

Supplementary Materials for

# **Monovar: single nucleotide variant detection in single cells**

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## Supplementary Notes on Results

### Performance Evaluation Using a Simulated Dataset

Three single cell sequencing datasets varying in the number of cells (10, 15 and 20 respectively) were simulated. A 1 Mbp region of chromosome 20 from human was chosen as the reference region for the simulated dataset (**Online Methods**). For each dataset, Monovar was compared against Samtools, GATK UnifiedGenotyper and GATK HaplotypeCaller. The algorithms were compared on the basis of two metrics, *detection efficiency* and precision. *Detection efficiency* (or recall) of an algorithm is defined as the percentage of true SNVs that it discovers from the single cells. Precision of an algorithm denotes the fraction of SNV calls that are true positives. Higher precision indicates lower number of false positives. While all the algorithms achieved similar detection efficiency, Monovar achieved higher precision compared to the other algorithms (**Supplementary Table 1**). Precision improvement of Monovar over GATK variants were ~22.6%, ~28.5% and ~31.9% for datasets with 10 cells, 15 cells and 20 cells respectively. Precision of each algorithm dropped as number of cells increased, owing to the higher possibility of calling false positives.

### Performance Evaluation in an Isogenic Cell Line

To validate Monovar and estimate its performance in comparison to other standard NGS variant callers, we analyzed data from an isogenic fibroblast cell line (SKN2). In these data, single cell exome sequencing was performed in addition to bulk exome sequencing using millions of cells (reference population). Because the single cells in SKN2 are isogenic, the consensus genotypes obtained from a reference population sample consisting of millions of cells can be used for validating genotypes identified in single cells<sup>8,16</sup>. To ensure the construction of a definitive reference set of variants, the reference population was sequenced at high coverage depth (59X) and breadth (99.76%)<sup>16</sup>. In this dataset, we can assume that the germline variants in a single cell are identical to the matched reference bulk population, and any additional mutations are considered FP errors, while missed mutations are either ADO or FN events. The exome sequencing data (mean coverage depth 65X and breadth 92.7%) for single cells were obtained using a method called single nucleus exome sequencing (SNES)<sup>16</sup>. Six single cells were gated from G1/0 stage of the cell cycle and six other single cells were gated from G2/M stage. In this previous work that used GATK as the SNV calling method, the allelic dropout rate was estimated to be 30.82% for G1/0 cells and 21.52% for G2/M cells. The FP error rate was 3.2e-5 for SNVs

and included predominantly (82.3%) deamination errors (C:G > T:A). The FP errors mostly occurred at random sites in the genomes of single cells<sup>16</sup>.

For this dataset, we compared Monovar to GATK (HaplotypeCaller) and Samtools. All algorithms were run to find multi-sample SNV call sets and those sets were compared on the basis of the aforementioned metrics. Data from 12 single cell samples and the reference population sample were pooled together and the algorithms were run on the pooled data. A union of the SNVs detected from the reference population sample using both Monovar and GATK constructed the gold standard variant set consisting of 51,154 SNVs. Out of these, 50,374 (98.5%) SNVs were called by both GATK and Monovar. The rationale for computing the union is to have a gold standard variant set that is unbiased towards any variant calling algorithm, ensuring a fair comparison.

These data show that Samtools performs poorly compared to GATK in terms of both metrics (**Supplementary Table 2**). Furthermore, Monovar achieves substantially higher precision (0.8376) compared to GATK (0.6641) and Samtools (0.5845) with a slight improvement in the detection efficiency. Such improvement is particularly evident, when inspecting the true-positive (TP) and the false-positive (FP) SNVs called jointly or uniquely by the 3 callers (**Fig. 1b-c**). A small percentage of SNVs detected by the algorithms (2.6% of total calls for Samtools, 2.2% of total calls for GATK and 4.9% of total calls for Monovar) are treated as neither TP nor FP because the reference population sample does not have sufficient coverage depth at those positions. Monovar also achieves the highest dbSNP precision, i.e., 83.02% of the SNVs detected by Monovar were found in dbSNP (v138), while for GATK it was 67.55% and for Samtools it was 60.71% (**Supplementary Table 3**). We also compared the spectrum of FP error variants, which showed that Monovar was able to broadly reduce many classes of FP transitions and transversions compared to that of GATK and Samtools (**Fig. 1d**). However, the most drastic reduction occurred in C:G > T:A transitions, which are the most prominent class of FP errors that arise during WGA<sup>16</sup>.

To assess the dependence of Monovar on the choice of threshold for classifying the genomic sites for the absence or presence of SNV, a precision-recall curve was drawn by varying the threshold used for calling SNV (**Fig. 1e**). Similar curves were drawn for GATK and Samtools by varying the minimum variant quality score used for calling SNV. These data show that Samtools achieves lower precision and detection efficiency compared to GATK and Monovar. Furthermore, Monovar achieves higher precision compared to GATK for the same detection efficiency.

To evaluate the effect of coverage depth on Monovar's variant calling performance, we down-sampled SKN2 data to various coverage depths (**Online Methods**). Monovar achieved consistently higher precision and detection efficiency as compared to GATK HaplotypeCaller for each down-sampled dataset (**Supplementary Figure 2**). Detection efficiency for each algorithm increases with higher coverage depth, whereas precision decreased. With higher coverage depth, more sites harboring false positive errors are represented in the datasets, resulting in the decrease in precision value. Higher coverage depth also results in more true SNVs being detected resulting in the rise in detection efficiency. The experiment shows that Monovar is able to detect most of the true mutations (~95%) at high precision (~93%) even for low coverage depth (10X).

To evaluate whether Monovar can detect true SNVs from subclones in heterogeneous mixed datasets, we performed a set of *in silico* mixing experiments. Subsets of normal SKN2 single cells were intermixed with subsets of tumor cells from Triple Negative Breast Cancer (TNBC) data<sup>8</sup> to mimic heterogeneous cell populations containing 0.076 to 0.5 proportions of SKN2 cells (**Online Methods**). For each subclone fraction, Monovar was evaluated in terms of precision and detection efficiency (**Supplementary Figure 3**). This experiment shows that even when only 1 SKN2 cell is present in the population (SKN2 subclone fraction 0.076), Monovar can detect >50% true mutations with very high precision (>95%). For a minor subclone (20% or 3/15 cells), Monovar was able to detect the majority (>85%) of true mutations at a high (~90%) precision and, as the SKN2 subclone frequency increases, detection efficiency of Monovar also increases.

### **Monovar Runtime**

Monovar was run on Intel processors with 2.50 GHz clock speed. When running on 2 CPU cores each with memory 8 GB, Monovar took about 7.5 hours to complete for the SKN2 dataset.

### **Supplementary Table 1 - Comparison of Variant Callers using Simulated Data.**

This table lists the comparison of different variant callers on three simulated datasets containing 10, 15 and 20 single cells, respectively. The results compare different metrics for multi-sample SNV calling. The columns are defined as: Number of true positives (TPs); Number of false positives (FPs); Precision [the ratio of TP and (TP + FP)]; the percentage of true SNVs called by the algorithm (Detection Efficiency).

### **Supplementary Table 2 - Comparison of Multi-sample SNV Calls in the Normal Cell Line**

This table lists the comparison of different variant calling algorithms for the isogenic cell line. All methods were run on data pooled from 12 single cell samples and the population sample. The results compare the different metrics for multi-sample SNV calling. The columns are defined as: Number of SNVs called by the algorithm; Number of true positives (TPs); the SNVs that are detected from both single cell and population samples; Number of false positives (FPs); SNVs detected from the single cell samples but are not detected in the reference population sample; Number of false negatives (FNs), the SNVs that are not detected from the single cell samples but are detected from the reference population sample; Precision [the ratio of TP and (TP + FP)]; the percentage of true SNVs called by the algorithm (Detection Efficiency).

### **Supplementary Table 3 - Overlap of SNV Callset with dbSNP for the Normal Cell Line**

This table lists the results of comparison of the algorithms for the isogenic cell line with respect to dbSNP (v138). The columns are defined as: Number of SNVs called by the algorithm (N); Number of true positives (TP), SNVs that are present in the dbSNP database; Number of false positives (FP), the SNVs not found in the dbSNP database; dbSNP Precision, the ratio of TP and total number of called SNVs (N).

### **Supplementary Table 4 – Somatic Mutations Detected in Tumor Samples**

This table lists all somatic mutations detected in the TNBC sample (ST4.1), the bladder cancer sample (ST4.2) and the ALL cancer sample (ST4.3). The columns are defined as: classification (subclonal or clonal classification); chromosome (human chromosome with mutation); coordinate (start coordinate of the mutations); ref (reference variant); var (mutation variant); dbSNP (overlap with a known SNP in the dbSNP database); cosmic (overlap with a known COSMIC database mutation); cancer gene (intersection with a cancer gene from the cancer census database); POLY (polyphen score); SIFT (sift score); Gene ID (Genbank Identifier); Exon (exon number); nucleotide (nucleotide position of the mutation); Amino Acid (amino acid substitution caused by

the mutation). Rows highlighted in blue are mutations with significant polyphen and sift scores that are annotated in the heatmap Figure 2. Red rows are significant, but are not annotated on the heatmap.

#### **Supplementary Table 5 – New Mutations Identified by Monovar**

This table lists new somatic mutations detected in the TNBC sample (ST5.1), the bladder cancer sample (ST5.2) and the ALL cancer sample (ST5.3) that were not previously identified in the original studies. The columns are defined as: classification (subclonal or clonal classification); chromosome (human chromosome with mutation); coordinate (start coordinate of the mutations); ref (reference variant); var (mutation variant); dbSNP (overlap with a known SNP in the dbSNP database); cosmic (overlap with a known COSMIC database mutation); cancer gene (intersection with a cancer gene from the cancer census database); POLY (polyphen score); SIFT (sift score); Gene ID (Genbank Identifier); Exon (exon number); nucleotide (nucleotide position of the mutation); Amino Acid (amino acid substitution caused by the mutation). Rows highlighted in blue are mutations with significant polyphen and sift scores that are annotated in the heatmap in Figure 2.

#### **Supplementary Table 6 - Prior probabilities for $p_{\beta}^{g^{[1]}g^{[2]}}$ for 10 genotypes**

The rows represent ten possible diploid genotypes ( $g^{[1]}g^{[2]}$ ). For each genotype, four conditional probabilities ( $p_{\beta}^{g^{[1]}g^{[2]}}$ ) are considered corresponding to four possible values of  $\beta$ .

Supplementary Table 1: Comparison of Variant Callers using Simulated Data

Dataset 1, Number of Single Cells = 10

Method	Number of True Positives (TP)	Number of False Positives (FP)	Precision (TP/TP+FP)	Detection Efficiency /Recall
Samtools	976	298	0.766	0.976
GATK UnifiedGenotyper	976	277	0.778	0.976
GATK HaplotypeCaller	976	281	0.776	0.976
Monovar	976	47	0.954	0.976

Dataset 2, Number of Single Cells = 15

Method	Number of True Positives (TP)	Number of False Positives (FP)	Precision (TP/TP+FP)	Detection Efficiency /Recall
Samtools	970	440	0.687	0.970
GATK UnifiedGenotyper	970	400	0.708	0.970
GATK HaplotypeCaller	970	402	0.706	0.970
Monovar	970	96	0.910	0.970

Dataset 3, Number of Single Cells = 20

Method	Number of True Positives (TP)	Number of False Positives (FP)	Precision (TP/TP+FP)	Detection Efficiency /Recall
Samtools	962	578	0.625	0.962
GATK UnifiedGenotyper	963	503	0.657	0.963
GATK HaplotypeCaller	963	505	0.656	0.963
Monovar	963	149	0.866	0.963



Supplementary Table 2 - Comparison of Multi-sample SNV Calls in the Normal Cell Line

Method	Number of SNVs Called (N)	Number of True Positives (TP)	Number of False Positives (FP)	Number of False Negatives (FN)	Precision (TP/TP+FP)	Detection Efficiency /Recall
Samtools	83790	47663	33877	3491	0.5845	93.17
GATK	75173	48781	24665	2373	0.6641	95.36
Monovar	62929	50114	9715	1040	0.8376	97.96

Supplementary Table 3: Overlap of the SNV Callset with dbSNP for the Normal Cell Line

Method	Number of SNVs Called (N)	Number of True Positives (TP)	Number of False Positives (FP)	dbSNP Precision (TP/N)
Samtools	83790	50877	32913	0.6071
GATK	75173	50785	24388	0.6755
Monovar	62929	52248	10681	0.8302

