

1 **Supplementary file**

2

3 **Exploring Nanopore direct sequencing performance of forensic STRs, SNPs, InDels, and DNA**
4 **methylation markers in a single assay**

5

6

7 ***Supplementary methods***

8 *Cohort description:* DNA was extracted from six anonymous male individuals with a chronological age of
9 19 to 53 years at the time of sample collection. The details per sample are described in Table S1.

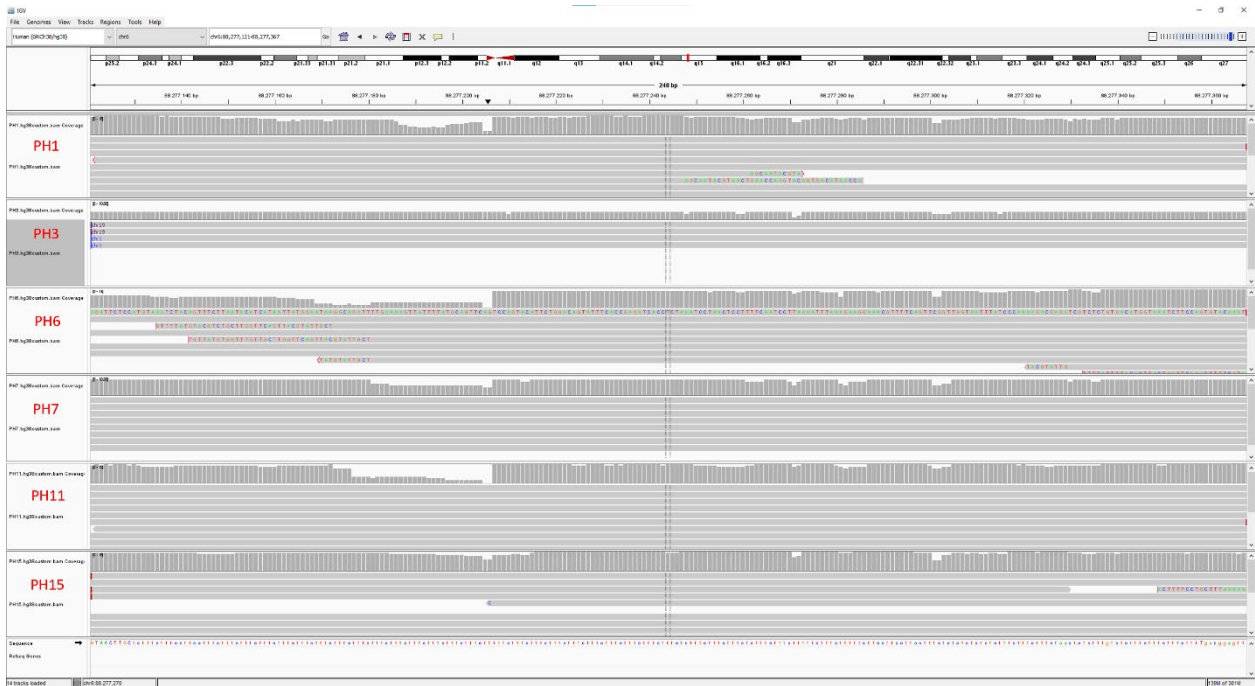
10

11 *Table S1: Detailed overview of the sample cohort*

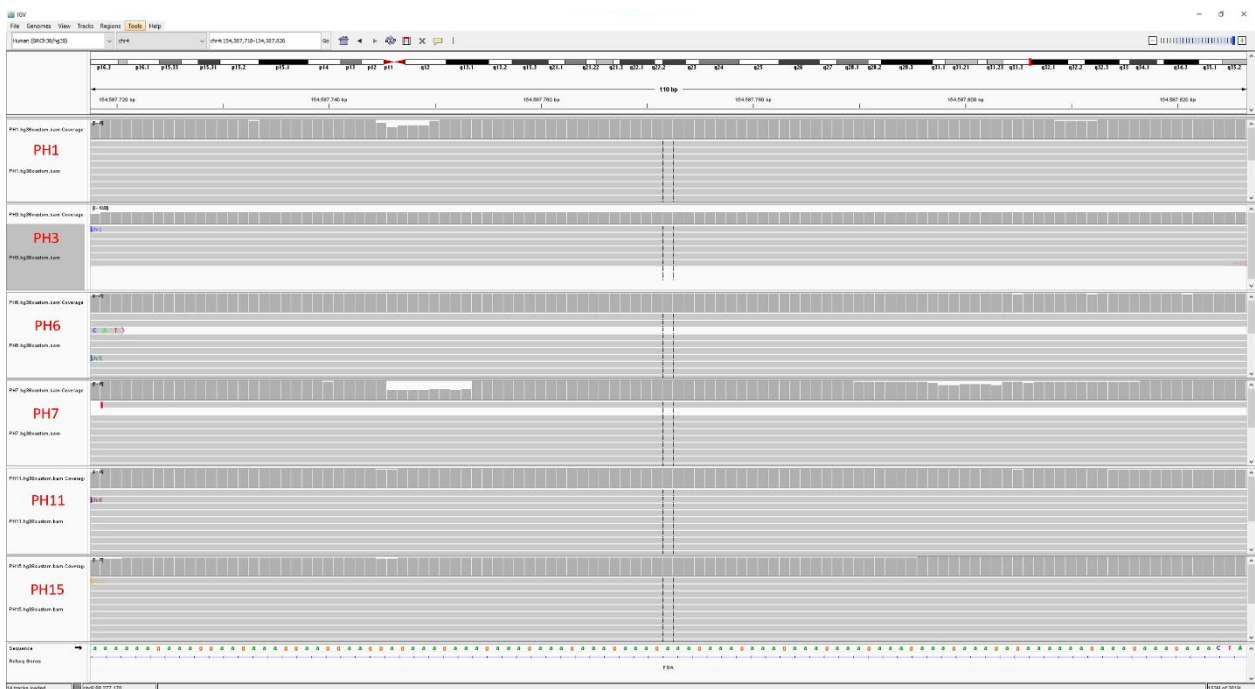
Sample ID	Biological sex	Chronological age (years)
PH1	M	35,3
PH3	M	19,1
PH6	M	27,6
PH7	M	23,4
PH11	M	43,8
PH15	M	53,1

12

13 *Sequencing data:* This study refrains from disclosing genotype details to maintain sample anonymity, and
14 neither raw nor processed data are publicly accessible. As an alternative, Figures S1-4 provide IGV
15 screenshots for several loci (SE33, FGA, DYS385a-b, rs683) across all six samples.
16



