

mtDNA Haplogroup Specific Control Region Mutation Motifs

African Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
L0a	16129-16148-16172-16187-16188G-16189-16223-16230-16311-16320	93-185-189-236-247	<i>523d-524d</i>
L0a1	16129-16148-16168-16172-16187-16188G-16189-16223-16230-16311-16320	93-185-189-(236)-247	<i>523d-524d</i>
L0a1a	16129-16148-16168-16172-16187-16188G-16189-16223-16230-16278-16311-16320	93-95C-185-189-236-247	<i>523d-524d</i>
L0a2	@16129-16148-16172-16187-16188G-16189-16223-16230-16311-16320	93-152-189-236-247	<i>523d-524d</i>
L0d	(16129)-(16187)-16189-16223-16230-16243-16311	189-247	
L0f	16169-16187-16189-16223-(16230)-16278-16311-16327	189-247	<i>16368</i>
L0k	16172-16187-16189-16209-16214-16223-16230-16278-16291G-16311	146-189-195-198-207-247	
L1b	16126-16187-16189-16223-16264-16270-16278-16311	182-185T-195-247	<i>357, 523d-524d</i>
L1b1	16126-16187-16189-16223-16264-16270-16278-16293-16311	(182)-185T-(195)-247	<i>357, 523d-524d</i>
L1c	(16129)-16189-(16223)-16278-16311	152-182-186A-189C-247(or 247d)-316	<i>523d-524d</i>
L1c1	16129-16189-(16223)-16278-16293-16360	(151)-152-182-186A-189C-247(or 247d)-316	<i>523d-524d</i>
L1c2	16129-16187-16189-(16223)-16265C-16278-16286G-16294-16311-16360	151-152-182-186A-189C-198-247-316	<i>523d-524d</i>
L1c3	16129-16189M-16215-(16223)-16278-16294-16311	151-152-182-186A-189C-247-316	<i>523d-524d</i>
L5a	16129-16148-16166-16189-16223-16278	247	
L5a1	16129-16148-16166-16189-16223-16278-16355-16362	247	
L5a2	16129-16148-16166-16189-16223-16278-16360	247(or 247d)	
L5b	16093-16129-16166-16172-16209-16213-16223-16278-16295	247	
L2a	16223-16278-16294	146-152-195	<i>16390</i>
L2a1	(16223)-16278-(16294)-16309	146-152-195	<i>16390</i>
L2a1a	16223-16278-16286-16294-16309	146-152-195	<i>16390</i>
L2a1b	16223-16278-16290-16294-16309	146-152-195	<i>16390</i>
L2b	16114A-16129-16213-16223-16278	146-150-152-182-195-198-204	<i>16390</i>
L2b1	16114A-(16129)-16213-16223-16278-16362	150-(152)-182-195-198-204	<i>16390</i>
L2c	16223-16278	146-150-(152)-182-(195)-325	<i>16390</i>
L2c1	16223-16278-16318	(146)-150-(152)-182-195-198-325	<i>16390</i>
L2c2	16223-16264-16278	93-146-150-152-182-195-198-325	<i>16390</i>
L2d1	16129-16189-16278-16300-16354	146-150-195	<i>16390-16399</i>
L2d2	16111A-16145-16223-16239-16278-16355	146-(150)-182	<i>16390-16399</i>
L6	16048-16223-16224-16278		
L3b	16124-16223-(16278)-(16362)		<i>523d-524d</i>
L3b1	@16124-16223-16278-16362		<i>523d-524d</i>
L3b2	16124-16223-16278-16311-16362		<i>523d-524d</i>