Supplementary Table ST4.1 Somatic Mutations Detected in TNBC

Classification	Chromos	Coordinat	Ref	Var	Gene Name	dbSNP	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr10	89682884	C	T	PTEN	.	p.?	PTEN	0.735283	0	stopgain SNV	NM_000314	exon5	c.C388T	p.R130X
Clonal	chr4	77447102	C	T	STBD1	.	NA	NA	NA	NA	synonymous SNV	NM_003943	exon1	c.C156T	p.G52G
Clonal	chr19	57018973	C	T	FPR3	.	NA	NA	0.999	0	nonsynonymous SNV	NM_002030	exon2	c.C160T	p.R54W
Clonal	chr16	30701629	C	T	ZNF629	.	NA	NA	NA	NA	synonymous SNV	NM_001080417	exon3	c.G1521A	p.T507T
Clonal	chr6	34134825	A	C	GRM4	.	NA	NA	0.967	0	nonsynonymous SNV	NM_001256811	exon5	c.T931G	p.S311A
Clonal	chr18	31087599	C	G	ZSCAN30	.	NA	NA	0.982	0	nonsynonymous SNV	NM_001112734	exon4	c.G1298C	p.R433T
Clonal	chr19	45232719	A	G	ZNF780B	.	NA	NA	NA	NA	synonymous SNV	NM_001005851	exon5	c.T1887C	p.N629N
Clonal	chrX	106970866	C	T	MID2	.	NA	NA	NA	NA	synonymous SNV	NM_012216	exon2	c.C315T	p.R105R
Clonal	chr14	72229640	G	C	DPF3	.	NA	NA	NA	NA	synonymous SNV	NM_012074	exon7	c.C639G	p.L213L
Clonal	chr11	4630409	C	A	OR51E1	.	NA	NA	0.006	0.21	nonsynonymous SNV	NM_152430	exon2	c.C77A	p.A26D
Clonal	chr1	120261858	G	C	NOTCH2	.	NA	NA	0.003	1	nonsynonymous SNV	NM_024408	exon33	c.C5980G	p.L1994V
Clonal	chr4	56875862	C	T	KIAA1211	.	NA	NA	NA	NA	synonymous SNV	NM_020722	exon8	c.C1437T	p.P479P
Clonal	chr2	234191331	C	T	UGT1A8	.	NA	NA	0.465889	0.04	nonsynonymous SNV	NM_019076	exon1	c.C239T	p.S80L
Clonal	chr18	16849409	A	G	ROCK1	.	NA	NA	0.093	0.87	nonsynonymous SNV	NM_005406	exon13	c.T1391C	p.M464T
Clonal	chr1	16598475	C	G	SPATA21	.	NA	NA	0.125	0	nonsynonymous SNV	NM_198546	exon12	c.G1303C	p.D435H
Clonal	chr6	43275813	G	C	CUL9	.	NA	NA	0.334	0	nonsynonymous SNV	NM_015089	exon14	c.G3325C	p.E1109Q
Clonal	chr1	152464249	G	A	UBAP2L	.	NA	NA	0.706009	0.05	nonsynonymous SNV	NM_014847	exon2	c.G26A	p.R9Q
Clonal	chr19	47723143	G	A	CEACAM1	.	NA	NA	0.001	0	nonsynonymous SNV	NM_001712	exon2	c.C314T	p.A105V
Clonal	chr6	132037967	G	T	ENPP3	.	NA	NA	0.7355	0	stopgain SNV	NM_005021	exon9	c.G817T	p.G273X
Clonal	chr11	6369679	G	A	SMPD1	.	NA	NA	0.325	0.44	nonsynonymous SNV	NM_001007593	exon2	c.G805A	p.G269S
Clonal	chr3	184728396	C	T	KLHL6	.	NA	NA	NA	NA	synonymous SNV	NM_130446	exon2	c.G390A	p.T130T
Clonal	chr16	70727901	C	A	PMFBP1	.	NA	NA	0.733742	0.19	stopgain SNV	NM_001160213	exon10	c.G715T	p.E239X
Clonal	chr13	50753147	G	A	FAM124A	.	NA	NA	NA	NA	synonymous SNV	NM_001242312	exon4	c.G1395A	p.L465L
Clonal	chr19	48915628	G	A	IRGC	.	NA	NA	0.475	0.57	nonsynonymous SNV	NM_019612	exon2	c.G1078A	p.A360T
Clonal	chr20	44071925	G	A	MMP9	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_004994	exon2	c.G152A	p.R51H
Clonal	chr3	102445981	C	T	IMPG2	.	NA	NA	NA	NA	synonymous SNV	NM_016247	exon13	c.G1884A	p.L628L
Clonal	chr6	43221105	G	A	PTK7	.	NA	NA	0.993	0	nonsynonymous SNV	NM_152880	exon15	c.G2477A	p.R826Q
Clonal	chr6	26025038	G	A	SLC17A2	.	NA	NA	0.732755	0.54	stopgain SNV	NM_005835	exon8	c.C784T	p.R262X
Clonal	chr1	111018302	C	T	KCNA3	.	NA	NA	0.999	0	nonsynonymous SNV	NM_002232	exon1	c.G653A	p.R218H
Clonal	chr2	73320350	C	G	CCT7	.	NA	NA	NA	0	nonsynonymous SNV	NM_006429	exon2	c.C78G	p.I26M
Clonal	chr7	47843113	G	A	PKD1L1	.	NA	NA	NA	NA	synonymous SNV	NM_138295	exon37	c.C5874T	p.T1958T
Clonal	chr1	65117387	G	T	JAK1	.	NA	NA	0.98	0	nonsynonymous SNV	NM_002227	exon4	c.C238A	p.L80M
Clonal	chr12	2800705	C	T	ITFG2	.	NA	NA	0.731979	0.03	stopgain SNV	NM_018463	exon7	c.C712T	p.R238X
Clonal	chr3	150951196	G	T	COMMD2	.	NA	NA	0.27	0.26	nonsynonymous SNV	NM_016094	exon4	c.C361A	p.L121I
Clonal	chr3	64557585	G	A	ADAMTS9	.	NA	NA	NA	NA	synonymous SNV	NM_182920	exon27	c.C4140T	p.S1380S
Clonal	chr15	43227468	G	A	DUOX1	.	NA	NA	0.998	0	nonsynonymous SNV	NM_017434	exon21	c.G2623A	p.E875K
Clonal	chr5	140037163	C	G	HARS	.	NA	NA	0.978	0	nonsynonymous SNV	NM_002109	exon8	c.G756C	p.E252D
Clonal	chrX	123484999	C	T	TENM1	.	NA	NA	0.961	0.09	nonsynonymous SNV	NM_014253	exon17	c.G2929A	p.D977N
Clonal	chr19	44658851	G	A	SUPT5H	.	NA	NA	0.003	0.38	nonsynonymous SNV	NM_003169	exon29	c.G3236A	p.R1079H
Clonal	chr14	75975794	C	T	ESRRB	.	NA	NA	NA	NA	synonymous SNV	NM_004452	exon4	c.C345T	p.Y115Y
Clonal	chr19	14368264	G	C	CD97	.	NA	NA	0.389	0.45	nonsynonymous SNV	NM_001025160	exon5	c.G457C	p.E153Q
Clonal	chr6	42998906	C	A	PTCRA	.	NA	NA	0.792	0	nonsynonymous SNV	NM_001243169	exon3	c.C147A	p.F49L
Clonal	chr11	66835862	C	A	SSH3	.	NA	NA	NA	NA	synonymous SNV	NM_017857	exon14	c.C1908A	p.S636S
Clonal	chr5	178961579	C	T	RUFY1	.	NA	NA	NA	NA	synonymous SNV	NM_025158	exon15	c.C1842T	p.G614G
Clonal	chr11	60805108	G	A	VWCE	.	NA	NA	NA	NA	synonymous SNV	NM_152718	exon8	c.C963T	p.P321P
Clonal	chrX	53241916	C	A	KDM5C	.	NA	NA	NA	NA	synonymous SNV	NM_004187	exon20	c.G3027T	p.A1009A
Clonal	chr20	51632206	C	T	ZNF217	.	NA	NA	NA	NA	synonymous SNV	NM_006526	exon1	c.G567A	p.Q189Q
Clonal	chr7	55527565	C	T	VOPP1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_030796	exon4	c.G232A	p.G78S
Clonal	chr1	94281482	G	T	ABCA4	.	NA	NA	0.735507	0	stopgain SNV	NM_000350	exon21	c.C3188A	p.S1063X
Clonal	chrX	5821019	G	T	NLGN4X	.	NA	NA	0	0.22	nonsynonymous SNV	NM_020742	exon6	c.C2290A	p.L764M
Clonal	chr6	36036645	G	C	SLC26A8	.	NA	NA	0.995	0.01	nonsynonymous SNV	NM_052961	exon14	c.C1591G	p.Q531E
Clonal	chr19	16200705	A	C	AP1M1	.	NA	NA	0	0.07	nonsynonymous SNV	NM_001130524	exon10	c.A1049C	p.N350T