17 **Figure S1: SE33.** Screenshot showing reads for locus SE33 across all six samples. Screenshots have been edited to ensure that no
18 genetic variants specific to individual samples are visible.
19
20



21 **Figure S2: FGA.** Screenshot showing reads for locus FGA across all six samples. Screenshots have been edited to ensure that no
22 genetic variants specific to individual samples are visible.
23
24

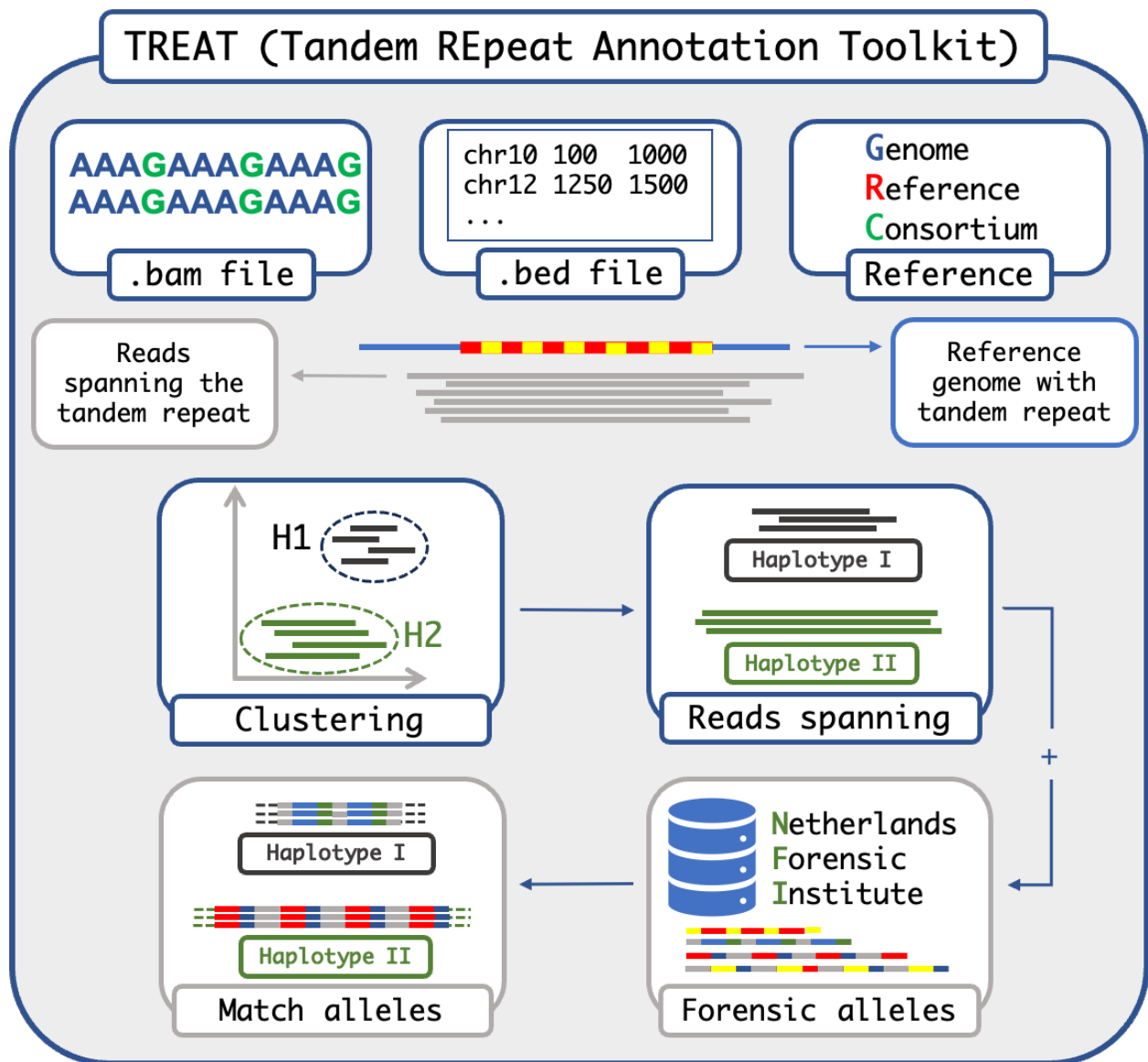
32 *Target selection:* This study included the following forensic DNA markers for ONT sequencing and
 33 validation (Table S2): 28 autosomal STRs – 27 from the Verogen ForenSeq DNA Signature Prep Kit (Qiagen)
 34 and one additional marker, SE33, from the IDSeek OmniSTR Global Autosomal STR Profiling Kit (NimaGen);
 35 24 Y-STRs and seven X-STRs from the Verogen ForenSeq DNA Signature Prep Kit (Qiagen); 40 SNPs and 1
 36 InDel from the Hlrplex-S System for hair, eye, and skin colour predictions (1-3); eight DNA methylation
 37 markers previously reported by the VISAGE consortium (4); 353 methylation markers incorporated in
 38 Horvath’s clock (5); and the complete mtDNA mitogenome.

39

40 *Table S2: Overview of the selected forensic DNA targets*

Marker type	Forensic relevance	# markers	Kit/publication	Reference(s)
Autosomal STRs	Identification	27 + 1 (SE33)	Verogen ForenSeq DNA Signature Prep Kit (Qiagen) + IDSeek OmniSTR Global Autosomal STR Profiling Kit (NimaGen)	(6)
Amelogenin	Sex typing	2	Verogen ForenSeq DNA Signature Prep Kit (Qiagen)	(6)
X-STRs	Female identification / BGA	7	Verogen ForenSeq DNA Signature Prep Kit (Qiagen)	(6)
Y-STRs	Male identification / Paternal BGA	24	Verogen ForenSeq DNA Signature Prep Kit (Qiagen)	(6)
INDELS	Autosomal BGA	46	Pereira <i>et al.</i> (2012)	(7)
mtDNA	Maternal BGA	Complete mtDNA	Anderson <i>et al.</i> (1981), Andrews <i>et al.</i> (1999)	(8,9)
SNPs	Hair/eye/skin colour	41	Hlrplex-S	(1-3)
CpGs	Age	353 + 8	Horvath’s clock + VISAGE Enhanced Tool for Age Prediction	(4,5)

41



42
43
44 **Figure S5: TREAT for tandem repeat genotyping.** The figure shows the main steps underlying TREAT (Tandem REpeat Annotation
45 Toolkit): in order to run, TREAT requires (i) sequencing data aligned to the reference genome (.bam file), (ii) genomic coordinates
46 to the regions of interest (.bed file), and (iii) the reference genome sequence (.fasta file). TREAT extracts the sequencing reads
47 spanning the regions of interest, and identifies the haplotypes using a clustering framework based on the size of the regions of
48 interest. Sequencing reads belonging to each haplotype are then queried for the presence of forensic alleles as derived from the
49 Netherlands Forensic Institute database. This procedure creates a set of putative forensic alleles matching the sequencing reads
50 in each haplotype. In order to prioritize an allele, we developed a score based on the size of the matched allele and the number
51 of sequencing reads matching the allele. The allele with the highest score was prioritized and subject to validation. Additional
52 information and source code are available at https://github.com/holstegelab/treat/tree/main/treat_applications/forensics.