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
L3d	16124-16223	152	<i>523d-524d</i>
L3d1	16124-16223-16319	152	<i>523d-524d</i>
L3d2	16124-16223-16256	152	<i>523d-524d</i>
L3d3	16124-16189-16223-16278-16304-16311	152	<i>523d-524d</i>
L3e1	16223-16327	150-189	
L3e1a	16185-16223-16327	150-189	
L3e1b	16223-16325d-16327	150-189	
L3e2	16223-16320	150	
L3e2a	16223-16320	150-195-198	<i>499</i>
L3e2b	16172-16189-16223-16320	150-195	
L3e2b1	16172-16183C-16189-16223-16320	150-152-195	
L3e3	16223-16265T	150-195	<i>523d-524d-573.pC</i>
L3e4	16051-16223-16264	150	<i>523d-524d</i>
L3i	16153-16223-16319	150	
L3x1	16169-16223-16278	150	
L3x2	16169-16193-16195	150	
L3f	16209-16223-16311		
L3f1	16209-16223-16292-16311	189	
L3f1a	16129-16209-16223-16292-16295-16311	189-200	
L3h	16223-16256A-16311	189C-195	
L3w	16223-16260-16311	150-152	
L4*	16179-16189-16223-16239-16311-16320-16362	150-199	
L4a	16223-16260-16311-16362		
L4g	16223-16293T-16311-16355-16362	146-244	<i>16399</i>
M1	16129-16189-(16223)-16249-16311	195	<i>16519, 489</i>
U6	16172-16219		
U6a	16172-16219-16278		
U6b	16172-16219-16311		
U6c	16169-16172-16189	150	<i>437-523d-524d</i>

*For each mtDNA haplogroup, 73, 263, 315.1 and insertions in the HV2 poly-C stretch were ignored; all mutations are transitions unless exact nucleotide is brought out, suffix "d" indicates deletion and "." + a number (or p) + suffix indicates insertion; mutation sites which have been found in the majority, but not all samples from a respective haplogroup are given in parentheses; prefix "@" indicates back mutation; mtDNA haplogroups which need mutation motif outside of HV1 and HV2 region to estimate their own haplogroups are shown in italics.

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West Eurasian Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
R0a	16126-16362		64
HV*	16223	235	523d-524d
HV0	16298	72	
HV1	16067		
HV2	16217		
H		(73A)	
H1a	16162	@73	16519
H1b	16189-16356		16519
H1f	16093-16189		
<i>H1c</i>			16519, 477
H1c1	16263		16519, 477
<i>H1d</i>			456
H2a	16235-16291		
H2a1	16354		
H2a3	16274		
H3a	16239G	152	
H5	16304		456
H5	16070		456
H6	16362	239	16482
H7*	16172-16173		16519
H8	16288-16362	146	
H9	16168		
H10	16114		
H11	16311	195	
H11a	16293-16311	195	
H12	16287	195	
H13a*	16218-16278	93	
H13a2	16148-16256-16319	189-193-249	
H14a	16256-16352		
<i>H15</i>			55-57
H19	16145-16227		
H20	16218-16328A		
T	16126-16294		16519
T1	16126-16163-16186-16189-16294		16519
T1a	16126-16163-16186-16189-16294	152-195	16519
T1b	16126-16163-16189-16243-16294		16519
T2	16126-16294-16296		16519
T2*	16126-16292-16294		16519
T2b	16126-16294-16296-16304		16519
T2d	16126-16182C-16183C-16189-16294-16296-16298	195	16519
J	16069-16126	295	489
<i>J1</i>	16069-16126	295	462-489
J1a	16069-16126-16145-16222-16235-16261-16271	295	462-489
J1b	16069-16126-16145-16222-16261	295	462-489
J1b*	16069-@16126-16145-16261	151-152-295	462-489
J1b1	16069-16126-16145-(16172)-16261	242-295	462-489
J1b2	16069-16126-16145-16261	271-295	462-489
J1c	16069-16126	228-295	462-489
<i>J1c1</i>	16069-16126	228-295	462-482-489
J2	16069-16126	150-152-295	489
J2a	16069-16126-16145-16231-16261	150-152-195-215-295	489
J2b	16069-16126-16193	150-(152)-295	489
U1	16249	285	
U1a	16189-16249	285	
<i>U1a1</i>	16189-16249	285	385, 523d-524d
U1b	16111-16249-16311-16327	146-195-279-285	