Clonal	chr6	36821201	G	A	CPNE5	.	NA	NA	0.964	0	nonsynonymous SNV	NM_020939	exon17	c.C1270T	p.R424C
Clonal	chr19	17953670	C	T	KCNN1	.	NA	NA	NA	NA	synonymous SNV	NM_002248	exon5	c.C651T	p.Y217Y
Clonal	chr7	100011846	C	T	LRCH4	.	NA	NA	0.178	0.29	nonsynonymous SNV	NM_002319	exon15	c.G1589A	p.R530Q
Clonal	chrX	152873794	C	T	HCFC1	.	NA	NA	0.956	0.09	nonsynonymous SNV	NM_005334	exon17	c.G3250A	p.E1084K
Clonal	chr19	19169055	G	A	RFXANK	.	NA	NA	0.002	0.28	nonsynonymous SNV	NM_003721	exon5	c.G332A	p.R111Q
Clonal	chr5	140187946	G	A	PCDH46	.	NA	NA	0.559211	0	nonsynonymous SNV	NM_018909	exon1	c.G86A	p.G29D
Clonal	chr8	121306627	T	C	COL14A1	.	NA	NA	NA	NA	synonymous SNV	NM_021110	exon15	c.T1857C	p.F619F
Clonal	chr19	45012991	G	A	DYRK1B	.	NA	NA	0.09	0.07	nonsynonymous SNV	NM_006483	exon4	c.C236T	p.S79L
Clonal	chr20	533252	G	A	TCF15	.	NA	NA	0.698278	0.02	stopgain SNV	NM_004609	exon2	c.C583T	p.R195X
Clonal	chr17	45958316	G	T	MYCBPAP	.	NA	NA	0.457141	0.47	stopgain SNV	NM_032133	exon14	c.G1987T	p.E663X
Clonal	chr19	12896481	G	A	FARSA	.	NA	NA	NA	NA	synonymous SNV	NM_004461	exon10	c.C1167T	p.G389G
Clonal	chr19	15146135	C	T	NOTCH3	.	NA	NA	0.993	0.5	nonsynonymous SNV	NM_000435	exon25	c.G4480A	p.G1494S
Clonal	chr19	60848088	G	T	ZNF581	.	NA	NA	0.968	0.01	nonsynonymous SNV	NM_016535	exon2	c.G339T	p.K113N
Clonal	chr1	153490533	G	A	FAM189B	.	NA	NA	0.958	0.08	nonsynonymous SNV	NM_001267608	exon2	c.C302T	p.A101V
Clonal	chr1	16598446	C	A	SPATA21	.	NA	NA	0.018	0	nonsynonymous SNV	NM_198546	exon12	c.G1332T	p.Q444H
Clonal	chr17	58156148	G	C	MARCH10	.	NA	NA	0.993	0.01	nonsynonymous SNV	NM_001100875	exon7	c.C1987G	p.Q663E
Clonal	chr1	179170880	C	T	KIAA1614	.	NA	NA	NA	NA	synonymous SNV	NM_020950	exon5	c.C1212T	p.G404G
Clonal	chr1	200570774	C	A	UBE2T	.	NA	NA	0.999	0	nonsynonymous SNV	NM_014176	exon3	c.C145T	p.G49C
Clonal	chr16	9770251	G	A	GRIN2A	.	NA	NA	NA	NA	synonymous SNV	NM_001134408	exon12	c.C2553T	p.G851G
Clonal	chr17	69836175	G	A	KIF19	.	NA	NA	NA	0	nonsynonymous SNV	NM_153209	exon2	c.G56A	p.R19Q
Clonal	chr1	16075303	C	T	SPEN	.	NA	NA	0.999	0	nonsynonymous SNV	NM_015001	exon3	c.C424T	p.R142C
Clonal	chr20	33485174	C	T	GDF5	.	NA	NA	0.964	0	nonsynonymous SNV	NM_000557	exon2	c.G1453A	p.V485M
Clonal	chr17	39991905	C	G	FZD2	.	NA	NA	0.972	0	nonsynonymous SNV	NM_001466	exon1	c.C1323G	p.I441M
Clonal	chr16	54080129	G	A	MMP2	.	NA	NA	0.932	0.25	nonsynonymous SNV	NM_004530	exon6	c.G1006A	p.A336T
Clonal	chr17	39992097	G	A	FZD2	.	NA	NA	NA	NA	synonymous SNV	NM_001466	exon1	c.G1515A	p.P505P
Clonal	chr17	39831558	G	C	GPATCH8	.	NA	NA	0.96	0	nonsynonymous SNV	NM_001002909	exon8	c.C3413G	p.S1138C
Clonal	chr3	47687162	A	G	SMARCC1	.	NA	NA	0.979	0	nonsynonymous SNV	NM_003074	exon19	c.T1889C	p.L630P
Clonal	chr3	49026456	G	A	WDR6	.	NA	NA	0	0.15	nonsynonymous SNV	NM_018031	exon2	c.G2575A	p.A859T
Clonal	chr22	40425560	C	G	MEI1	.	NA	NA	NA	0	nonsynonymous SNV	NM_152513	exon1	c.C72G	p.F24L
Clonal	chr8	2034136	G	A	MYOM2	.	NA	NA	0.308	0.22	nonsynonymous SNV	NM_003970	exon19	c.G2356A	p.A786T
Clonal	chr2	86535747	C	T	KDM3A	.	NA	NA	0	0.04	nonsynonymous SNV	NM_001146688	exon5	c.C482T	p.T161M
Clonal	chr10	100140401	G	A	PYROXD2	.	NA	NA	NA	NA	synonymous SNV	NM_032709	exon12	c.C1236T	p.D412D
Clonal	chr4	13210648	C	A	BOD1L1	.	NA	NA	0.995	0	nonsynonymous SNV	NM_148894	exon10	c.G6974T	p.S2325I
Clonal	chr1	47277018	C	T	CYP4X1	.	NA	NA	0.986	0.72	nonsynonymous SNV	NM_178033	exon7	c.C875T	p.S292F
Clonal	chr17	64733081	G	A	ABCA10	.	NA	NA	0.303	0.02	nonsynonymous SNV	NM_080282	exon4	c.C14T	p.A5V
Clonal	chr18	40535737	G	A	SETBP1	.	NA	NA	0.977	0.03	nonsynonymous SNV	NM_015559	exon2	c.G428A	p.R143H
Clonal	chr2	1656476	C	T	PXDN	.	NA	NA	NA	NA	nonsynonymous SNV	NM_012293	exon9	c.G964A	p.V322M
Clonal	chr8	2041541	C	A	MYOM2	.	NA	NA	0.442	0.06	nonsynonymous SNV	NM_003970	exon22	c.C2837A	p.S946Y
Clonal	chr20	18474646	G	T	SEC23B	.	NA	NA	0.547	0	nonsynonymous SNV	NM_032986	exon15	c.G1712T	p.R571M
Clonal	chr2	31659258	G	T	UNKNOWN	.	NA	NA	NA	0.19	unknown				
Clonal	chr16	56633668	C	T	MMP15	.	NA	NA	NA	NA	synonymous SNV	NM_002428	exon7	c.C1197T	p.R399R
Clonal	chr6	15641462	C	T	DTNBP1	.	NA	NA	0	0.56	nonsynonymous SNV	NM_032122	exon8	c.G655A	p.A219T
Clonal	chr20	25441537	G	A	NINL	.	NA	NA	0.793	0.28	nonsynonymous SNV	NM_025176	exon4	c.C383T	p.P128L
Clonal	chr7	6527600	C	T	GRID2IP	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001145118	exon6	c.G1069A	p.V357I
Clonal	chr5	137654301	G	C	CDC25C	.	NA	NA	0.858	0.03	nonsynonymous SNV	NM_001790	exon9	c.C790G	p.L264V
Clonal	chr11	93443313	G	T	HEPHL1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001098672	exon6	c.G1189T	p.G397C
Clonal	chr18	28226897	T	C	GAREM	.	NA	NA	0.992	0.02	nonsynonymous SNV	NM_001242409	exon2	c.A221G	p.Y74C
Clonal	chr1	150549566	G	A	FLG	.	NA	NA	0.524509	0.27	stopgain SNV	NM_002016	exon3	c.C4420T	p.R1474X
Clonal	chr12	69235341	G	C	PTPRB	.	NA	NA	NA	0	nonsynonymous SNV	NM_001206971	exon17	c.C4085G	p.P1362R
Clonal	chr14	68598931	G	A	DCAF5	.	NA	NA	0.735527	NA	stopgain SNV	NM_003861	exon8	c.C997T	p.R333X
Clonal	chr11	45789078	C	T	SLC35C1	.	NA	NA	NA	NA	synonymous SNV	NM_001145265	exon3	c.C672T	p.N224N
Clonal	chr8	119662258	A	G	SAMD12	.	NA	NA	NA	NA	synonymous SNV	NM_001101676	exon2	c.T69C	p.G23G
Clonal	chr6	43301484	C	A	DNPH1	.	NA	NA	0.119	0.03	nonsynonymous SNV	NM_006443	exon4	c.G490T	p.G164W
Clonal	chr19	47603350	G	A	LIPE	.	NA	NA	NA	NA	synonymous SNV	NM_005357	exon6	c.C1953T	p.H651H
Clonal	chr7	92568606	G	T	SAMD9	.	NA	NA	0.885	0.15	nonsynonymous SNV	NM_001193307	exon2	c.C4741A	p.P1581T
Clonal	chr1	12809901	C	T	PRAMEF11	.	NA	NA	NA	NA	synonymous SNV	NM_001146344	exon3	c.G543A	p.L181L

Clonal	chr4	38474861	C	A	TLR1	.	NA	NA	0	0.01	nonsynonymous SNV	NM_003263	exon4	c.G1987T	p.G663C
Clonal	chr2	73530918	C	A	ALMS1	.	NA	NA	NA	NA	synonymous SNV	NM_015120	exon8	c.C3753A	p.V1251V
Clonal	chr18	42281616	T	G	RNF165	.	NA	NA	0.979	0	nonsynonymous SNV	NM_152470	exon4	c.T578G	p.M193R
Clonal	chr19	62659243	G	A	VN1R1	.	NA	NA	0.314	0	nonsynonymous SNV	NM_020633	exon1	c.C424T	p.L142F
Clonal	chrX	17656289	C	T	NHS	.	NA	NA	0.841	0.01	nonsynonymous SNV	NM_001136024	exon7	c.C3611T	p.S1204L
Clonal	chr6	161389811	T	G	MAP3K4	.	NA	NA	0.956	0.05	nonsynonymous SNV	NM_006724	exon3	c.T517G	p.S173A
Clonal	chr11	117489271	C	T	TMPRSS4	.	NA	NA	0.339	0.14	nonsynonymous SNV	NM_001173551	exon9	c.C815T	p.A272V
Clonal	chr11	4901738	G	A	OR51G1	.	NA	NA	NA	NA	synonymous SNV	NM_001005237	exon1	c.C408T	p.T136T
Clonal	chr19	51109392	G	A	NANOS2	.	NA	NA	0.999	0	nonsynonymous SNV	NM_001029861	exon1	c.C400T	p.R134C
Clonal	chr6	50918917	C	T	TFAP2B	.	NA	NA	NA	NA	synonymous SNV	NM_003221	exon7	c.C1236T	p.A412A
Clonal	chr19	13802590	G	A	ZSWIM4	.	NA	NA	0.874	0.36	nonsynonymous SNV	NM_023072	exon13	c.G2696A	p.R899H
Clonal	chr6	107497407	G	A	BEND3	.	NA	NA	0.993	0	nonsynonymous SNV	NM_001080450	exon5	c.C1681T	p.R561C
Clonal	chr12	113603240	G	C	TBX3	.	NA	NA	1	0	nonsynonymous SNV	NM_005996	exon2	c.C484G	p.R162G
Clonal	chr14	23969936	C	A	KHNYN	.	NA	NA	0.813	0	nonsynonymous SNV	NM_015299	exon2	c.C160A	p.L54M
Clonal	chr10	45276747	G	A	MARCH8	.	NA	NA	0.789104	0	nonsynonymous SNV	NM_001002266	exon5	c.C361T	p.R121C
Clonal	chr13	97626985	C	T	RNF113B	.	NA	NA	NA	NA	synonymous SNV	NM_178861	exon1	c.G507A	p.S169S
Clonal	chr16	30920365	C	G	STX1B	.	NA	NA	0.003	0.03	nonsynonymous SNV	NM_052874	exon2	c.G91C	p.E31Q
Clonal	chr19	8521159	C	T	MYO1F	.	NA	NA	0.685	0.03	nonsynonymous SNV	NM_012335	exon10	c.G986A	p.R329H
Clonal	chr21	44795059	G	A	KRTAP10-2	.	NA	NA	NA	NA	synonymous SNV	NM_198693	exon1	c.C711T	p.P237P
Clonal	chr4	103737794	C	T	NFKB1	.	NA	NA	NA	NA	synonymous SNV	NM_001165412	exon15	c.C1572T	p.D524D
Clonal	chr21	44795071	G	A	KRTAP10-2	.	NA	NA	NA	NA	synonymous SNV	NM_198693	exon1	c.C699T	p.L233L
Clonal	chr3	185583815	G	T	CHRD	.	NA	NA	0.983	0.01	nonsynonymous SNV	NM_003741	exon11	c.G1235T	p.G412V
Clonal	chr5	161048856	C	T	GABRA6	.	NA	NA	NA	NA	synonymous SNV	NM_000811	exon5	c.C465T	p.D155D
Clonal	chr20	47167864	C	T	STAU1	.	NA	NA	0.937	0	nonsynonymous SNV	NM_017452	exon10	c.G1123A	p.A375T
Clonal	chr20	33605568	G	C	ERGIC3	.	NA	NA	0.14	0.47	nonsynonymous SNV	NM_198398	exon8	c.G697C	p.E233Q
Clonal	chr11	64513555	G	T	BATF2	.	NA	NA	NA	NA	synonymous SNV	NM_138456	exon3	c.C447A	p.L149L
Clonal	chr1	176690275	C	T	RASAL2	.	NA	NA	0.917	0	nonsynonymous SNV	NM_170692	exon12	c.C2080T	p.R694C
Clonal	chr1	235068488	C	A	MTR	.	NA	NA	0.977	0	nonsynonymous SNV	NM_000254	exon15	c.C1481A	p.A494D
Clonal	chr7	23775286	C	A	STK31	.	NA	NA	0.102	0.01	nonsynonymous SNV	NM_001260504	exon12	c.C1495A	p.R499S
Clonal	chr11	77609101	G	A	GAB2	.	NA	NA	0.999	0.09	nonsynonymous SNV	NM_012296	exon9	c.C1685T	p.T562M
Clonal	chrX	54486634	C	T	TSR2	.	NA	NA	NA	NA	synonymous SNV	NM_058163	exon3	c.C249T	p.D83D
Clonal	chr15	62578773	C	G	ZNF609	.	NA	NA	NA	NA	synonymous SNV	NM_015042	exon1	c.C102G	p.L34L
Clonal	chr8	23162822	G	A	CHMP7	.	NA	NA	0.023	0.29	nonsynonymous SNV	NM_152272	exon3	c.G454A	p.A152T
Clonal	chr16	30643283	G	A	SRCAP	.	NA	NA	NA	NA	synonymous SNV	NM_006662	exon25	c.G5037A	p.Q1679Q
Clonal	chr14	23975446	T	C	KHNYN	.	NA	NA	NA	NA	synonymous SNV	NM_015299	exon7	c.T1698C	p.F566F
Clonal	chr1	156702186	A	T	OR10K1	.	NA	NA	0.021	0.01	nonsynonymous SNV	NM_001004473	exon1	c.A211T	p.I71F
Clonal	chr1	32276060	C	T	KHDRBS1	.	NA	NA	0.854	0.01	nonsynonymous SNV	NM_006559	exon6	c.C943T	p.R315C
Clonal	chr1	154883415	G	A	BCAN	.	NA	NA	1	0.14	nonsynonymous SNV	NM_021948	exon3	c.G290A	p.R97H
Clonal	chr5	75990240	A	C	IQGAP2	.	NA	NA	0.98	0	nonsynonymous SNV	NM_006633	exon21	c.A2521C	p.T841P
Clonal	chrX	10495556	G	T	MID1	.	NA	NA	0.999	0	nonsynonymous SNV	NM_001193277	exon2	c.C32A	p.P11H
Clonal	chr19	17602544	G	T	UNC13A	.	NA	NA	NA	0.08	nonsynonymous SNV	NM_001080421	exon28	c.C3444A	p.F1148L
Clonal	chr1	172139794	A	G	SERPINC1	.	NA	NA	NA	NA	synonymous SNV	NM_000488	exon7	c.T1251C	p.S417S
Clonal	chr16	18963792	G	C	TMC7	.	NA	NA	0	0.28	nonsynonymous SNV	NM_001160364	exon10	c.G1093C	p.D365H
Clonal	chr8	22062341	C	T	LG13	.	NA	NA	0.735256	0.18	stopgain SNV	NM_139278	exon8	c.G924A	p.W308X
Clonal	chr15	83204028	C	T	ALPK3	.	NA	NA	0.995	0.01	nonsynonymous SNV	NM_020778	exon8	c.C4589T	p.P1530L
Clonal	chr11	16833062	G	A	PLEKHA7	.	NA	NA	0.997	0	nonsynonymous SNV	NM_175058	exon6	c.C472T	p.R158W
Clonal	chr17	35601217	G	C	RAPGEFL1	.	NA	NA	0.137	0.44	nonsynonymous SNV	NM_016339	exon9	c.G841C	p.E281Q
Clonal	chr12	76939694	G	A	NAV3	.	NA	NA	NA	NA	synonymous SNV	NM_014903	exon9	c.G1944A	p.S648S
Clonal	chr10	102756544	G	A	LZTS2	.	NA	NA	0	0.55	nonsynonymous SNV	NM_032429	exon5	c.G1639A	p.A547T
Clonal	chr5	132260575	G	A	AFF4	.	NA	AFF4	0.99	0.07	nonsynonymous SNV	NM_014423	exon11	c.C1646T	p.S549F
Clonal	chr3	171633033	G	A	CLDN11	.	NA	NA	0.735205	0	stopgain SNV	NM_005602	exon3	c.G419A	p.W140X
Clonal	chr3	150406814	C	T	CP	.	NA	NA	0.13	0	nonsynonymous SNV	NM_000096	exon6	c.G1039A	p.G347S
Clonal	chr14	51544388	G	A	NID2	.	NA	NA	0.154	0.02	nonsynonymous SNV	NM_007361	exon19	c.C3770T	p.T1257M
Clonal	chr19	7870931	C	A	LRRCE8	.	NA	NA	NA	NA	synonymous SNV	NM_001268285	exon2	c.C1137A	p.G379G
Clonal	chr1	166073164	G	C	ADCY10	.	NA	NA	0.01	0	nonsynonymous SNV	NM_001167749	exon19	c.C2565G	p.I855M
Clonal	chr1	20517689	T	C	VWA5B1	.	NA	NA	NA	NA	synonymous SNV	NM_001039500	exon6	c.T729C	p.H243H