53 **Supplementary Results**

54 *General QC analysis of the selected patient samples:* DNA methylation profiling was performed as
 55 described in main text (Illumina EPIC BeadChip array, v1). Quality control was performed conform the
 56 standard operational procedure of the genome diagnostic laboratory, dept. of Human Genetics,
 57 Amsterdam UMC, ISO 15189:2012, RvA M130. DNA methylation profile quality control included
 58 MethylAid analysis, applying default parameters for EPIC array and sex confirmation (10,11). A detailed
 59 overview of DNA methylation quality control results is presented in Table S3. Nanopore run report details
 60 for each sample are presented in Table S4.

61

62 *Table S3: Overview DNA methylation quality control.*

Sample_ID	PH1	PH3	PH6	PH7	PH11	PH15
Reported Sex	M	M	M	M	M	M
MU	pass	pass	pass	pass	pass	pass
OP	pass	pass	pass	pass	pass	pass
BS	pass	pass	pass	pass	pass	pass
HC	pass	pass	pass	pass	pass	pass
DP	pass	pass	pass	pass	pass	pass
Predicted Sex	M	M	M	M	M	M
Overall QC	pass	pass	pass	pass	pass	pass
Horvath's age	36.6	21.6	32.7	26.7	51.4	48.1

63 MU: ratio methylated and unmethylated signal; OP: polymorphic outlier control, BS: bisulfite conversion control (I); HC: hybridization control;
 64 DP: Detection P-value.

65

Sample	Estimated bases (Gb)	Reads generated (M)	Data produced (GB)	Estimated N50 (kb)	Read length (kb)	Aggregated reads (Mb)
PH1	11.93	12.1	138.22	0.708	28 - 92	93.07
					92 - 156	0.34
					156 - 220	None
					220 - 268	0.27
PH3	4.57	4.39	44.73	2.72	0.28125 - 0.53125	15.83
					0.53125 - 0.78125	11.51
					0.78125 - 1.03125	8.32
					1.03125 - 1.28125	8.6
PH6	11.9	10.86	116.21	3.94	1.28125 - 1.35938	1,41
					0.125 - 0.625	92.68
					0.625 - 1.125	18.3
PH7	NA	NA	NA	NA	1.125 - 1.40625	7.92
					NA	NA
					NA	NA
PH11	7.14	6.5	80.03	4.63	30 - 62	60,69
					62 - 94	2,2
					94 - 119	0,12
PH15	5.75	5.25	57.2	4.33	0.046875 - 0.296875	44,14
					0.296875 - 0.546875	7,64
					0.546875 - 0.796875	1,96
					0.796875 - 1.04688	3,77

76 DNAm: The ONT DNAm dataset showed a large number of CpGs with a reported beta value of 0 or 1. The
 77 total number and fraction of CpGs with a beta value of 0 or 1 decreased with increasing read depth (Table
 78 S4). Pearson’s correlation coefficient between ONT and validation datasets generally increased with
 79 increasing read depth (Table S5).

80

81 *Table S5: Overview of DNAm dataset (Horvath’s clock)*

Read depth	CpGs in dataset	CpGs with beta 0 or 1	% of CpGs with beta 0 or 1
1-9	922	646	70
10-19	926	454	49
20-29	117	47	40

82

83

84 *Table S6: Pearson’s correlations and number of CpGs, organized per read depth category (Horvath’s clock)*

Read depth	PH1		PH3		PH6		PH7		PH11		PH15	
	R	CpGs	R	CpGs	R	CpGs	R	CpGs	R	CpGs	R	CpGs
All	0.917	178	0.784	66	0.930	164	0.686	82	0.875	160	0.904	168
1-9	0.763	27	0.775	65	0.873	9	0.672	78	0.830	74	0.705	23
10-19	0.944	130	NA	1	0.922	130	0.793	6	0.903	85	0.915	122
20-29	0.937	21	NA	NA	0.976	25	NA	NA	NA	1	0.944	23

85 R: Pearson’s correlation coefficient

86 **References**

- 87 1. Chaitanya L, Breslin K, Zuniga S, Wirken L, Pospiech E, Kukla-Bartoszek M, et al. The HirisPlex-S
88 system for eye, hair and skin colour prediction from DNA: Introduction and forensic developmental
89 validation. *Forensic Sci Int Genet.* 2018;35:123-35.
- 90 2. Walsh S, Chaitanya L, Clarisse L, Wirken L, Draus-Barini J, Kovatsi L, et al. Developmental
91 validation of the HirisPlex system: DNA-based eye and hair colour prediction for forensic and
92 anthropological usage. *Forensic Sci Int Genet.* 2014;9:150-61.
- 93 3. Walsh S, Liu F, Wollstein A, Kovatsi L, Ralf A, Kosiniak-Kamysz A, et al. The HirisPlex system for
94 simultaneous prediction of hair and eye colour from DNA. *Forensic Science International: Genetics.*
95 2013;7:98-115.
- 96 4. Wozniak A, Heidegger A, Piniewska-Rog D, Pospiech E, Xavier C, Pisarek A, et al. Development of
97 the VISAGE enhanced tool and statistical models for epigenetic age estimation in blood, buccal cells and
98 bones. *Aging (Albany NY).* 2021;13(5):6459-84.
- 99 5. Horvath S. DNA methylation age of human tissues and cell types. *Genome Biology.*
100 2013;14(R115).
- 101 6. Jager AC, Alvarez ML, Davis CP, Guzman E, Han Y, Way L, et al. Developmental validation of the
102 MiSeq FGx Forensic Genomics System for Targeted Next Generation Sequencing in Forensic DNA
103 Casework and Database Laboratories. *Forensic Sci Int Genet.* 2017;28:52-70.
- 104 7. Pereira R, Phillips C, Pinto N, Santos C, dos Santos SE, Amorim A, et al. Straightforward inference
105 of ancestry and admixture proportions through ancestry-informative insertion deletion multiplexing.
106 *PLoS One.* 2012;7(1):e29684.
- 107 8. Andrews RM, Kubacka I, Chinnery PF, Lightowers RN, Turnbull DM, Howell N. Reanalysis and
108 revision of the Cambridge reference sequence for human mitochondrial DNA. *Nat Genet.*
109 1999;23(2):147.
- 110 9. Anderson S, Bankier AT, Barrell BG, de Bruijn MH, Coulson AR, Drouin J, et al. Sequence and
111 organization of the human mitochondrial genome. *Nature.* 1981;290(5806):457-65.
- 112 10. Iterson Mv, Tobi EW, Sliker RC, Hollander Wd, Rene Luijk, Slagboom PE, Heijmans BT.
113 MethylAid: visual and interactive quality control of large Illumina 450k datasets. *Bioinformatics.*
114 2014;30(23):3435-7.
- 115 11. Pelegí-Sisó D, de Prado P, Ronkainen J, Bustamante M, González JR. methylclock: a Bioconductor
116 package to estimate DNA methylation age. *Bioinformatics.* 2020;37(12):1759-60.
- 117 12. Thompson JD, Higgins DG, Gibson TJ. CLUSTAL W: improving the sensitivity of progressive
118 multiple sequence alignment through sequence weighting, position-specific gap penalties and weight
119 matrix choice. *Nucleic Acids Res.* 1994;22(22):4673-80.