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
U2	16051		
U2d	16051-16189-16234-16294	152-199	<i>16519, 471</i>
U2e	16051-16129C-16189-(16362)	152-217	<i>16519, 508</i>
U3	16343	150	
<i>U3a</i>	16343	150	<u><i>16390</i></u>
<i>U4/U9</i>			<u><i>499</i></u>
U4	16356	195	<i>16519, 499</i>
U4a1	16134-16356	152-(195)	<i>16519, 499</i>
U4a2	(16356)	195-310	<i>16519, 499</i>
U9a	16051-16278		<i>499</i>
U9b	16242	195	<i>499-573.pC</i>
U5	16270		
U5a	16256-16270		
<i>U5a1</i>	16256-16270		<u><i>16399</i></u>
U5b	16270	150	
U5b1a	16189-16270	150-217	
U5b1b	16189-16270	150	
U5b1c	16192-16311	150	
<i>U5b2*</i>	16189-16192-16270	150	<u><i>16398</i></u>
U7	16318Y	152	
U8a		282	
U8a1	16146-16342	282	
U8b	16189-16234		
K	16224-16311		<i>16519</i>
<i>K1a</i>	16224-16311		<i>16519, 497</i>
<i>K1a9</i>	16093-16224-16311	195	<i>16519-16524, 497</i>
K1b2	16224-16311	146-195	<i>16519</i>
K1c	16224-16311	146-152	<i>16519, 498d</i>
K2	16224-16311	146	<i>16519</i>
K2a	16224-16311	146-152	<i>16519</i>
<i>K2a2a</i>	16224-16311	146-152	<i>16519, 512C</i>
R1	16278-16311		
R2	16071	152	<i>16519</i>
I	16129-16223	199-204-250	<i>16391-16519</i>
I1	16129-16223-16311	199-204-250	<i>16391-16519, 573.pC</i>
I1a	16129-16172-16223-16311	199-203-204-250	<i>16391-16519, 455.1-573.pC</i>
I3	16129-16223	152-199-204-207-250	<i>16391-16519, 573.pC</i>
I4	16129-16223-16304	199-204-250	<i>16391-16519, 573.pC</i>
N1a	16147A-16172-16223-16248-16320-16355	152-199-204	<i>16519</i>
N1d	16223-16301-16356	199-204	<i>16519</i>
N1b	16145-16176G-16223		<i>16519</i>
<i>N1b1</i>	16145-16176G-16223		<u><i>16390-16519</i></u>
N1c	16201-16223-16265		
N2a	16153-16223	189-199	
W	16292-16223	189-195-204-207	<i>16519</i>
W3	16292-16223	189-194-195-204-207	<i>16519</i>
X	16189-16278		<i>16519</i>
X1	16189-16278	146-153	<i>16519</i>
X2	16189M-16278	195	<i>16519</i>
X2a	16189-16213-16223-16278	153-195-200	<i>16519</i>
X2b	16189-16223-16278	(153)-195-225-226	<i>16519</i>
X2c	16183C-16189-16223-16255-16278	153-195-225-(227)	<i>16519</i>
X2e	16189A-16223-16278	153-195-225	<i>16519</i>
X2d	16189-16223-16278	@153-195-(204)-207	<i>16519</i>
X2f	16189-16223-16278	153-195-257	<i>16519</i>