Clonal	chrX	47372565	C	G	CFP	.	NA	NA	0.99	0.02	nonsynonymous SNV	NM_002621	exon4	c.G283C	p.E95Q
Clonal	chr19	62456657	C	T	ZNF805	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001023563	exon4	c.C658T	p.R220W
Clonal	chr2	69027045	G	C	GKN2	.	NA	NA	0.143	0.43	nonsynonymous SNV	NM_182536	exon5	c.C367G	p.L123V
Clonal	chr19	10885628	G	A	CARM1	.	NA	NA	0.244	0.05	nonsynonymous SNV	NM_199141	exon6	c.G745A	p.E249K
Clonal	chr11	6218198	G	A	CNGA4	.	NA	NA	0	0.88	nonsynonymous SNV	NM_001037329	exon4	c.G598A	p.A200T
Clonal	chr21	45725138	G	T	COL18A1	.	NA	NA	0.73525	NA	stopgain SNV	NM_030582	exon12	c.G2089T	p.G697X
Clonal	chr19	56218192	T	C	KLK11	.	NA	NA	0.001	1	nonsynonymous SNV	NM_001136032	exon5	c.A568G	p.S190G
Clonal	chr1	184621833	C	T	C1orf27	.	NA	NA	NA	0	nonsynonymous SNV	NM_001164245	exon4	c.C325T	p.R109C
Clonal	chr11	63877439	G	T	CCDC88B	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_032251	exon22	c.G3728T	p.R1243L
Clonal	chr7	100114009	G	A	GNB2	.	NA	NA	0.548	0.05	nonsynonymous SNV	NM_005273	exon9	c.G752A	p.R251H
Clonal	chrX	23658867	G	A	ACOT9	.	NA	NA	0.640186	NA	stopgain SNV	NM_001037171	exon5	c.C349T	p.Q117X
Clonal	chrX	16611206	A	C	CTPS2	.	NA	NA	0.619	0.01	nonsynonymous SNV	NM_001144002	exon9	c.T937G	p.C313G
Clonal	chr19	53915913	A	G	RASIP1	.	NA	NA	0.945	0.01	nonsynonymous SNV	NM_017805	exon12	c.T2846C	p.L949P
Clonal	chr5	75616853	G	A	SV2C	.	NA	NA	0.999	0	nonsynonymous SNV	NM_014979	exon5	c.G1024A	p.E342K
Clonal	chr1	17139087	C	T	CROCC	.	NA	NA	0.999	0.02	nonsynonymous SNV	NM_014675	exon13	c.C1720T	p.R574W
Clonal	chr16	30685336	C	G	RNF40	.	NA	NA	0.469	0.1	nonsynonymous SNV	NM_014771	exon10	c.C1249G	p.L417V
Clonal	chr18	58392876	C	A	ZCCHC2	.	NA	NA	NA	0	nonsynonymous SNV	NM_017742	exon13	c.C2582A	p.P861H
Clonal	chr7	99656145	C	G	PVRIG	.	NA	NA	0.036	0	nonsynonymous SNV	NM_024070	exon4	c.C509G	p.A170G
Clonal	chr19	61176972	C	T	NLRP8	.	NA	NA	0.999	0.58	nonsynonymous SNV	NM_176811	exon7	c.C2677T	p.H893Y
Clonal	chr19	60133783	G	T	NLRP7	.	NA	NA	NA	NA	synonymous SNV	NM_139176	exon9	c.C2622A	p.A874A
Clonal	chr15	29610300	C	T	OTUD7A	.	NA	NA	0.996	0.08	nonsynonymous SNV	NM_130901	exon4	c.G554A	p.R185H
Clonal	chr1	74782223	G	A	TNNI3K	.	NA	NA	0.004	0	nonsynonymous SNV	NM_015978	exon25	c.G2477A	p.R826Q
Clonal	chr1	158360390	A	G	ATP1A2	.	NA	NA	0	0.35	nonsynonymous SNV	NM_000702	exon5	c.A415G	p.I139V
Clonal	chr11	129498879	C	T	APLP2	.	NA	NA	0	0.26	nonsynonymous SNV	NM_001642	exon7	c.C1085T	p.A362V
Clonal	chr5	178071778	C	G	ZNF354A	.	NA	NA	0.012	0	nonsynonymous SNV	NM_005649	exon5	c.G1707C	p.Q569H
Clonal	chr9	115851289	C	T	ZNF618	.	NA	NA	NA	0.65	nonsynonymous SNV	NM_133374	exon14	c.C1607T	p.A536V
Clonal	chr9	37512840	C	G	FBXO10	.	NA	NA	NA	0.02	nonsynonymous SNV	NM_012166	exon7	c.G1912C	p.E638Q
Clonal	chr9	87823044	G	C	NAA35	.	NA	NA	0.999	0	nonsynonymous SNV	NM_024635	exon20	c.G1828C	p.D610H
Clonal	chr9	128495387	G	A	LMX1B	.	NA	NA	NA	NA	synonymous SNV	NM_002316	exon4	c.G705A	p.K235K
Clonal	chr19	59317118	G	T	PRPF31	.	NA	NA	0.003	0.84	nonsynonymous SNV	NM_015629	exon4	c.G306T	p.E102D
Clonal	chr11	6610301	A	G	DCHS1	.	NA	NA	NA	NA	synonymous SNV	NM_003737	exon6	c.T3018C	p.R1006R
Clonal	chr19	50866405	C	G	GIPR	.	NA	NA	0.987	0.01	nonsynonymous SNV	NM_000164	exon4	c.C195G	p.F65L
Clonal	chr1	151922589	C	T	NPR1	.	NA	NA	NA	NA	synonymous SNV	NM_000906	exon6	c.C1377T	p.N459N
Clonal	chr16	70273285	C	T	PHLPP2	.	NA	NA	0.334	0.15	nonsynonymous SNV	NM_015020	exon5	c.G760A	p.V254M
Clonal	chr16	19396335	T	C	TMC5	.	NA	NA	NA	NA	synonymous SNV	NM_024780	exon9	c.T1425C	p.G475G
Clonal	chr14	75300805	C	T	TLL5	.	NA	NA	NA	NA	synonymous SNV	NM_015072	exon19	c.C1645T	p.L547L
Clonal	chr2	70771463	C	T	ADD2	.	NA	NA	0.996	0.02	nonsynonymous SNV	NM_001185054	exon8	c.G812A	p.R271Q
Clonal	chr15	64397992	G	A	DIS3L	.	NA	NA	NA	NA	synonymous SNV	NM_001143688	exon8	c.G1146A	p.Q382Q
Clonal	chr7	107402741	T	C	LAMB1	.	NA	NA	0.002	0.18	nonsynonymous SNV	NM_002291	exon12	c.A1408G	p.N470D
Clonal	chr11	74224338	C	T	RNF169	.	NA	NA	1	NA	nonsynonymous SNV	NM_001098638	exon6	c.C1042T	p.R348C
Clonal	chr19	7490909	C	T	ZNF358	.	NA	NA	0.999	NA	nonsynonymous SNV	NM_018083	exon2	c.C781T	p.R261W
Clonal	chr19	10435587	G	A	PDE4A	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_001111309	exon14	c.G1679A	p.R560H
Clonal	chr19	7713933	G	C	CD209	.	NA	NA	0.271898	0.24	nonsynonymous SNV	NM_001144894	exon5	c.C1075G	p.P359A
Clonal	chr9	21156083	A	T	IFNA21	.	NA	NA	0.001	0.01	nonsynonymous SNV	NM_002175	exon1	c.T529A	p.L177I
Clonal	chr1	41820217	C	G	HIVEP3	.	NA	NA	0.84	0.24	nonsynonymous SNV	NM_024503	exon4	c.G2839C	p.A947P
Clonal	chr1	151928920	C	T	NPR1	.	NA	NA	NA	NA	synonymous SNV	NM_000906	exon19	c.C2772T	p.G924G
Clonal	chr16	4431493	C	T	DNAJA3	.	NA	NA	NA	NA	synonymous SNV	NM_001135110	exon4	c.C546T	p.P182P
Clonal	chr18	7016032	C	A	LAMA1	.	NA	NA	1	0	nonsynonymous SNV	NM_005559	exon17	c.G2348T	p.G783V
Clonal	chrX	36938656	G	A	FAM47C	.	NA	NA	0.056	0.06	nonsynonymous SNV	NM_001013736	exon1	c.G2252A	p.R751H
Clonal	chr16	30278031	C	T	TBC1D10B	.	NA	NA	NA	NA	synonymous SNV	NM_015527	exon7	c.G1605A	p.A535A
Clonal	chr7	65741614	G	A	KCTD7	.	NA	NA	0.999	0.02	nonsynonymous SNV	NM_001167961	exon4	c.G830A	p.C277Y
Clonal	chr19	17756592	G	T	FCHO1	.	NA	NA	0.838	0.13	nonsynonymous SNV	NM_001161359	exon24	c.G2135T	p.G712V
Clonal	chr16	3433149	C	T	ZNF597	.	NA	NA	NA	NA	synonymous SNV	NM_152457	exon2	c.G6A	p.A2A
Clonal	chr11	19034291	G	T	MRGPRX2	.	NA	NA	0.576	0.09	nonsynonymous SNV	NM_054030	exon2	c.C235A	p.L79I
Clonal	chr14	20560132	G	C	NDRG2	.	NA	NA	0.911	0.01	nonsynonymous SNV	NM_016250	exon5	c.C231G	p.I77M
Clonal	chrX	132300894	C	T	GPC4	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_001448	exon2	c.G302A	p.R101H