Supplementary File 1
(will be uploaded as a separate Excel file after the review process)

STR	Chr	RefSeq (hg38)	Adaptive sampling region (hg38)	Midread 5' SNP	Chr	Position (hg38)	Position (hg38)	Midread 3' SNP	Adaptive sampling region (hg38)	Midread 5' SNP	Chr	Position (hg38)	Position (hg38)	Midread 3' SNP	Adaptive sampling region (hg38)
D1S1	X	118894-118971**	chr11:118894-118971	Aut Phn SNP	1	3391583	3391583	Aut Phn SNP	118894-118971	1	3391583	3391583	Aut Phn SNP	118894-118971	
D1S2	X	118972-119049**	chr11:118972-119049	Aut Phn SNP	2	3391583	3391583	Aut Phn SNP	118972-119049	2	3391583	3391583	Aut Phn SNP	118972-119049	
D1S3	X	119050-119127**	chr11:119050-119127	Aut Phn SNP	3	3391583	3391583	Aut Phn SNP	119050-119127	3	3391583	3391583	Aut Phn SNP	119050-119127	
D1S4	X	119128-119205**	chr11:119128-119205	Aut Phn SNP	4	3391583	3391583	Aut Phn SNP	119128-119205	4	3391583	3391583	Aut Phn SNP	119128-119205	
D1S5	X	119206-119283**	chr11:119206-119283	Aut Phn SNP	5	3391583	3391583	Aut Phn SNP	119206-119283	5	3391583	3391583	Aut Phn SNP	119206-119283	
D1S6	X	119284-119361**	chr11:119284-119361	Aut Phn SNP	6	3391583	3391583	Aut Phn SNP	119284-119361	6	3391583	3391583	Aut Phn SNP	119284-119361	
D1S7	X	119362-119439**	chr11:119362-119439	Aut Phn SNP	7	3391583	3391583	Aut Phn SNP	119362-119439	7	3391583	3391583	Aut Phn SNP	119362-119439	
D1S8	X	119440-119517**	chr11:119440-119517	Aut Phn SNP	8	3391583	3391583	Aut Phn SNP	119440-119517	8	3391583	3391583	Aut Phn SNP	119440-119517	
D1S9	X	119518-119595**	chr11:119518-119595	Aut Phn SNP	9	3391583	3391583	Aut Phn SNP	119518-119595	9	3391583	3391583	Aut Phn SNP	119518-119595	
D1S10	X	119596-119673**	chr11:119596-119673	Aut Phn SNP	10	3391583	3391583	Aut Phn SNP	119596-119673	10	3391583	3391583	Aut Phn SNP	119596-119673	
D1S11	X	119674-119751**	chr11:119674-119751	Aut Phn SNP	11	3391583	3391583	Aut Phn SNP	119674-119751	11	3391583	3391583	Aut Phn SNP	119674-119751	
D1S12	X	119752-119829**	chr11:119752-119829	Aut Phn SNP	12	3391583	3391583	Aut Phn SNP	119752-119829	12	3391583	3391583	Aut Phn SNP	119752-119829	
D1S13	X	119830-119907**	chr11:119830-119907	Aut Phn SNP	13	3391583	3391583	Aut Phn SNP	119830-119907	13	3391583	3391583	Aut Phn SNP	119830-119907	
D1S14	X	119908-119985**	chr11:119908-119985	Aut Phn SNP	14	3391583	3391583	Aut Phn SNP	119908-119985	14	3391583	3391583	Aut Phn SNP	119908-119985	
D1S15	X	119986-120063**	chr11:119986-120063	Aut Phn SNP	15	3391583	3391583	Aut Phn SNP	119986-120063	15	3391583	3391583	Aut Phn SNP	119986-120063	
D1S16	X	120064-120141**	chr11:120064-120141	Aut Phn SNP	16	3391583	3391583	Aut Phn SNP	120064-120141	16	3391583	3391583	Aut Phn SNP	120064-120141	
D1S17	X	120142-120219**	chr11:120142-120219	Aut Phn SNP	17	3391583	3391583	Aut Phn SNP	120142-120219	17	3391583	3391583	Aut Phn SNP	120142-120219	
D1S18	X	120220-120297**	chr11:120220-120297	Aut Phn SNP	18	3391583	3391583	Aut Phn SNP	120220-120297	18	3391583	3391583	Aut Phn SNP	120220-120297	
D1S19	X	120298-120375**	chr11:120298-120375	Aut Phn SNP	19	3391583	3391583	Aut Phn SNP	120298-120375	19	3391583	3391583	Aut Phn SNP	120298-120375	
D1S20	X	120376-120453**	chr11:120376-120453	Aut Phn SNP	20	3391583	3391583	Aut Phn SNP	120376-120453	20	3391583	3391583	Aut Phn SNP	120376-120453	
D1S21	X	120454-120531**	chr11:120454-120531	Aut Phn SNP	21	3391583	3391583	Aut Phn SNP	120454-120531	21	3391583	3391583	Aut Phn SNP	120454-120531	
D1S22	X	120532-120609**	chr11:120532-120609	Aut Phn SNP	22	3391583	3391583	Aut Phn SNP	120532-120609	22	3391583	3391583	Aut Phn SNP	120532-120609	
D1S23	X	120610-120687**	chr11:120610-120687	Aut Phn SNP	23	3391583	3391583	Aut Phn SNP	120610-120687	23	3391583	3391583	Aut Phn SNP	120610-120687	
D1S24	X	120688-120765**	chr11:120688-120765	Aut Phn SNP	24	3391583	3391583	Aut Phn SNP	120688-120765	24	3391583	3391583	Aut Phn SNP	120688-120765	
D1S25	X	120766-120843**	chr11:120766-120843	Aut Phn SNP	25	3391583	3391583	Aut Phn SNP	120766-120843	25	3391583	3391583	Aut Phn SNP	120766-120843	
D1S26	X	120844-120921**	chr11:120844-120921	Aut Phn SNP	26	3391583	3391583	Aut Phn SNP	120844-120921	26	3391583	3391583	Aut Phn SNP	120844-120921	
D1S27	X	120922-121000**	chr11:120922-121000	Aut Phn SNP	27	3391583	3391583	Aut Phn SNP	120922-121000	27	3391583	3391583	Aut Phn SNP	120922-121000	
D1S28	X	121001-121078**	chr11:121001-121078	Aut Phn SNP	28	3391583	3391583	Aut Phn SNP	121001-121078	28	3391583	3391583	Aut Phn SNP	121001-121078	
D1S29	X	121079-121156**	chr11:121079-121156	Aut Phn SNP	29	3391583	3391583	Aut Phn SNP	121079-121156	29	3391583	3391583	Aut Phn SNP	121079-121156	