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South Asian (Indian) Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
M2a	16223-16270-16319-16352	204	447G-489
M2b	16223-16274-16319		447G-489
M3	16126-16223		482-489
M4a	16145-16223-16261-16311		489
M4b	16223-16311		489-511
M5	16129-16223		489
M5*	16129-16223-16230-16233-16304		489
M5a	16129-16223-16291		16519, 489
M6	16223-16231-16362		461-489
M25	16223-16304		489
M18	16223-16318T	194-246	489
M38	16223	189-246	489
M30	16223	195A	489-523d-524d
M31a	16223-16311	249d	16519, 489
M31b	16126-16136-16223	152	16519, 489
M31c	16136-16223-16311	188-234-282	16519, 489
M32	16223-16319-16344-16357	195-207	16526, 489
M33a*	16223-16316	150-293	489
M33b	16223-16324		489
M34	16223-16249		489-569
M35	16223	199	489
M35a	16093-16223	199	482-489
M36	16223	239	489
M37a	16223	151-152	489
M39	16223		55.1T-65.1T-66T, 489
M40	16223		16463, 489
M40a	16179-16223-16294	200	16463, 489
M41	16223-16327-16330		375-489
M48	16223-16225-16234	199	16390, 489
M49	16153-16223-16234		489
M50	16166C-16223-16263-16309		489
U2	16051		
U2a	16051-16206C		
U2b	16051	146	
U2c	16051-16234	152	
R5	16266-16304		16524, 523d-524d
R6	16274-16362	195	
R7	16260-16261-16319-16362		16519
N5	16111-16311		

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East Asian Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
D4/G	16223-16362		489
D1	16223-16325-16362		489
D4a	16129-16223-16362	152	(16519), 489
D4a3	16129-16223-16249-16362	152	16519, 489
D4b1	16223-16319-16362		489-523d-524d
D4b2a	16223-16355-16362	280	489-523d-524d
<i>D4b2a</i>	16223-16362	199	489-523d-524d
D4b2b	(16223)-16362	194	16519, 489-523d-524d
D4c	16245-16362		489
D4e1	16223-16362	94	489
D2	16129-16223-16271-16362		489
D4e2	16223-16256-16362		489
D4g1	16223-16278-16362		489-573.pC
D4g2	16362	195-298	489
D4h1	16174-16223-16362	146-183	489
D4h2	16174-16223-16311-16362	152	489
D4i	16223-16294-16362		489
D4j1	16184-16223-16311-16362		489
D4j2	16223-16293-16362		489
D4k	16192-16223-@16362	195	489
<i>D4l</i>	16145-16223-16362		16368, 489
D4m	16244-16362		489
D4n	16223-16355A-16362		489
D4o	16223-16290-16362	195	489
D5	16189-16223-16362	150	489
D5a1	16182C-16183C-16189-16223-16362	150-309d	16390, 68, 489
D5a2	16182Y-16183C-16189-16223-16266-16362	150	489-523d-524d
<i>D5b</i>	16189-16223-16362	150	456-489
D5c	16188.1C-16193.1C-16362	150-152	489
D5d	16148-16189-16223-16362	150	489
D6a	16189-16223-16274-16362	146	489
G1a1	16223-16325-16362	150	16519, 489
G1a2	16184-16223-16290-16362	150	489
G1a3	16184-16214-16223-16362		489
<i>G1b</i>	16129-16223-16362		16017, 489
G2a	16189-16223-16278-16362		489
G2a1	16223-16227-16278-(16362)		489
G2a2	16051-16150-16223-16278-16362		489
G2a3	(16189)-16223-16278-16362	260	489
G2a4	16204-16223-16278-16362	146-152	489
G2b	16172-16223-16362	263A	489
G2c	16093-16223-16278-16303-16311-16362		64, 489
G3a	16223-16274-(16362)	143-(152)	489
G3b1	16223-16274-16362	195	489
G4	16114A-16223-16362	191.1A	489
M7a	16209-16223		489
M7a1	16209-16223-16324		489-(523d-524d)
M7a2	16140-16209-16223	146	489
M7b	16223-16297	150-199	489
M7b1	16129-16192-16223-16297	150-199	489
M7b2	16129-16189-16223-16297-16298	150-199	489
M7d	16129-16152-16179-16192-16223	@199	489