Clonal	chr1	78875334	G	A	IFI44L	.	NA	NA	NA	NA	synonymous SNV	NM_006820	exon6	c.G906A	p.E302E	
Clonal	chr13	100510177	T	C	NALCN	.	NA	NA	NA	NA	synonymous SNV	NM_052867	exon42	c.A4899G	p.Q1633Q	
Clonal	chr7	139438201	G	T	JHDM1D	.	NA	NA	NA	0	NA	nonsynonymous SNV	NM_030647	exon19	c.C2603A	p.A868E
Clonal	chr4	1923647	G	A	WHSC1	.	NA	WHSC1	NA	NA	synonymous SNV	NM_133331	exon12	c.G2028A	p.P676P	
Clonal	chr15	68912309	C	T	LARP6	.	NA	NA	NA	NA	synonymous SNV	NM_018357	exon3	c.G612A	p.Q204Q	
Clonal	chr11	102247802	C	T	UNKNOWN	.	NA	NA	NA	NA	unknown					
Clonal	chrX	13705439	C	T	GPM6B	.	NA	NA	0.997	0.1	nonsynonymous SNV	NM_001001994	exon5	c.G547A	p.G183R	
Clonal	chr14	34304053	G	A	BAZ1A	.	NA	NA	NA	NA	synonymous SNV	NM_013448	exon22	c.C3474T	p.G1158G	
Clonal	chr15	40372284	T	C	GANC	.	NA	NA	0.181	0.2	nonsynonymous SNV	NM_198141	exon5	c.T389C	p.L130P	
Clonal	chr1	155205752	C	T	ARHGEF11	.	NA	NA	NA	NA	synonymous SNV	NM_198236	exon10	c.G771A	p.Q257Q	
Clonal	chr1	113438839	C	T	LRIG2	.	NA	NA	1	0.01	nonsynonymous SNV	NM_014813	exon6	c.C742T	p.R248W	
Clonal	chr1	154302398	A	G	RAB25	.	NA	NA	0.991	0.01	nonsynonymous SNV	NM_020387	exon2	c.A116G	p.H39R	
Clonal	chr21	46633149	G	A	PCNT	.	NA	NA	0.009	0.15	nonsynonymous SNV	NM_006031	exon18	c.G3529A	p.V1177I	
Clonal	chrX	100497875	C	T	BTK	.	NA	NA	0.988	0.01	nonsynonymous SNV	NM_000061	exon15	c.G1387A	p.V463I	
Clonal	chr1	224628639	T	C	PARP1	.	NA	NA	0.021	0.24	nonsynonymous SNV	NM_001618	exon14	c.A1981G	p.T661A	
Clonal	chr1	199552431	G	A	PKP1	.	NA	NA	0.157	0.26	nonsynonymous SNV	NM_000299	exon4	c.G829A	p.E277K	
Clonal	chr7	92601510	G	T	SAMD9L	.	NA	NA	0.115	0.21	nonsynonymous SNV	NM_152703	exon5	c.C1711A	p.L571I	
Clonal	chr20	2794141	G	A	VPS16	.	NA	NA	NA	NA	synonymous SNV	NM_080413	exon18	c.G1839A	p.L613L	
Clonal	chr6	31702873	G	A	PRRC2A	.	NA	NA	NA	NA	synonymous SNV	NM_004638	exon11	c.G1209A	p.P403P	
Clonal	chr1	120267911	C	T	NOTCH2	.	NA	NA	NA	NA	synonymous SNV	NM_024408	exon26	c.G4731A	p.L1577L	
Clonal	chr14	51804602	C	T	PTGDR	.	NA	NA	0.06	0.5	nonsynonymous SNV	NM_000953	exon1	c.C320T	p.A107V	
Clonal	chr6	144128533	A	C	PHACTR2	.	NA	NA	0.891	0.03	nonsynonymous SNV	NM_001100165	exon5	c.A897C	p.L299F	
Clonal	chr20	47689689	G	A	B4GALT5	.	NA	NA	0.004	0.01	nonsynonymous SNV	NM_004776	exon7	c.C850T	p.R284W	
Clonal	chr6	111042482	C	T	CDK19	.	NA	NA	NA	NA	synonymous SNV	NM_015076	exon13	c.G1458A	p.S486S	
Clonal	chr11	64323677	C	T	MAP4K2	.	NA	NA	0.651	0.47	nonsynonymous SNV	NM_004579	exon13	c.G970A	p.E324K	
Clonal	chr3	36871718	C	T	TRANK1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_014831	exon12	c.G4367A	p.R1456Q	
Clonal	chr4	40135366	C	T	RBM47	.	NA	NA	1	0	nonsynonymous SNV	NM_019027	exon3	c.G302A	p.R101H	
Clonal	chr16	22988255	C	A	USP31	.	NA	NA	0.017	0.02	nonsynonymous SNV	NM_020718	exon16	c.G2672T	p.S891I	
Clonal	chr1	164306443	C	T	FAM78B	.	NA	NA	0.195	0.24	nonsynonymous SNV	NM_001017961	exon2	c.G445A	p.A149T	
Clonal	chr19	10195794	G	C	S1PR2	.	NA	NA	0.017	0.01	nonsynonymous SNV	NM_004230	exon2	c.C788G	p.S263C	
Clonal	chr2	85719846	G	T	USP39	.	NA	NA	0.642067	0.25	stopgain SNV	NM_006590	exon9	c.G1105T	p.E369X	
Clonal	chr7	82421586	T	C	PCL0	.	NA	NA	NA	NA	nonsynonymous SNV	NM_033026	exon5	c.A6619G	p.T2207A	
Clonal	chr6	149436760	G	A	UST	.	NA	NA	0.617	0.01	nonsynonymous SNV	NM_005715	exon8	c.G1036A	p.E346K	
Clonal	chr6	36036768	G	A	SLC26A8	.	NA	NA	NA	NA	synonymous SNV	NM_052961	exon13	c.C1548T	p.I516I	
Clonal	chr11	60459416	G	C	TMEM132A	.	NA	NA	0.778	0.04	nonsynonymous SNV	NM_017870	exon10	c.G1956C	p.L652F	
Clonal	chr6	138686600	G	A	KIAA1244	.	NA	NA	NA	NA	synonymous SNV	NM_020340	exon30	c.G4866A	p.V1622V	
Clonal	chr19	50896961	G	A	QPCTL	.	NA	NA	0.95	0.08	nonsynonymous SNV	NM_017659	exon6	c.G952A	p.G318R	
Clonal	chr6	43520541	G	T	ABCC10	.	NA	NA	1	0	nonsynonymous SNV	NM_001198934	exon13	c.G2727T	p.W909C	
Clonal	chr1	148794633	G	T	ADAMTSL4	.	NA	NA	0	1	nonsynonymous SNV	NM_019032	exon8	c.G1339T	p.A447S	
Clonal	chr16	45518404	G	A	GPT2	.	NA	NA	0.901	0	nonsynonymous SNV	NM_001142466	exon11	c.G1135A	p.V379M	
Clonal	chr11	66149270	C	T	RBM14	.	NA	NA	NA	NA	synonymous SNV	NM_006328	exon2	c.C1347T	p.Y449Y	
Clonal	chr19	16527182	C	T	SLC35E1	.	NA	NA	NA	NA	synonymous SNV	NM_024881	exon5	c.G783A	p.T261T	
Clonal	chr19	9438374	C	T	ZNF560	.	NA	NA	0.973	0.14	nonsynonymous SNV	NM_152476	exon10	c.G2249A	p.R750H	
Clonal	chr6	138244039	G	A	TNFAIP3	.	p.0?	NA	0.027	0.28	nonsynonymous SNV	NM_006290	exon9	c.G2263A	p.E755K	
Clonal	chr14	61611826	C	A	SYT16	.	NA	NA	NA	NA	synonymous SNV	NM_031914	exon3	c.C957A	p.S319S	
Clonal	chr1	148750893	T	C	ECM1	.	NA	NA	1	0	nonsynonymous SNV	NM_004425	exon7	c.T1045C	p.C349R	
Clonal	chr3	99555803	C	T	OR5K4	.	NA	NA	0.746	0.06	nonsynonymous SNV	NM_001005517	exon1	c.C416T	p.T139M	
Clonal	chr20	61045457	G	A	GID8	.	NA	NA	0.025	0.01	nonsynonymous SNV	NM_017896	exon4	c.G481A	p.G161R	
Clonal	chr19	13889899	C	T	CC2D1A	.	NA	NA	NA	NA	synonymous SNV	NM_017721	exon7	c.C765T	p.G255G	
Tumor Subclone 1 & 3	chr19	60403609	G	A	PTPRH	.	NA	NA	NA	NA	synonymous SNV	NM_002842	exon7	c.C1227T	p.P409P	
Tumor Subclone 1 & 3	chr2	216669107	A	C	TMEM169	.	NA	NA	0.052	1	nonsynonymous SNV	NM_001142311	exon2	c.A176C	p.N59T	
Tumor Subclone 1 & 3	chr5	76006183	A	G	IQGAP2	.	NA	NA	NA	NA	synonymous SNV	NM_006633	exon27	c.A3420G	p.S1140S	
Tumor Subclone 1 & 3	chr11	85134422	A	G	SYTL2	.	NA	NA	0.535141	0	nonsynonymous SNV	NM_032943	exon4	c.T295C	p.W99R	
Tumor Subclone 1 & 3	chr9	118500654	G	A	TRIM32	.	NA	NA	0.002	0.49	nonsynonymous SNV	NM_001099679	exon2	c.G812A	p.R271Q	
Tumor Subclone 1 & 3	chr9	34253146	C	A	KIF24	.	NA	NA	NA	0	nonsynonymous SNV	NM_194313	exon9	c.G1468T	p.D490Y	
Tumor Subclone 1 & 3	chr19	51135931	G	A	NOVA2	.	NA	NA	0.72055	0.01	nonsynonymous SNV	NM_002516	exon4	c.C509T	p.P170L	