D1S30	X	121157-121234**	chr11:121157-121234	Aut Phn SNP	30	3391583	3391583	Aut Phn SNP	121157-121234	30	3391583	3391583	Aut Phn SNP	121157-121234	
D1S31	X	121235-121312**	chr11:121235-121312	Aut Phn SNP	31	3391583	3391583	Aut Phn SNP	121235-121312	31	3391583	3391583	Aut Phn SNP	121235-121312	
D1S32	X	121313-121390**	chr11:121313-121390	Aut Phn SNP	32	3391583	3391583	Aut Phn SNP	121313-121390	32	3391583	3391583	Aut Phn SNP	121313-121390	
D1S33	X	121391-121468**	chr11:121391-121468	Aut Phn SNP	33	3391583	3391583	Aut Phn SNP	121391-121468	33	3391583	3391583	Aut Phn SNP	121391-121468	
D1S34	X	121469-121546**	chr11:121469-121546	Aut Phn SNP	34	3391583	3391583	Aut Phn SNP	121469-121546	34	3391583	3391583	Aut Phn SNP	121469-121546	
D1S35	X	121547-121624**	chr11:121547-121624	Aut Phn SNP	35	3391583	3391583	Aut Phn SNP	121547-121624	35	3391583	3391583	Aut Phn SNP	121547-121624	
D1S36	X	121625-121702**	chr11:121625-121702	Aut Phn SNP	36	3391583	3391583	Aut Phn SNP	121625-121702	36	3391583	3391583	Aut Phn SNP	121625-121702	
D1S37	X	121703-121780**	chr11:121703-121780	Aut Phn SNP	37	3391583	3391583	Aut Phn SNP	121703-121780	37	3391583	3391583	Aut Phn SNP	121703-121780	
D1S38	X	121781-121858**	chr11:121781-121858	Aut Phn SNP	38	3391583	3391583	Aut Phn SNP	121781-121858	38	3391583	3391583	Aut Phn SNP	121781-121858	
D1S39	X	121859-121936**	chr11:121859-121936	Aut Phn SNP	39	3391583	3391583	Aut Phn SNP	121859-121936	39	3391583	3391583	Aut Phn SNP	121859-121936	
D1S40	X	121937-122014**	chr11:121937-122014	Aut Phn SNP	40	3391583	3391583	Aut Phn SNP	121937-122014	40	3391583	3391583	Aut Phn SNP	121937-122014	
D1S41	X	122015-122092**	chr11:122015-122092	Aut Phn SNP	41	3391583	3391583	Aut Phn SNP	122015-122092	41	3391583	3391583	Aut Phn SNP	122015-122092	
D1S42	X	122093-122170**	chr11:122093-122170	Aut Phn SNP	42	3391583	3391583	Aut Phn SNP	122093-122170	42	3391583	3391583	Aut Phn SNP	122093-122170	
D1S43	X	122171-122248**	chr11:122171-122248	Aut Phn SNP	43	3391583	3391583	Aut Phn SNP	122171-122248	43	3391583	3391583	Aut Phn SNP	122171-122248	
D1S44	X	122249-122326**	chr11:122249-122326	Aut Phn SNP	44	3391583	3391583	Aut Phn SNP	122249-122326	44	3391583	3391583	Aut Phn SNP	122249-122326	
D1S45	X	122327-122404**	chr11:122327-122404	Aut Phn SNP	45	3391583	3391583	Aut Phn SNP	122327-122404	45	3391583	3391583	Aut Phn SNP	122327-122404	
D1S46	X	122405-122482**	chr11:122405-122482	Aut Phn SNP	46	3391583	3391583	Aut Phn SNP	122405-122482	46	3391583	3391583	Aut Phn SNP	122405-122482	
D1S47	X	122483-122560**	chr11:122483-122560	Aut Phn SNP	47	3391583	3391583	Aut Phn SNP	122483-122560	47	3391583	3391583	Aut Phn SNP	122483-122560	
D1S48	X	122561-122638**	chr11:122561-122638	Aut Phn SNP	48	3391583	3391583	Aut Phn SNP	122561-122638	48	3391583	3391583	Aut Phn SNP	122561-122638	
D1S49	X	122639-122716**	chr11:122639-122716	Aut Phn SNP	49	3391583	3391583	Aut Phn SNP	122639-122716	49	3391583	3391583	Aut Phn SNP	122639-122716	
D1S50	X	122717-122794**	chr11:122717-122794	Aut Phn SNP	50	3391583	3391583	Aut Phn SNP	122717-122794	50	3391583	3391583	Aut Phn SNP	122717-122794	
D1S51	X	122795-122872**	chr11:122795-122872	Aut Phn SNP	51	3391583	3391583	Aut Phn SNP	122795-122872	51	3391583	3391583	Aut Phn SNP	122795-122872	
D1S52	X	122873-122950**	chr11:122873-122950	Aut Phn SNP	52	3391583	3391583	Aut Phn SNP	122873-122950	52	3391583	3391583	Aut Phn SNP	122873-122950	
D1S53	X	122951-123028**	chr11:122951-123028	Aut Phn SNP	53	3391583	3391583	Aut Phn SNP	122951-123028	53	3391583	3391583	Aut Phn SNP	122951-123028	
D1S54	X	123029-123106**	chr11:123029-123106	Aut Phn SNP	54	3391583	3391583	Aut Phn SNP	123029-123106	54	3391583	3391583	Aut Phn SNP	123029-123106	
D1S55	X	123107-123184**	chr11:123107-123184	Aut Phn SNP	55	3391583	3391583	Aut Phn SNP	123107-123184	55	3391583	3391583	Aut Phn SNP	123107-123184	
D1S56	X	123185-123262**	chr11:123185-123262	Aut Phn SNP	56	3391583	3391583	Aut Phn SNP	123185-123262	56	3391583	3391583	Aut Phn SNP	123185-123262	
D1S57	X	123263-123340**	chr11:123263-123340	Aut Phn SNP	57	3391583	3391583	Aut Phn SNP	123263-123340	57	3391583	3391583	Aut Phn SNP	123263-123340	
D1S58	X	123341-123418**	chr11:123341-123418	Aut Phn SNP	58	3391583	3391583	Aut Phn SNP	123341-123418	58	3391583	3391583	Aut Phn SNP	123341-123418	
D1S59	X	123419-123496**	chr11:123419-123496	Aut Phn SNP	59	3391583	3391583	Aut Phn SNP	123419-123496	59	3391583	3391583	Aut Phn SNP	123419-123496	
D1S60	X	123497-123574**	chr11:123497-123574	Aut Phn SNP	60	3391583	3391583	Aut Phn SNP	123497-123574	60	3391583</				