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
M7c	16223	146-199	16519, 489-523d-524d
M7c1	16223-16295	(146)-199	16519, 489-523d-524d (or 513d-514d)
M7c3	@16223	146A-199	489-523d-524d
M8	16223-16298		489
M8a	16223-16298-16319		489
M8a1	16223-16298-16319-16311		489
M8a2	16184-16223-16298-16319		489
CZ	16223-16298	249d	489
C	(16223)-16298-16327	249d	16519, 489
C1	(16223)-(16298)-16325-16327	249d-290d-291d	16519, 489-523d-524d
C1a	16223-16298-16325-16327-16356	93-249d-290d-291d	16519, 489-523d-524d
C1b	(16223)-(16298)-16325-16327	249d-290d-291d	16519, 489-493-523d-524d
C1c	16223-16298-16325-16327	249d-290d-291d	16519, 489-@523d-@524d
C1d1	16051-16188-16204-16223-@16298-16325-16327-16362	249d-290d-291d	16519, 489-523d-524d
C1d2	16051-(16223)-(16298)-16325-16327	194-249d-290d-291d	16519, 489-523d-524d
C5	16223-16288-16298-16327	249d	16519, 489
pre-Z	16223-16260-16298	152-249d	489
Z	16185-16223-16260-16298	152-249d(or 247d)	489
Z*	16185-16223-16260-16294-16298	150-249d	489
E1a1a	16223-16362-16291		16390, 489
E1a2	16223-16362		16390, 373, 489
E1b	16223-16261-16362	152	16390, 489
E2	16051-16223-16362	195	16390, 489
M9a*	16223-16234-16362	153	489
M9a	16223-16234-16316-16362		489
M9b	16051-16209-16223-16362		489-573.pC
M10	16223-16311		489-573.pC
M10a	16129-16223-16311-16357		16497, 489 523d-524d-573.pC
M10b	16066-16223-16311		489-573.pC
M11	16223	215-318-326	489
M12	16223-16234-16290		489
M13	16145-16188-16223	152	489
F	16304	249d	
F1ac	16129-16304	249d	16519, 523d-524d
F1a	16129-16172-16304	249d	16519, 523d-524d
F1a1	(16129)-16162-16172-(16304)	249d	(16519), 523d-524d
F1a2	16172-16304	249d	16465-16519, 523d-524d
F1a3	16172-16284-16304-16311	249d	16390-16519, 523d-524d
F1c	16111-16129-16304	152-249d	16519, 523d-524d
F1bd	(16183C)-16189-16304	249d	16519, 523d-524d
F1b	(16182C)-16183C-16189-16232A-16249-16304-16311	249d	(16519), 523d-524d
F1d	16189-16304	146-249d	16519, 523d-524d
F2*	@16304	235-249d	

Haplogroup	HV1	HV2	HV3 etc.
F2a	16291-16304	249d	
F2b	16203-16304	249d	
F3a	16298-@16304-16355-16362	249d	
F3b	16220C-16298-@16304-16362	249d	
F4a	16207-16304-16362	146-249d	16399
F4b	16218-16304-16311	249d	573.pC
R9b	16304-16309		16390
R9c	16157-16304		
R11	16183C-16189-16311	185-189	16519
B4	16183C-16189-16217		
B4a	16182C-16183C-16189-16217-16261		(16519), 523d-524d
B4a1a	16182C-16183C-16189-16217-16261	146	(16519), 523d-524d
B4a1b	16182C-16183C-16189-16217-16261-16268-16288		(16519), 523d-524d
B4g	16182C-16183C-16189-16217-16261-16292		16519, 523d-524d
B4b	16183C-16189-16217		16519, 499
B4b1	16136-16183C-16189-16217		16519, 499
B2a	16111-16183C-16189-16217		16483-16519, 499
B2c	16182C-16183C-16189-16217		16519, 499
B4d1	16183C-16189-16217	316	
B4d3	16183C-16185-16189d-16217-16234		546
B4c1a	16183C-16189-16217-16311		
B4c1b	16140-16183C-16189-16217-16274	150	
B4c1c	16183C-16189-16217-16311	150-195-214	
B4c2	16147-16184A-16189-16217-16235		
B4f	16168-16172-16183C-16189-16217-16249-16325	200	16390
B5	16140-16189		16519, 523d-524d
B5a	16140-16189-16266R	210	16519, 523d-524d
B5a2	16129-16140-16187-16189-16266R	93-210	16519, 523d-524d
B5b	16140-16183C-16189-16243		16519, 523d-524d (or 513d-514d)
B5b2	16111-16140-16183C-16189-16234-16243		(16463)-16519, 523d-524d
B5b3	16140-16183C-16189-16243-16256	103-189-199-203-204	16519, 523d-524d
B6	16093-16179-16189	150	
A	16223-16290-16319	235	
A4	16223-16290-16319-16362	235	523d-524d
A2	16111-16223-16290-16319-(16362)	146-(235)	64, 523d-524d
A4a	16223-16249-16290-16319-16362	(235)	523d-524d
A4b	16189-16223-16290-16319-16362	235	523d-524d
A4c	16223-16290-16319-16362	200-235	523d-524d
A4d	16223-16290-16319-16362	151-235	523d-524d
A5a	16187-16223-16290-16319	235	523d-524d
A5b	16126-16223-16235-16290-16319	235	
A5c	16129-16213-16223-16290-16319	152-235	@523d-@524d
A7	16051-16223-16290-16319	152-235	523d-524d
A8	16223-16242-16290-16319	146-152-(235)	64, 523d-524d
N9a	16223-16257A-16261	150	
N9a1	16111-16129-16223-16257A-16261	150	
N9a3	16129-16223-16257A-16261	150	
N9a2	16172-16223-16257A-16261	150	
N9a2ab	16172-16223-16257A-16261	150	16497
N9a4	16145-16172-16223-16245-16257A-(16261)	150	524.1A-524.2C
N9a5	16172-16189-16209-16223-16257A-16261	150	
N9a6	16223-16257A-16261-16292	150	