Tumor Subclone 1 & 3	chr15	50323890	G	A	MYO5C	.	NA	NA	0.009	0.08	nonsynonymous SNV	NM_018728	exon19	c.C2345T	p.A782V
Tumor Subclone 1 & 3	chr9	129981450	C	A	CIZ1	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_001131015	exon8	c.G857T	p.R286L
Tumor Subclone 1 & 3	chr20	42998735	C	T	PABPC1L	.	NA	NA	0.957	0	nonsynonymous SNV	NM_001124756	exon12	c.C1595T	p.T532I
Tumor Subclone 1 & 3	chr7	103564472	A	C	ORC5	.	NA	NA	NA	NA	synonymous SNV	NM_002553	exon13	c.T1254G	p.A418A
Tumor Subclone 1 & 3	chr1	242594629	A	G	C1orf100	.	NA	NA	0.002	0.17	nonsynonymous SNV	NM_001276349	exon2	c.A4G	p.T2A
Tumor Subclone 1 & 3	chr9	137913423	G	T	CAMSAP1	.	NA	NA	NA	NA	synonymous SNV	NM_015447	exon3	c.C462A	p.A154A
Tumor Subclone 1 & 3	chr9	122260634	C	T	CDK5RAP2	.	NA	NA	0	0.59	nonsynonymous SNV	NM_018249	exon20	c.G2290A	p.A764T
Tumor Subclone 1 & 3	chr7	77645317	T	C	MAGI2	.	NA	NA	0.981	0.27	nonsynonymous SNV	NM_012301	exon14	c.A2350G	p.M784V
Tumor Subclone 1 & 3	chr15	39828307	T	C	MGA	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001164273	exon16	c.T5393C	p.M1798T
Tumor Subclone 2	chr2	232030747	T	C	NCL	.	NA	NA	0.673	0	nonsynonymous SNV	NM_005381	exon9	c.A1298G	p.Y433C
Tumor Subclone 2	chr15	32142634	C	T	CHRM5	.	p.R142C	NA	1	0	nonsynonymous SNV	NM_012125	exon3	c.C424T	p.R142C
Tumor Subclone 2	chr11	28274927	G	T	METTL15	.	NA	NA	0.871	0.15	nonsynonymous SNV	NM_152636	exon6	c.G651T	p.Q217H
Tumor Subclone 2	chr1	43808031	G	A	PTPRF	.	NA	NA	0.999	0.02	nonsynonymous SNV	NM_130440	exon6	c.G563A	p.R188H
Tumor Subclone 2	chr19	10063188	C	T	C19orf66	.	NA	NA	NA	NA	synonymous SNV	NM_018381	exon7	c.C525T	p.Y175Y
Tumor Subclone 2	chr19	40741899	C	T	ATP4A	.	NA	NA	0	0.03	nonsynonymous SNV	NM_000704	exon8	c.G1091A	p.S364N
Tumor Subclone 2	chr4	5675245	C	T	EVC2	.	NA	NA	NA	NA	synonymous SNV	NM_001166136	exon14	c.G2181A	p.R727R
Tumor Subclone 2	chr19	19101983	C	T	TMEM161A	.	NA	NA	0.998	0.01	nonsynonymous SNV	NM_017814	exon6	c.G577A	p.E193K
Tumor Subclone 2	chr5	176619604	A	G	NSD1	.	NA	NSD1	0.426	0.05	nonsynonymous SNV	NM_022455	exon14	c.A4975G	p.M1659V
Tumor Subclone 2	chr15	92728327	T	C	MCTP2	.	NA	NA	0.998	0	nonsynonymous SNV	NM_001159643	exon12	c.T1655C	p.L552P
Tumor Subclone 2	chr11	57715280	G	A	OR9Q2	.	NA	NA	0.907	0	nonsynonymous SNV	NM_001005283	exon1	c.G742A	p.V248I
Tumor Subclone 2	chr4	5628937	C	T	EVC2	.	NA	NA	0.99	1	nonsynonymous SNV	NM_001166136	exon18	c.G2963A	p.R988K
Tumor Subclone 2	chr3	120808478	A	G	PLA1A	.	NA	NA	0.302	0.07	nonsynonymous SNV	NM_015900	exon2	c.A241G	p.T81A
Tumor Subclone 2	chr10	13214134	A	G	OPTN	.	NA	NA	0.616	0	nonsynonymous SNV	NM_021980	exon12	c.A1463G	p.E488G
Tumor Subclone 2	chr3	46698570	C	T	ALS2CL	.	NA	NA	NA	NA	synonymous SNV	NM_001190707	exon11	c.G1128A	p.P376P
Tumor Subclone 2	chr11	61303399	G	A	MYRF	.	NA	NA	0.999	0.04	nonsynonymous SNV	NM_013279	exon15	c.G2075A	p.R692H
Tumor Subclone 2	chr7	83429029	C	T	SEMA3A	.	NA	NA	0.999	0.03	nonsynonymous SNV	NM_006080	exon17	c.G1910A	p.R637H
Tumor Subclone 2	chr5	137504297	A	T	BRD8	.	NA	NA	0.137	0	nonsynonymous SNV	NM_139199	exon26	c.T3611A	p.I1204N
Tumor Subclone 2	chr1	234036347	C	A	LYST	.	NA	NA	NA	NA	synonymous SNV	NM_000081	exon6	c.G2712T	p.V904V
Tumor Subclone 2	chr14	62741434	G	A	RHOJ	.	NA	NA	0.407	0	nonsynonymous SNV	NM_020663	exon1	c.G94A	p.V32M
Tumor Subclone 2	chr1	181122892	C	T	DHX9	.	NA	NA	NA	NA	synonymous SNV	NM_001357	exon28	c.C3513T	p.S1171S
Tumor Subclone 2	chr1	38038016	C	A	MANEAL	.	NA	NA	0.997	0.03	nonsynonymous SNV	NM_152496	exon2	c.C262A	p.H88N
Tumor Subclone 2	chr11	123106605	G	A	ZNF202	.	NA	NA	0.725252	0.58	stopgain SNV	NM_003455	exon4	c.C202T	p.R68X
Tumor Subclone 2	chr6	157192179	C	T	ARID1B	.	NA	NA	0.992	0	nonsynonymous SNV	NM_017519	exon2	c.C1669T	p.R557W
Tumor Subclone 2	chr19	10126351	G	A	DNMT1	.	NA	NA	NA	NA	synonymous SNV	NM_001130823	exon21	c.C1743T	p.D581D
Tumor Subclone 2	chr1	202088131	C	G	ZC3H11A	.	NA	NA	0.646733	0.03	stopgain SNV	NM_014827	exon20	c.C2414G	p.S805X
Tumor Subclone 2	chr5	39170767	C	T	FYB	.	NA	NA	NA	NA	nonsynonymous SNV	NM_199335	exon8	c.G1622A	p.R541H
Tumor Subclone 2	chr11	129245178	C	A	NFRKB	.	NA	NA	0.991	0.11	nonsynonymous SNV	NM_001143835	exon24	c.G2952T	p.Q984H
Tumor Subclone 2	chr14	23678497	T	C	EMC9	.	NA	NA	0.989	0.25	nonsynonymous SNV	NM_016049	exon5	c.A352G	p.N118D
Tumor Subclone 2	chr5	180592485	G	A	TRIM41	.	NA	NA	0.222	0.24	nonsynonymous SNV	NM_033549	exon3	c.G1130A	p.R377Q
Tumor Subclone 2	chr8	24827761	C	T	NEFM	.	NA	NA	0.785343	0	nonsynonymous SNV	NM_005382	exon1	c.C550T	p.R184W
Tumor Subclone 2	chr21	31561077	C	T	TIAM1	.	NA	NA	0.993	0	nonsynonymous SNV	NM_003253	exon5	c.G83A	p.R28H
Tumor Subclone 2	chr15	43036445	G	A	C15orf43	.	NA	NA	0.812	0	nonsynonymous SNV	NM_152448	exon2	c.G124A	p.A42T
Tumor Subclone 2	chr13	100561568	G	A	NALCN	.	NA	NA	0.735469	0.19	stopgain SNV	NM_052867	exon19	c.C2203T	p.R735X
Tumor Subclone 2	chr14	22914721	G	A	IL25	.	NA	NA	0.999	0.02	nonsynonymous SNV	NM_022789	exon2	c.G326A	p.R109H
Tumor Subclone 2	chr1	179969344	G	A	CACNA1E	.	NA	NA	NA	0.38	nonsynonymous SNV	NM_001205293	exon21	c.G3097A	p.A1033T
Tumor Subclone 2	chrX	12727439	G	T	PRPS2	.	NA	NA	0.610221	NA	nonsynonymous SNV	NM_001039091	exon2	c.G315T	p.E105D
Tumor Subclone 2	chr11	93446151	A	G	HEPHL1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001098672	exon8	c.A1402G	p.T468A
Tumor Subclone 2	chr11	44245705	C	T	ALX4	.	NA	NA	0.999	0	nonsynonymous SNV	NM_021926	exon3	c.G821A	p.R274H
Tumor Subclone 2	chr12	116777719	C	T	KSR2	.	NA	NA	NA	NA	synonymous SNV	NM_173598	exon3	c.G282A	p.T94T
Tumor Subclone 2	chr21	30724762	A	G	KRTAP13-4	.	NA	NA	1	0	nonsynonymous SNV	NM_181600	exon1	c.A298G	p.R100G
Tumor Subclone 2	chr16	68284688	G	A	NFAT5	.	NA	NA	NA	NA	synonymous SNV	NM_173215	exon13	c.G3177A	p.Q1059Q
Tumor Subclone 2	chr15	40952124	A	G	TTBK2	.	NA	NA	0.927	0.1	nonsynonymous SNV	NM_173500	exon3	c.T194C	p.V65A
Tumor Subclone 2	chr18	11871066	C	T	GNAL	.	NA	NA	1	0	nonsynonymous SNV	NM_001142339	exon13	c.C1078T	p.R360C
Tumor Subclone 2	chr13	51605934	T	C	NEK3	.	NA	NA	NA	0.54	nonsynonymous SNV	NM_001146099	exon14	c.A1277G	p.K426R
Tumor Subclone 2	chr19	47519622	G	A	TMEM145	.	NA	NA	NA	NA	synonymous SNV	NM_173633	exon14	c.G1242A	p.V414V
Tumor Subclone 2	chr12	54502636	C	T	DNAJC14	.	NA	NA	NA	NA	synonymous SNV	NM_032364	exon5	c.G1782A	p.V594V



Tumor Subclone 2	chr22	43974435	C	T	KIAA0930	.	NA	NA	0.87	0.36	nonsynonymous SNV	NM_015264	exon8	c.G1013A	p.R338Q
Tumor Subclone 3	chr9	116893031	G	A	TNC	.	NA	NA	1	0	nonsynonymous SNV	NM_002160	exon2	c.C88T	p.R30W
Tumor Subclone 3	chr11	116770922	A	G	CEP164	.	NA	NA	0.003	0.02	nonsynonymous SNV	NM_001271933	exon21	c.A2846G	p.E949G
Tumor Subclone 3	chr3	187782498	C	T	DNAJB11	.	NA	NA	0.005	0.16	nonsynonymous SNV	NM_016306	exon6	c.C620T	p.T207M
Tumor Subclone 3	chr13	102188761	T	C	CCDC168	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001146197	exon4	c.A12287G	p.H4096R
Tumor Subclone 3	chr8	67251997	G	A	CRH	.	NA	NA	NA	NA	synonymous SNV	NM_000756	exon2	c.C270T	p.A90A
Tumor Subclone 3	chr21	15261541	C	T	NRIP1	.	NA	NA	0.98	0.08	nonsynonymous SNV	NM_003489	exon4	c.G844A	p.E282K
Tumor Subclone 3	chr11	6611691	C	T	DCHS1	.	NA	NA	0	0.04	nonsynonymous SNV	NM_003737	exon4	c.G2123A	p.R708H
Tumor Subclone 3	chr19	56274650	G	A	KLK14	.	NA	NA	0.197	NA	nonsynonymous SNV	NM_022046	exon5	c.C382T	p.L128F
Tumor Subclone 3	chr2	191721139	G	A	STAT4	.	NA	NA	NA	NA	synonymous SNV	NM_003151	exon2	c.C36T	p.I121
Tumor Subclone 3	chrX	118487757	G	A	SLC25A5	.	NA	NA	0.1	0	nonsynonymous SNV	NM_001152	exon2	c.G217A	p.G73S
Tumor Subclone 3	chrX	53449158	G	A	SMC1A	.	NA	NA	1	0	nonsynonymous SNV	NM_006306	exon11	c.C1903T	p.R635C
Tumor Subclone 3	chr6	30655688	C	T	ABCF1	.	NA	NA	0.471	0.06	nonsynonymous SNV	NM_001025091	exon7	c.C491T	p.A164V
Tumor Subclone 3	chr1	243596900	C	T	KIF26B	.	NA	NA	NA	NA	synonymous SNV	NM_018012	exon3	c.C607T	p.L203L
Tumor Subclone 3	chr19	8703036	A	T	OR2Z1	.	NA	NA	0.157	0.44	nonsynonymous SNV	NM_001004699	exon1	c.A646T	p.T216S
Tumor Subclone 3	chr18	28511245	T	C	KLHL14	.	NA	NA	NA	NA	synonymous SNV	NM_020805	exon8	c.A1635G	p.K545K
Tumor Subclone 3	chr12	40799111	A	C	GXYLT1	.	NA	NA	0.999	0.22	nonsynonymous SNV	NM_173601	exon3	c.T444G	p.H148Q
Tumor Subclone 2	chr16	31342719	G	A	ITGAD	.	NA	NA	0	1	nonsynonymous SNV	NM_005353	exon27	c.G3098A	p.S1033N
Tumor Subclone 2	chr11	85123211	G	A	SYTL2	.	NA	NA	0.535681	0	nonsynonymous SNV	NM_032943	exon7	c.C806T	p.P269L
Tumor Subclone 2	chr1	152017273	C	T	SLC27A3	.	NA	NA	0.057	0.17	nonsynonymous SNV	NM_024330	exon5	c.C1315T	p.R439C
Tumor Subclone 2	chr2	74543550	C	G	MOGS	.	NA	NA	0.799	0.05	nonsynonymous SNV	NM_001146158	exon5	c.G556C	p.A186P
Tumor Subclone 2	chr14	28307391	C	T	FOXG1	.	NA	NA	NA	NA	synonymous SNV	NM_005249	exon1	c.C1155T	p.A385A
Tumor Subclone 2	chr12	112182630	C	A	TPCN1	.	NA	NA	0.067	NA	nonsynonymous SNV	NM_017901	exon3	c.C187A	p.P63T
Tumor Subclone 2	chr21	44818101	G	A	KRTAP10-4	.	NA	NA	0.401049	NA	nonsynonymous SNV	NM_198687	exon1	c.G38A	p.R13H
Tumor Subclone 2	chr14	23953810	A	G	NYNRIN	.	NA	NA	NA	NA	synonymous SNV	NM_025081	exon9	c.A3015G	p.R1005R
Tumor Subclone 2	chr6	24958912	G	A	FAM65B	.	NA	NA	NA	NA	synonymous SNV	NM_015864	exon10	c.C690T	p.G230G
Tumor Subclone 2	chr17	45152189	G	A	FAM117A	.	NA	NA	NA	NA	synonymous SNV	NM_030802	exon5	c.C640T	p.L214L
Tumor Subclone 2	chr2	74289326	T	C	MTHFD2	.	NA	NA	0.967	0.34	nonsynonymous SNV	NM_006636	exon4	c.T532C	p.W178R
Tumor Subclone 2	chr16	1477918	A	G	PTX4	.	NA	NA	0.626776	0	nonsynonymous SNV	NM_001013658	exon2	c.T181C	p.Y61H
Tumor Subclone 3	chr9	131670394	T	C	USP20	.	NA	NA	0.51	0.38	nonsynonymous SNV	NM_001008563	exon11	c.T980C	p.M327T
Tumor Subclone 3	chr17	8079202	G	A	CTC1	.	NA	NA	0.005	0.16	nonsynonymous SNV	NM_025099	exon8	c.C1333T	p.R445C
Tumor Subclone 3	chr3	52373976	G	A	DNAH1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_015512	exon34	c.G5419A	p.D1807N
Tumor Subclone 3	chr2	176744810	G	A	HOXD3	.	NA	NA	NA	NA	synonymous SNV	NM_006898	exon3	c.G861A	p.P287P
Tumor Subclone 3	chr19	6446473	G	A	TUBB4A	.	NA	NA	0.998	0	nonsynonymous SNV	NM_006087	exon4	c.C1037T	p.P346L
Tumor Subclone 3	chr7	15692143	C	T	MEOX2	.	NA	NA	0	0.48	nonsynonymous SNV	NM_005924	exon1	c.G410A	p.S137N
Tumor Subclone 3	chrX	46318834	G	A	CHST7	.	NA	NA	0.995	0	nonsynonymous SNV	NM_019886	exon1	c.G524A	p.G175E
Tumor Subclone 3	chr8	48802367	C	T	KIAA0146	.	NA	NA	NA	NA	synonymous SNV	NM_001080394	exon17	c.C2394T	p.D798D
Tumor Subclone 3	chr5	159276967	G	A	ADRA1B	.	NA	NA	NA	NA	synonymous SNV	NM_000679	exon1	c.G477A	p.R159R
Tumor Subclone 1	chr19	9385043	A	G	ZNF266	.	NA	NA	0.998	0	nonsynonymous SNV	NM_006631	exon11	c.T1558C	p.Y520H
Tumor Subclone 1	chr19	16180883	G	A	AP1M1	.	NA	NA	NA	NA	synonymous SNV	NM_001130524	exon5	c.G441A	p.P147P
Tumor Subclone 1	chr19	56964284	T	C	FPR2	.	NA	NA	NA	NA	synonymous SNV	NM_001462	exon2	c.T561C	p.P187P
Tumor Subclone 1	chr19	59412890	T	C	LILRB3	.	NA	NA	0.986	0	nonsynonymous SNV	NM_006864	exon13	c.A1780G	p.T594A
Tumor Subclone 1	chrX	27676337	T	C	DCAF8L2	.	NA	NA	NA	NA	synonymous SNV	NM_001136533	exon1	c.T1404C	p.N468N
Tumor Subclone 1	chr7	100321976	C	T	SRRT	.	NA	NA	0.973	0.09	nonsynonymous SNV	NM_001128852	exon13	c.C1628T	p.T543M
Tumor Subclone 1	chr20	54379078	A	G	AURKA	.	NA	NA	0.915	0	nonsynonymous SNV	NM_198436	exon9	c.T899C	p.M300T
Tumor Subclone 1	chr9	136857541	A	G	COL5A1	.	NA	NA	NA	NA	synonymous SNV	NM_000093	exon63	c.A5037G	p.T1679T
Tumor Subclone 1	chr1	166332960	T	G	GPR161	.	NA	NA	0.993	0.32	nonsynonymous SNV	NM_001267614	exon2	c.A167C	p.E56A
Tumor Subclone 1	chr6	51720711	G	A	PKHD1	.	NA	NA	0.999	0.49	nonsynonymous SNV	NM_170724	exon58	c.C9662T	p.P3221L
Tumor Subclone 1	chr11	123106521	T	C	KNF202	.	NA	NA	0.977	0.04	nonsynonymous SNV	NM_003455	exon4	c.A286G	p.T96A
Tumor Subclone 1	chr5	16808008	G	A	MYO10	.	NA	NA	NA	NA	nonsynonymous SNV	NM_012334	exon19	c.C1858T	p.H620Y
Tumor Subclone 1	chr1	157013254	A	G	OR6N2	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_001005278	exon1	c.T796C	p.Y266H
Tumor Subclone 1	chr19	42881708	A	C	ZNF607	.	NA	NA	0.404	0	nonsynonymous SNV	NM_032689	exon5	c.T1164G	p.S388R
Tumor Subclone 1	chr11	62046756	T	G	AHNAK	.	NA	NA	0.001	0.02	nonsynonymous SNV	NM_001620	exon5	c.A11709C	p.Q3903H
Tumor Subclone 1	chr14	23711815	A	G	REC8	.	NA	NA	0.825	0.08	nonsynonymous SNV	NM_005132	exon3	c.A110G	p.N37S
Tumor Subclone 1	chr8	110371310	A	G	NUDCD1	.	NA	NA	NA	NA	synonymous SNV	NM_032869	exon5	c.T669C	p.R223R
Tumor Subclone 1	chr11	62277035	A	T	ZBTB3	.	NA	NA	NA	NA	synonymous SNV	NM_024784	exon2	c.T828A	p.T276T