CpG cg08434234 7 13751173 13784642 chr7:137833026-137858927 x
 CpG cg22920873 7 139205153 13940407 chr7:139327906-139352907 x
 CpG cg04999991 7 150027050 150219991 chr7:150317460-150342461 x
 CpG cg14951253 8 12809014 129512055 chr8:129300004-129340005 x
 CpG cg20045488 8 21987861 22123344 chr8:22117847-22142348 x
 CpG cg25552492 8 22011999 22156486 chr8:22140295-22158986 x
 CpG cg05365729 8 23262073 23404560 chr8:23392059-23417060 x
 CpG cg21305265 8 25316571 25459055 chr8:25446354-25471555 x
 CpG cg26281819 8 27348940 27491423 chr8:27479322-27503923 x
 CpG cg14058362 8 3024145 30384145 chr8:30371564-30396565 x
 CpG cg02388150 8 41165099 41308180 chr8:41295679-41320680 x
 CpG cg14408969 8 42396118 42540675 chr8:42528477-42553478 x
 CpG cg16241714 8 48050511 47737949 chr8:47725488-47750489 x
 CpG cg08090772 8 67344640 66432405 chr8:66419904-66444905 x
 CpG cg22280637 8 86350278 85430849 chr8:85425568-85450569 x
 CpG cg20070637 8 97550688 96493640 chr8:96481139-96506140 x
 CpG cg05755779 8 12007925 119067386 chr8:119054885-119079886 x
 CpG cg14409958 8 120651652 119639412 chr8:119626911-119651912 x
 CpG cg18956095 8 124287111 123274871 chr8:123262370-123287371 x
 CpG cg07770222 8 144120106 143038669 chr8:143026188-143051189 x
 CpG cg24471894 9 2838508 2838508 chr9:2826007-2852008 x
 CpG cg19724470 9 5450936 5450936 chr9:5438435-5463436 x
 CpG cg09722555 9 34662282 34662282 chr9:34649784-34674785 x
 CpG cg04094100 9 37465712 37465712 chr9:37453214-37478215 x
 CpG cg07158339 9 67502027 69055321 chr9:69023820-69047821 x
 CpG cg01875649 9 74556649 71911731 chr9:71899232-71924233 x
 CpG cg02054291 9 86572014 83057099 chr9:83044598-83069599 x
 CpG cg11299964 9 128469783 125707504 chr9:125695003-125720004 x
 CpG cg01027739 9 131842738 129080459 chr9:129067958-129092959 x
 CpG cg09191327 9 133540108 130664721 chr9:130652220-130677221 x
 CpG cg07280315 9 131661305 131176763 chr9:131172517-131197268 x
 CpG cg16408304 9 137120759 134327229 chr9:134314728-134339729 x
 CpG cg02332492 9 139404078 136946226 chr9:136933725-136958726 x
 CpG cg01656216 10 31273710 30984781 chr10:30972280-30997281 x
 CpG cg00198942 10 35894430 35605502 chr10:35593001-35618002 x
 CpG cg17384128 10 44555000 44960052 chr10:4447951-44972552 x
 CpG cg09001994 10 52834404 51074748 chr10:51062235-51087236 x
 CpG cg13129046 10 71389096 69629940 chr10:69617439-69642440 x
 CpG cg01560871 10 72545424 70785668 chr10:70773167-70798168 x
 CpG cg04268405 10 73732221 71963463 chr10:71950962-71975963 x
 CpG cg04180783 10 75402320 73642562 chr10:73630091-73655092 x
 CpG cg04123262 10 75450278 74584698 chr10:74576599-74601600 x
 CpG cg19346193 10 12751190 125824621 chr10:125812105-125837121 x
 CpG cg00436603 10 135340740 133527236 chr10:133514735-133539736 x
 CpG cg24126851 11 6678143 6650912 chr11:6644411-6646912 x
 CpG cg13216567 11 12030643 12009096 chr11:11990595-12021596 x
 CpG cg05500610 11 32065184 31293638 chr11:311257137-311259138 x
 CpG cg04533047 11 44126114 44105167 chr11:44002664-44117667 x
 CpG cg22637507 11 43902407 43880857 chr11:438668356-438918357 x
 CpG cg20240860 11 44087423 44065873 chr11:44053372-44078373 x
 CpG cg21370143 11 47374208 47352657 chr11:47340156-47365157 x
 CpG cg01511367 11 57103611 57326157 chr11:57326157-57348657 x
 CpG cg04820001 11 94106332 64230060 chr11:64242079-64251560 x
 CpG cg08965235 11 65325158 65557687 chr11:655545186-65570187 x
 CpG cg13547237 11 65687877 65920406 chr11:65907905-65932906 x
 CpG cg07730301 11 6777952 68010482 chr11:67997981-68022982 x
 CpG cg19967310 11 73661920 73950875 chr11:73958374-73963375 x
 CpG cg16547695 11 75140611 74494566 chr11:74174175-74421366 x
 CpG cg17063029 11 89224799 89491631 chr11:89479130-89504131 x
 CpG cg14727952 11 102218358 102347627 chr11:102335126-102360127 x
 CpG cg25301936 11 113929164 114028442 chr11:114045941-114070942 x
 CpG cg01096399 11 119188145 119317405 chr11:119304934-119329935 x
 CpG cg03717274 11 12516888 125746991 chr11:125734892-125759893 x
 CpG cg01234063 11 126250007 126256112 chr11:126254361-126260462 x
 CpG cg26723847 11 134095652 134225758 chr11:134213257-134238258 x
 CpG cg16579101 12 6677158 6567992 chr12:6555491-6558492 x
 CpG cg01802374 12 6882083 6772917 chr12:6760416-6762917 x
 CpG cg04315449 12 15039025 14886091 chr12:14873950-14898951 x
 CpG cg13202412 12 30504312 30485408 chr12:30473950-30498951 x
 CpG cg19721847 12 30849114 30696180 chr12:30683679-30708680 x
 CpG cg09869858 12 48120416 47726633 chr12:47714132-47739133 x