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
N9b	16183C-16189-16223		16519
N9b2	16183C-16189-16223-16294-16309		16519
Y	16126-16231		
Y1	16126-16231-16266		
Y1b	16126-16231-16266	146	16519
Y2	16126-16231-16311		482

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Southeast Asian Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
M21ab	16093-16129-16223		489
M21a	(16093)-16129-16223-16256-16271-(16362)		489
M21b	(16093)-(16129)-16223-16263		16381, 489
M21c	16223-16242-16319		489
M21d	16192-16223-16291-16304		489
M22	16223-16290-16304		489
M45/M7a	16209-16223		489
M45a	16129-16209-16223-16272	152-225-249d-316	489
M45b	16189-16209-16223		489
M46	16223-16278		489
M46*	16140-16172-16189-16223-16278	249	489-523d-524d
M47	16129-16166C-16189-16223-16233-16287-16319		489
R9*	16304-16362		
R21	16168-16295-16304		
R22	16249-16288-16304		
R23	16256-16290		16465
N21	16193-(16223)-16291		
N22	16168-(16223)-16249		

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South Pacific Haplogroup

Haplogroup	HV1	HV2	HV3 <i>etc.</i>
M27a	16048-16077T-16172-16223-16311-16320	195-234	489-537
M27b	16209-16223-16299	152	16390, 489
M27c	16223-16301-16304	146-186	489
M28	16148-16223-16362	152-195	16468, 489
M28a	16086-16129-16148-16223-16362	152-195	16468, 489
M28b	16148-16223-16362	94-152-195-204	16468, 489
M29	16189-16223-16311	151-152-211	464-489-513
M29a	16189-16223-16311	151-152-211-310	464-489-513
M29b	16189-16223-16294-16311	151-152-211	464-489-513
M42	16223-16287-16356		489
Q	16129-16223-16241-16311		489
Q1	16129-16144-16148-16223-16241-16265C-16311-16343	89-92-146	489
Q2	16066-16129-16223-16241-16311	195-228T	489
Q3	16129-16223-16241-16311	143	489
P1	16176-16266-16357	212	
P2	16188-16278-16357	103-143	16497
P3		127-128	573.pC
P4a	16319	152	507-517
P4b	16274-16291		
P6	16311-16362		
S1	16075		
S3	16140-16187-16189-16287-16311	151-152-195	63-64-66
N12	16213		

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