributions of known haplogroups. The interactive maps developed provide a powerful tool to educate with convenient manipulating features.

METHODS/RESULTS

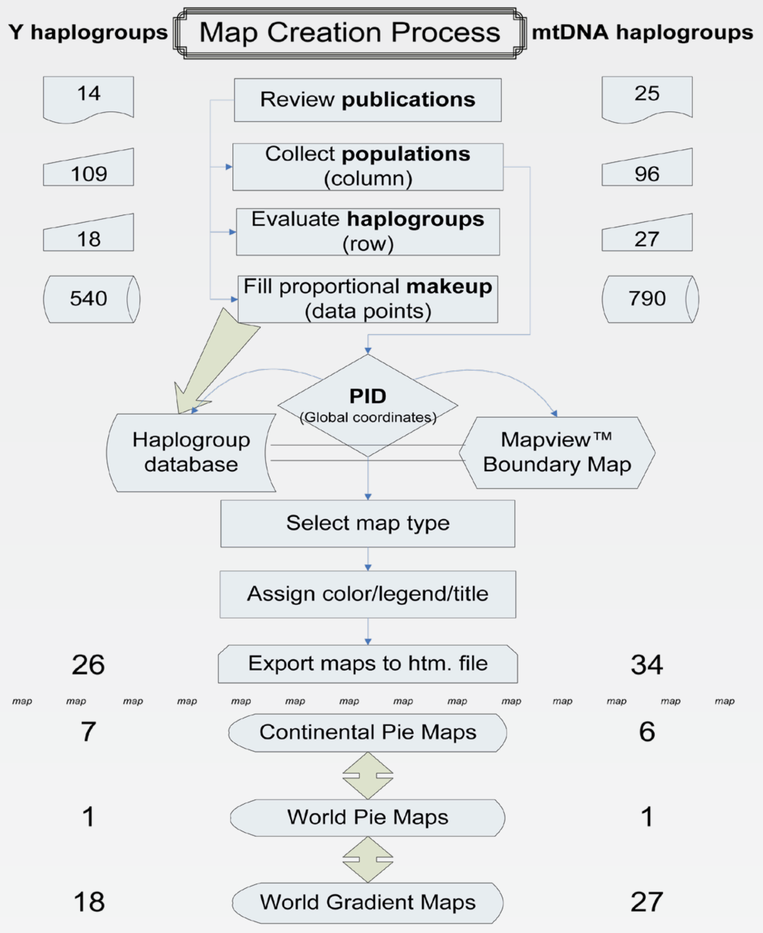

Table: a portion of Y haplogroup database

PID	Haplogroup Population	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	total	Longitude	Latitude	Reference
Cameroon north	Fali		18.00			59.00													23.00	100.00	13.4	7.32	*A Back Migratio*
Cameroon south	Bamileke		4.00			96.00														100.00	13.28	3.12	*A Back Migratio*
Central African re	Biaka Pygmies		35.00			65.00														100.00	2.94	6.61	*A Back Migratio*
Morocco_Arabs	Arabs					76.00	22.00												2.00	100.00	-7.93	31.79	*A Back Migratio*
South Africa	!Kung	36.00	8.00			56.00														100.00	22.94	-3.56	*A Back Migratio*
Morocco_Berbers	Berbers	3.00			11.00	87.00														101.00	-1.88	28.35	*A Back Migratio*
Vanuatu	Vanuatu			18.00		15.00	6.00		3.00				3.00							**45.00**	166.96	-15.38	*A Predominantly*
Mataram	Mataram			12.00	2.00	5.00	14.00	4.00	17.00				1.00							**55.00**	116.13	-8.59	*A Predominantly*
Fiji	Fiji			3.00		15.00	41.00		6.00				9.00							**74.00**	179.41	-16.58	*A Predominantly*
Atiu	Atiu (southern cooks)			84.00	3.00		1.00						3.00							**91.00**	-158.17	-28.37	*A Predominantly*

VALIDATION

Data within the newly constructed database were verified against the Haplogroup specifications defined by YCC (Y Chromosome Consortium) for Y haplogroups and PhyloTree for mtDNA haplogroups.