 CpG cg25683012 12 57030113 56636229 chr12:56623828-56648829 x
 CpG cg03364642 12 58065758 57611975 chr12:57594974-57624975 x
 CpG cg18573829 12 7960312 75209621 chr12:75197120-75222121 x
 CpG cg09418383 12 80084718 79069038 chr12:79678437-79703438 x
 CpG cg00864867 12 80085268 79691488 chr12:79678437-79703438 x
 CpG cg07498421 12 94071223 93677447 chr12:93664946-93689947 x
 CpG cg04462291 12 104234579 103841701 chr12:103829200-103854201 x
 CpG cg05293988 12 107349063 106955315 chr12:10649428-106969815 x
 CpG cg10281002 12 114846399 114408594 chr12:114394903-114421094 x
 CpG cg24754120 13 34392869 33818732 chr13:33806231-33831232 x
 CpG cg04832038 13 99739382 99087128 chr13:99074627-99099628 x
 CpG cg09646392 13 108921052 108268704 chr13:108256203-108281204 x
 CpG cg01027805 14 21566863 21308704 chr14:21062033-21111204 x
 CpG cg06728602 14 17986034 17931916 chr14:1792301415-17923416 x
 CpG cg15661406 14 57960976 57484258 chr14:57481741-57506748 x
 CpG cg09133026 14 75388105 74921402 chr14:74908901-74933902 x
 CpG cg24058112 14 88459866 87993522 chr14:87981021-88006022 x
 CpG cg13667272 14 90799568 90322224 chr14:90319723-90344724 x
 CpG cg05282827 14 91721731 91253829 chr14:9149124-91256229 x
 CpG cg16024652 14 93798309 93331963 chr14:93331963-93344463 x
 CpG cg22432269 15 22892697 22980371 chr15:22967870-22992871 x
 CpG cg13836627 15 30113723 29821520 chr15:29809019-29834020 x
 CpG cg00707305 15 41185973 40893775 chr15:40881274-40906275 x
 CpG cg14764183 15 41382688 41153670 chr15:41150189-41152170 x
 CpG cg03286785 15 44580973 44288775 chr15:44276274-44301275 x
 CpG cg06121469 15 44956098 44663900 chr15:446651399-446901400 x
 CpG cg19305227 15 45444335 45252137 chr15:45221352-45246353 x
 CpG cg06993413 15 68182024 65517866 chr15:65505305-65530306 x
 CpG cg01578041 15 71147837 70854968 chr15:70843467-70868468 x
 CpG cg21182378 15 72161225 72318784 chr15:72307385-72332386 x
 CpG cg00075967 15 74495354 74203013 chr15:74190512-74215513 x
 CpG cg13828047 15 75182130 74889789 chr15:74877288-74902289 x
 CpG cg20761322 15 78423564 78131222 chr15:78118721-78143722 x
 CpG cg20380864 15 81070851 80778510 chr15:80766009-80791010 x
 CpG cg17409020 15 83954229 83285477 chr15:83272916-83297917 x
 CpG cg24888049 15 91426667 90883437 chr15:90879636-90904637 x
 CpG cg17338403 15 92395836 91852606 chr15:91840105-91865106 x
 CpG cg08170996 15 96874031 96330802 chr15:96318301-96343302 x
 CpG cg16899442 16 776458 726458 chr16:7113957-719958 x
 CpG cg06126647 16 1665084 1615083 chr16:161402392-1627983 x
 CpG cg08131960 16 2079597 2020596 chr16:2014006-2016506 x
 CpG cg02331561 16 2391081 2341080 chr16:2328579-2331080 x
 CpG cg06361108 16 2478781 2428780 chr16:2416279-2441280 x
 CpG cg14654875 16 3493997 3443997 chr16:3431496-3456497 x
 CpG cg07015931 16 22012404 22001083 chr16:21988592-22013744 x
 CpG cg15703512 16 22012965 22001244 chr16:21988592-22013744 x
 CpG cg06000813 16 23689002 23679481 chr16:23665980-23690981 x
 CpG cg06688448 16 57220097 57186185 chr16:57173684-57198685 x
 CpG cg25771195 16 58163814 58129910 chr16:58117409-58142410 x
 CpG cg20190381 16 68844408 68820505 chr16:687818004-68806805 x
 CpG cg17654944 16 83737641 83720582 chr16:83714567-83739568 x
 CpG cg20447000 16 81272281 81238676 chr16:81226175-81251176 x
 CpG cg19706682 16 84179331 84145726 chr16:84133225-84158226 x
 CpG cg07595943 16 84224901 84191295 chr16:84178794-84203795 x
 CpG cg02999813 16 84734014 84700408 chr16:84687907-84712908 x
 CpG cg10245473 16 87654571 87601867 chr16:87580656-87615657 x
 CpG cg05902609 17 1587888 1684594 chr17:1672083-1697094 x
 CpG cg19478743 17 4642647 4739352 chr17:47476805-47511852 x
 CpG cg14723032 17 6460572 6557252 chr17:6544751-6569752 x
 CpG cg03790483 17 6899297 6995978 chr17:6983477-7008478 x
 CpG cg06162695 17 12621313 13017996 chr17:13005495-13030496 x
 CpG cg03463213 17 16478966 16069952 chr17:16057051-16082052 x
 CpG cg05590257 17 17109570 17206256 chr17:17183755-17218756 x
 CpG cg06144905 17 27369780 29042762 chr17:29030261-29055262 x
 CpG cg08124722 17 32970702 34270995 chr17:34258194-34283195 x
 CpG cg06557358 17 32907002 34579983 chr17:34567482-34592483 x
 CpG cg01485445 17 39282199 38705845 chr17:38693465-38718466 x
 CpG cg00091603 17 39041602 40885350 chr17:40872849-40897850 x
 CpG cg02580606 17 39267276 41370474 chr17:41357973-41382974 x
 CpG cg09206673 17 40833697 42681679 chr17:42669178-42694179 x
 CpG cg25809905 17 42467728 44390360 chr17:44377859-44402860 x