Tumor Subclone 1	chr19	57408039	C	T	PPP2R1A	.	NA	NA	0.211	0.13	nonsynonymous SNV	NM_014225	exon6	c.C671T	p.A224V
Tumor Subclone 1	chr19	43801800	A	G	EIF3K	.	p.18V	NA	0.536	0	nonsynonymous SNV	NM_013234	exon1	c.A52G	p.I18V
Tumor Subclone 1	chr6	26343033	T	C	HIST1H1D	.	NA	NA	NA	NA	synonymous SNV	NM_005320	exon1	c.A108G	p.A36A
Tumor Subclone 1	chr11	67515634	A	G	UNKNOWN	.	NA	NA	NA	0	unknown				
Tumor Subclone 1	chr12	78713621	A	G	PPP1R12A	.	NA	NA	NA	NA	synonymous SNV	NM_001143886	exon18	c.T2250C	p.P750P
Tumor Subclone 1	chr19	22155111	A	G	ZNF676	.	NA	NA	NA	NA	synonymous SNV	NM_001001411	exon3	c.T1248C	p.T416T
Tumor Subclone 1	chr11	76617918	T	G	GDPD4	.	NA	NA	0.004	0.42	nonsynonymous SNV	NM_182833	exon14	c.A1397C	p.K466T
Tumor Subclone 1	chr7	20410807	A	G	ITGB8	.	NA	NA	NA	NA	synonymous SNV	NM_002214	exon11	c.A1719G	p.Q573Q
Tumor Subclone 1	chr5	150703334	G	A	SLC36A2	.	NA	NA	NA	NA	synonymous SNV	NM_181776	exon3	c.C274T	p.L92L
Tumor Subclone 1	chr2	99354567	T	G	EIF5B	.	NA	NA	NA	NA	synonymous SNV	NM_015904	exon9	c.T1494G	p.T498T
Tumor Subclone 1	chr14	63678518	A	G	SYNE2	.	NA	NA	0.004	0.04	nonsynonymous SNV	NM_015180	exon82	c.A15265G	p.S5089G
Tumor Subclone 1	chr20	18091384	G	A	CSRP2BP	.	NA	NA	0.997	0.01	nonsynonymous SNV	NM_020536	exon6	c.G1466A	p.R489Q
Tumor Subclone 1	chr19	39524671	C	A	KIAA0355	.	NA	NA	NA	NA	synonymous SNV	NM_014686	exon10	c.C1992A	p.G664G
Tumor Subclone 1	chr1	168381957	A	G	METTL11B	.	NA	NA	NA	0.56	nonsynonymous SNV	NM_001136107	exon1	c.A85G	p.I29V
Tumor Subclone 1	chr14	93464706	T	C	FAM181A	.	NA	NA	0.941	0.15	nonsynonymous SNV	NM_001207074	exon2	c.T322C	p.C108R
Tumor Subclone 1	chr8	88955052	T	C	DCAF4L2	.	NA	NA	NA	NA	synonymous SNV	NM_152418	exon1	c.A264G	p.T88T
Tumor Subclone 1	chr6	33050317	G	C	BRD2	.	NA	NA	0.78105	0.01	nonsynonymous SNV	NM_005104	exon3	c.G130C	p.E44Q
Tumor Subclone 1	chr1	205934663	A	G	CR1L	.	NA	NA	NA	0.82	nonsynonymous SNV	NM_175710	exon5	c.A806G	p.H269R
Tumor Subclone 1	chr7	2284378	C	T	SNX8	.	NA	NA	NA	NA	synonymous SNV	NM_013321	exon2	c.G183A	p.P61P
Tumor Subclone 1	chr20	36789658	G	A	SLC32A1	.	NA	NA	NA	NA	synonymous SNV	NM_080552	exon2	c.G540A	p.V180V
Tumor Subclone 1	chr1	87141693	T	C	UNKNOWN	.	NA	NA	NA	NA	unknown				
Tumor Subclone 1	chr2	201040306	T	C	SPATS2L	.	NA	NA	NA	0.07	nonsynonymous SNV	NM_015535	exon10	c.T896C	p.L299P
Tumor Subclone 1	chr14	93129862	A	G	UNC79	.	NA	NA	0.998	0.35	nonsynonymous SNV	NM_020818	exon23	c.A2585G	p.H862R
Tumor Subclone 1	chr1	149203452	A	G	SETDB1	.	NA	NA	NA	NA	synonymous SNV	NM_001145415	exon22	c.A3864G	p.G1288G
Tumor Subclone 1	chr5	7743911	T	A	ADCY2	.	NA	NA	0.979	NA	nonsynonymous SNV	NM_020546	exon5	c.T828A	p.N276K
Tumor Subclone 1	chr19	9223072	A	C	OR7E24	.	NA	NA	NA	0	nonsynonymous SNV	NM_001079935	exon1	c.A353C	p.Q118P
Tumor Subclone 1	chrX	9581713	A	G	TBL1X	.	NA	NA	NA	NA	synonymous SNV	NM_001139466	exon4	c.A87G	p.Q29Q
Tumor Subclone 1	chr1	151000008	A	G	KPRP	.	NA	NA	NA	NA	synonymous SNV	NM_001025231	exon2	c.A1320G	p.L440L
Tumor Subclone 1	chr19	60193821	A	T	NLRP2	.	NA	NA	0.512	0.02	nonsynonymous SNV	NM_001174083	exon11	c.A2608T	p.R870W
Tumor Subclone 1	chr2	241097450	A	G	ANKMY1	.	NA	NA	NA	NA	synonymous SNV	NM_016552	exon11	c.T2115C	p.S705S
Tumor Subclone 1	chr18	59457439	A	G	SERPIN4	.	NA	NA	0.720997	0	nonsynonymous SNV	NM_002974	exon7	c.T728C	p.M243T
Tumor Subclone 1	chr6	132901910	T	C	UNKNOWN	.	NA	NA	NA	NA	unknown				
Tumor Subclone 1	chr6	152374609	T	C	ESR1	.	NA	ESR1	NA	NA	synonymous SNV	NM_001122740	exon6	c.T1222C	p.L408L
Tumor Subclone 1	chr17	16038550	T	G	NCOR1	.	NA	NA	0.999	0.08	nonsynonymous SNV	NM_001190440	exon1	c.A59C	p.Y20S
Tumor Subclone 1	chr17	32586770	T	C	ACACA	.	NA	NA	0.838	0.33	nonsynonymous SNV	NM_198834	exon43	c.A5395G	p.S1799G
Tumor Subclone 1	chr14	80372417	T	C	CEP128	.	NA	NA	NA	NA	synonymous SNV	NM_152446	exon11	c.A942G	p.T314T
Tumor Subclone 1	chr8	70748004	A	G	SLC05A1	.	NA	NA	0.999	0.16	nonsynonymous SNV	NM_030958	exon10	c.T2201C	p.F734S