CONCLUSION

This educational tool provides 60 data-dependent maps of Y and mtDNA haplogroups with convenient navigation features.

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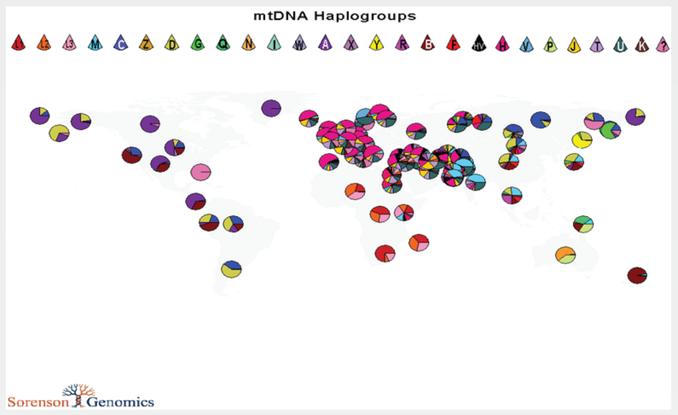
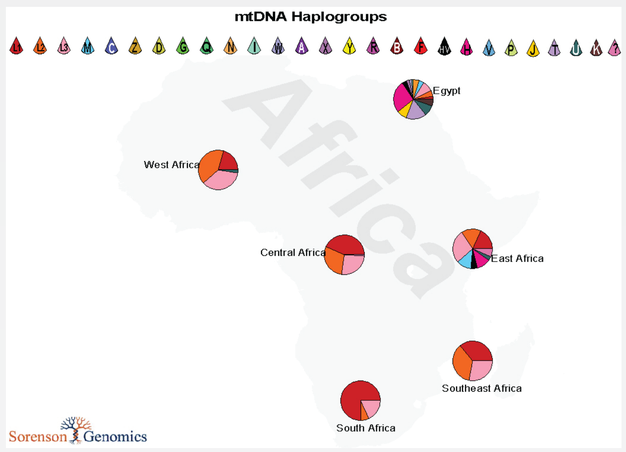
mtDNA Haplogroup Maps

Figure 1: World pie map demonstrates the % makeup of each haplogroup in association with other haplogroups for the entire world



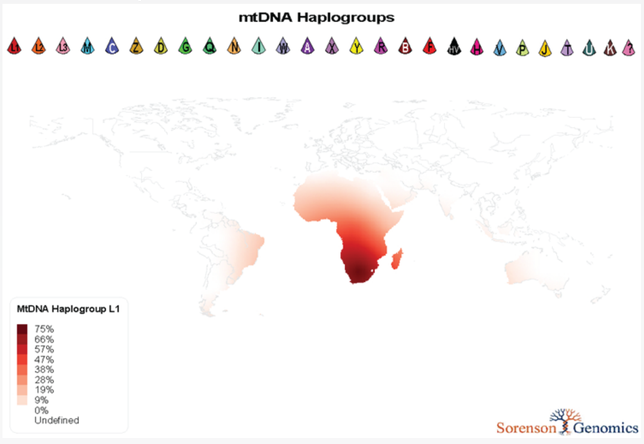
Features: Click continental/sub-continental areas to observe continental/sub-continental pie maps; Click a letter to view the corresponding haplogroup gradient map.

*Figure 2: **Continental/sub-continental pie maps** show the % makeup of each haplogroup in association with other haplogroups for the specific region.*



Features: Click the title "Y Haplogroup" or space between the letters to observe the world pie map; Click a letter to view the corresponding haplogroup gradient map.

Figure3: Gradient maps exhibit the approximate geographical distribution of a specific haplogroup using representative color intensity.



Features: Click the title "Y Haplogroup" or space between the letters to observe the world pie map; Click a letter to view the corresponding haplogroup gradient map.

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