CpG	cg21460081	17	46556012	48578050	chr17:48566149-48591150	x
CpG	cg25928579	17	46592534	48615172	chr17:48602671-48627672	x
CpG	cg17686885	17	52977709	54900408	chr17:54887907-54912908	x
CpG	cg00374717	17	66303145	68307004	chr17:68294503-68319504	x
CpG	cg09722397	17	72855943	74859820	chr17:74847303-74872318	x
CpG	cg04121983	17	73511085	75150004	chr17:75025033-75127504	x
CpG	cg11032156	17	73901339	75905258	chr17:75802757-75917758	x
CpG	cg16410345	17	73976089	75980008	chr17:75967507-75992508	x
CpG	cg19761273	17	80233096	82274220	chr17:82261719-82286720	x
CpG	cg12985418	18	19320538	21740577	chr18:21738076-21753077	x
CpG	cg14894144	18	21270554	23690590	chr18:23678089-23703090	x
CpG	cg17589341	18	43304079	45724114	chr18:45711613-45736614	x
CpG	cg10486998	18	74961787	77249831	chr18:77237330-77262331	x
CpG	cg09441152	18	77712293	79952293	chr18:79939792-79964793	x
CpG	cg12946225	19	3573751	3573751	chr19:3561252-3586253	x
CpG	cg02479575	19	4769553	4769564	chr19:4757140-4782148	x
CpG	cg26005082	19	4769560	4769568	chr19:4757140-4782148	x
CpG	cg14308452	19	5794184	5794173	chr19:5771672-5796673	x
CpG	cg02085507	19	6739192	6739181	chr19:6726680-6751681	x
CpG	cg27377450	19	7446301	7381415	chr19:7368914-7393915	x
CpG	cg05250458	19	9473565	9362889	chr19:9350388-9375389	x
CpG	cg15341340	19	12962237	12881423	chr19:12868922-12893923	x
CpG	cg11025793	19	13262015	13151201	chr19:13138708-13163701	x
CpG	cg02489552	19	15121531	15010719	chr19:14998218-15023219	x
CpG	cg07408456	19	15590532	15479721	chr19:15467220-15492221	x
CpG	cg26842024	19	16436122	16325311	chr19:16312810-16337811	x
CpG	cg13899108	19	18344322	18233512	chr19:18220604-18246601	x
CpG	cg06952310	19	19327990	19217181	chr19:19204680-19229681	x
CpG	cg21395782	19	19626814	19516005	chr19:19503504-19528505	x
CpG	cg12330694	19	38747796	38257156	chr19:38244655-38269656	x
CpG	cg20063386	19	38827378	38336738	chr19:38324237-38349238	x
CpG	cg05921699	19	42380725	41876655	chr19:41864154-41889154	x
CpG	cg12768605	19	44324951	43820799	chr19:43808298-43833299	x
CpG	cg07291563	19	48494441	48446184	chr19:48433683-48458684	x
CpG	cg15974053	19	49339789	48836532	chr19:48824031-48849032	x
CpG	cg27016307	19	49568913	49156656	chr19:49143155-49168156	x
CpG	cg14060828	19	49926276	49423019	chr19:49410518-49435519	x
CpG	cg05294243	19	51569106	51065849	chr19:51053348-51078349	x
CpG	cg07455279	19	54605703	54102395	chr19:54089942-54114943	x
CpG	cg26456957	19	55629363	55117995	chr19:55105494-55130495	x
CpG	cg22190114	19	56459234	55947868	chr19:55935367-55960368	x
CpG	cg01644850	19	58193231	57681863	chr19:57669362-57694363	x
CpG	cg22258540	19	58464846	58353480	chr19:58340979-58365979	x
CpG	cg24116886	20	137877	157236	chr20:144735-169736	x
CpG	cg22449114	20	590243	609599	chr20:597098-622099	x
CpG	cg24899750	20	16710314	16729669	chr20:16717168-16742169	x
CpG	cg17729667	20	25566382	25585746	chr20:25573245-25598246	x
CpG	cg24834740	20	37434552	38809909	chr20:38793408-38818409	x
CpG	cg23662675	20	45985596	47356852	chr20:47344351-47369352	x
CpG	cg06926735	20	48732667	50116130	chr20:50103629-50128630	x
CpG	cg14597908	20	57414960	58839905	chr20:58827404-58852405	x
CpG	cg02047577	20	62587702	63956349	chr20:63943948-63968949	x
CpG	cg03167275	21	38886093	37513775	chr21:37501274-37526275	x
CpG	cg17544190	21	31785454	32413126	chr21:3240064-32425646	x
CpG	cg13854474	21	37757525	36385227	chr21:36372726-36397727	x
CpG	cg15460409	21	38379570	37007270	chr21:36964769-37019770	x
CpG	cg01262913	21	38580486	37208185	chr21:37185684-37230685	x
CpG	cg17274064	21	40033892	38661968	chr21:38649467-38674468	x
CpG	cg12373771	22	17601381	17120491	chr22:17107990-17132991	x
CpG	cg25166896	22	20009063	20021540	chr22:20009039-20034040	x
CpG	cg05442902	22	21369010	21014721	chr22:21002220-21027221	x
CpG	cg20295671	22	22096486	21736197	chr22:21723696-21748697	x
CpG	cg18440048	22	24093826	23751639	chr22:23739138-23764139	x
CpG	cg07849904	22	28197796	27801808	chr22:27789307-27814308	x
CpG	cg01407797	22	29168514	28772526	chr22:28760025-28785026	x
CpG	cg10853760	22	38071677	37675670	chr22:37663169-37688170	x
CpG	cg03124451	22	39548131	39152126	chr22:39139625-39164626	x
CpG	cg19167673	22	39640835	39244830	chr22:39232329-39257330	x
CpG	cg11932564	22	42322146	41926142	chr22:41913641-41938642	x
CpG	cg26453588	22	43506021	43110015	chr22:43097514-43122515	x
CpG	cg26394940	22	46449461	46053581	chr22:46041080-46066077	x
CpG	cg13269407	22	46450107	46054227	chr22:46041080-46066077	x
CpG	cg17285325	22	50968343	50529914	chr22:50517413-50542414	x