Supplementary Table ST4.2 Somatic Mutations Detected in Bladder Cancer

Classification	Chromosome	Coordinate	Ref	Var	Gene Name	dbSNP ID	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr19	60023121	G	A	KIR3DL1	.	NA	NA	0.178079	0.58	nonsynonymous SNV	NM_013289	exon4	c.G497A	p.R166H
Clonal	chr10	104856368	G	C	NT5C2	.	NA	NA	NA	NA	synonymous SNV	NM_001134373	exon4	c.C261G	p.L87L
Clonal	chr5	156412146	C	T	HAVCR1	.	NA	NA	NA	NA	synonymous SNV	NM_001099414	exon4	c.G477A	p.T159T
Clonal	chr10	88669050	C	T	BMPR1A	.	NA	BMPR1A	1	0	nonsynonymous SNV	NM_004329	exon10	c.C1010T	p.S337L
Clonal	chr7	117054876	C	T	CFTR	.	NA	NA	0	0.09	nonsynonymous SNV	NM_000492	exon22	c.C3533T	p.S1178L
Clonal	chr4	39183676	C	G	UGDH	.	NA	NA	0.413	0	nonsynonymous SNV	NM_003359	exon8	c.G994C	p.A332P
Clonal	chr4	39183688	C	A	UGDH	.	NA	NA	0.107	0	nonsynonymous SNV	NM_003359	exon8	c.G982T	p.D328Y
Clonal	chr1	110102794	C	T	EPS8L3	.	NA	NA	0	0.58	nonsynonymous SNV	NM_133181	exon7	c.G476A	p.G159D
Clonal	chr1	12842174	T	C	PRAMEF2	.	NA	NA	NA	NA	synonymous SNV	NM_023014	exon3	c.T327C	p.D109D
Clonal	chr2	197973698	C	T	SF3B1	.	NA	NA	0.852	0.03	nonsynonymous SNV	NM_012433	exon18	c.G2704A	p.E902K
Clonal	chr12	53706824	C	T	NEUROD4	.	NA	NA	0.721691	0	stopgain SNV	NM_021191	exon2	c.C334T	p.R112X
Clonal	chr8	52895673	C	T	PCMTD1	.	NA	NA	0.026	0.1	nonsynonymous SNV	NM_052937	exon6	c.G865A	p.V289I
Clonal	chr4	164612757	G	A	TKTL2	.	NA	NA	0.418	0.02	nonsynonymous SNV	NM_032136	exon1	c.C1580T	p.S527F
Clonal	chr11	123994416	G	T	PANX3	.	NA	NA	0.999	0.18	nonsynonymous SNV	NM_052959	exon4	c.G554T	p.R185L
Clonal	chr19	12815346	G	A	MAST1	.	NA	NA	NA	NA	synonymous SNV	NM_014975	exon4	c.G252A	p.A84A
Clonal	chr3	130638090	C	G	MBD4	.	NA	NA	0.502	0.07	nonsynonymous SNV	NM_001276271	exon3	c.G1087C	p.E363Q
Clonal	chr20	6013772	C	A	FERMT1	.	NA	NA	0.994	0.01	nonsynonymous SNV	NM_017671	exon12	c.G1534T	p.D512Y
Clonal	chr12	6925289	G	T	C12orf57	.	NA	NA	NA	NA	synonymous SNV	NM_138425	exon3	c.G324T	p.P108P
Clonal	chr1	109279013	G	A	CLCC1	.	NA	NA	NA	NA	synonymous SNV	NM_015127	exon11	c.C1308T	p.S436S
Clonal	chr18	17599869	G	T	MIB1	.	NA	NA	0.999	0.4	nonsynonymous SNV	NM_020774	exon2	c.G368T	p.R123L
Clonal	chr3	120933910	T	A	MAATS1	.	NA	NA	0.427	0.08	nonsynonymous SNV	NM_033364	exon9	c.T1098A	p.D366E
Clonal	chr10	72206982	T	C	TBATA	.	NA	NA	0.002	0.3	nonsynonymous SNV	NM_152710	exon7	c.A623G	p.Q208R
Clonal	chr9	39168337	C	G	CNTNAP3	.	NA	NA	0.992	0	nonsynonymous SNV	NM_033655	exon5	c.G559C	p.D187H
Clonal	chr2	112864063	G	A	RGPD8	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001164463	exon20	c.C2930T	p.S977L
Clonal	chrX	70386653	G	C	ZMYM3	.	NA	NA	0.588	0.02	nonsynonymous SNV	NM_001171163	exon6	c.C1199G	p.S400C
Clonal	chr20	39467262	G	A	CHD6	.	NA	NA	NA	NA	synonymous SNV	NM_032221	exon37	c.C7533T	p.V2511V
Clonal	chr3	52786731	C	T	ITIH1	.	NA	NA	NA	NA	synonymous SNV	NM_002215	exon1	c.C60T	p.L20L
Clonal	chr5	133354731	G	C	VDAC1	.	NA	NA	0.735514	0.01	stopgain SNV	NM_003374	exon4	c.C131G	p.S44X
Clonal	chr19	43292745	G	A	SIPA1L3	.	NA	NA	NA	NA	synonymous SNV	NM_015073	exon8	c.G2172A	p.T724T
Clonal	chr8	105670255	G	A	LRP12	.	NA	NA	0.01	0.07	nonsynonymous SNV	NM_013437	exon1	c.C47T	p.A16V
Clonal	chr14	59020707	C	A	L3HYPDH	.	NA	NA	NA	NA	synonymous SNV	NM_144581	exon1	c.G81T	p.T27T
Clonal	chr19	4495381	G	A	SEMA6B	.	NA	NA	NA	NA	synonymous SNV	NM_032108	exon17	c.C1899T	p.R633R
Clonal	chr17	30704820	C	A	SLFN11	.	NA	NA	0.556597	0.09	stopgain SNV	NM_001104588	exon6	c.C1570T	p.E524X
Clonal	chr8	134325811	G	T	NDRG1	.	NA	NA	0.196	0	nonsynonymous SNV	NM_001258432	exon12	c.C662A	p.A221E
Clonal	chr8	144991915	C	A	NRBP2	.	NA	NA	0.734689	NA	stopgain SNV	NM_178564	exon11	c.G841T	p.E281X
Clonal	chr4	1773366	C	G	FGFR3	8_S249del	NA	FGFR3	0.522	0.01	nonsynonymous SNV	NM_022965	exon7	c.C746G	p.S249C
Clonal	chr4	2611320	G	C	FAM193A	.	NA	NA	0.015	0.03	nonsynonymous SNV	NM_003704	exon4	c.G226C	p.E76Q
Clonal	chrX	55119822	A	C	PAGE2B	.	NA	NA	NA	NA	synonymous SNV	NM_001015038	exon3	c.A180C	p.A60A
Clonal	chr19	21285269	C	T	ZNF708	.	NA	NA	0.958	0.06	nonsynonymous SNV	NM_021269	exon2	c.G4A	p.G2R
Clonal	chr17	70720800	C	T	NUP85	.	NA	NA	NA	NA	synonymous SNV	NM_024844	exon5	c.C396T	p.F132F
Tumor Subclone 1	chr9	15459955	C	T	PSIP1	.	NA	NA	NA	NA	synonymous SNV	NM_033222	exon11	c.G1014A	p.K338K
Tumor Subclone 1	chrX	65331711	C	T	HEPH	.	NA	NA	NA	NA	synonymous SNV	NM_138737	exon9	c.C1578T	p.F526F
Tumor Subclone 1	chr3	44738927	G	C	ZNF502	.	NA	NA	0.745	0.06	nonsynonymous SNV	NM_001134440	exon4	c.G1614C	p.Q538H
Tumor Subclone 1	chr3	44738567	G	C	ZNF502	.	NA	NA	0.003	0.52	nonsynonymous SNV	NM_001134440	exon4	c.G1254C	p.Q418H
Tumor Subclone 1	chr5	180099203	C	G	OR2Y1	.	NA	NA	NA	NA	synonymous SNV	NM_001001657	exon1	c.G462C	p.V154V
Tumor Subclone 1	chr9	114376732	C	T	KIAA1958	.	NA	NA	0.84	0	nonsynonymous SNV	NM_133465	exon2	c.C551T	p.S184L
Tumor Subclone 1	chr9	114376902	C	T	KIAA1958	.	NA	NA	0.902	0.05	nonsynonymous SNV	NM_133465	exon2	c.C721T	p.H241Y
Tumor Subclone 1	chr16	66713912	C	T	NFATC3	.	NA	NA	NA	NA	synonymous SNV	NM_004555	exon2	c.C625T	p.L209L
Tumor Subclone 1	chr2	24047657	G	A	UBXN2A	.	NA	NA	0.018	0.44	nonsynonymous SNV	NM_181713	exon3	c.G49A	p.E17K
Tumor Subclone 1	chr15	38108932	G	A	EIF2AK4	.	NA	NA	NA	NA	synonymous SNV	NM_001013703	exon34	c.G4536A	p.L1512L
Tumor Subclone 1	chr16	66714069	C	G	NFATC3	.	NA	NA	0.735352	0.02	stopgain SNV	NM_004555	exon2	c.C782G	p.S261X
Tumor Subclone 1	chr1	225219372	G	A	ADCK3	.	NA	NA	0.011	0.03	nonsynonymous SNV	NM_020247	exon3	c.G226A	p.E76K

Tumor Subclone 1	chr6	38891314	G	C	DNAH8	.	NA	NA	NA	NA	synonymous SNV	NM_001206927	exon26	c.G3426C	p.G1142G
Tumor Subclone 1	chr1	7756132	C	T	VAMP3	.	NA	NA	0.735397	0.01	stopgain SNV	NM_004781	exon2	c.C46T	p.Q16X
Tumor Subclone 1	chr20	2584261	G	C	NOP56	.	NA	NA	0.998	0	nonsynonymous SNV	NM_006392	exon7	c.G778C	p.D260H
Tumor Subclone 1	chr1	47173844	C	G	CYP4A11	.	NA	NA	0.786	0.03	nonsynonymous SNV	NM_000778	exon5	c.G573C	p.L191F
Tumor Subclone 1	chr6	159098329	C	G	SYTL3	.	NA	NA	0.006	0.04	nonsynonymous SNV	NM_001242395	exon12	c.C1032G	p.I344M
Tumor Subclone 1	chr5	10455546	C	G	MARCH6	.	NA	NA	NA	NA	synonymous SNV	NM_001270660	exon12	c.C960G	p.V320V
Tumor Subclone 1	chr17	64499978	G	C	ABCA9	.	NA	NA	0	0.84	nonsynonymous SNV	NM_080283	exon28	c.C3649G	p.L1217V
Tumor Subclone 1	chr22	38043570	C	G	RPL3	.	NA	NA	0.982	0.05	nonsynonymous SNV	NM_000967	exon3	c.G207C	p.K69N
Tumor Subclone 1	chr5	55004159	C	G	SLC38A9	.	NA	NA	0.841	0.08	nonsynonymous SNV	NM_173514	exon4	c.G235C	p.D79H
Tumor Subclone 1	chr13	23919323	A	G	PARP4	.	NA	NA	0.941	0.01	nonsynonymous SNV	NM_006437	exon26	c.T3116C	p.I1039T
Tumor Subclone 1	chr11	47600865	C	A	MTCH2	.	NA	NA	NA	NA	synonymous SNV	NM_014342	exon12	c.G789T	p.T263T
Tumor Subclone 1	chr7	64025809	A	G	ZNF273	.	NA	NA	0.116	0.3	nonsynonymous SNV	NM_021148	exon4	c.A668G	p.Q223R
Tumor Subclone 1	chr16	22453366	G	C	LOC100132247	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001135865	exon7	c.G1561C	p.A521P
Tumor Subclone 1	chr2	202053133	G	T	STRADB	.	NA	NA	0.999	0	nonsynonymous SNV	NM_018571	exon12	c.G1247T	p.W416L
Tumor Subclone 1	chrX	99549746	G	A	PCDH19	.	NA	NA	0.768	0	nonsynonymous SNV	NM_001105243	exon1	c.C506T	p.T169M
Tumor Subclone 1	chr19	45060359	G	A	FCGBP	.	NA	NA	0.999	0.21	nonsynonymous SNV	NM_003890	exon28	c.C12829T	p.P4277S
Tumor Subclone 1	chr4	100761370	C	G	MTTP	.	NA	NA	0.95	0	nonsynonymous SNV	NM_000253	exon18	c.C2472G	p.F824L
Tumor Subclone 1	chr6	31430894	G	C	HLA-B	.	NA	NA	NA	NA	synonymous SNV	NM_005514	exon5	c.C981G	p.V327V
Tumor Subclone 1	chr12	11065759	C	G	TAS2R19	.	NA	NA	0.616	NA	nonsynonymous SNV	NM_176888	exon1	c.G679C	p.A227P
Tumor Subclone 2	chr4	119850753	G	C	METTL14	.	NA	NA	0.732961	0.1	nonsynonymous SNV	NM_020961	exon11	c.G1219C	p.D407H
Tumor Subclone 2	chr1	152241066	G	C	NUP210L	.	NA	NA	0.937	0.31	nonsynonymous SNV	NM_207308	exon36	c.C4950G	p.I1650M
Tumor Subclone 2	chr8	39066802	C	T	ADAM9	.	NA	NA	NA	NA	synonymous SNV	NM_003816	exon19	c.C2148T	p.I716I
Tumor Subclone 2	chr16	30501393	C	G	ZNF785	.	NA	NA	0.903	0	nonsynonymous SNV	NM_152458	exon3	c.G1207C	p.E403Q
Tumor Subclone 2	chr4	14643885	C	T	CPEB2	.	NA	NA	0.735404	0	stopgain SNV	NM_182485	exon5	c.C2128T	p.R710X
Tumor Subclone 2	chr2	219032824	C	T	USP37	.	NA	NA	0.907	0.21	nonsynonymous SNV	NM_020935	exon23	c.G2576A	p.G859E
Tumor Subclone 2	chr8	7205184	G	A	ZNF705G	.	NA	NA	NA	NA	stopgain SNV	NM_001164457	exon3	c.C220T	p.Q74X
Tumor Subclone 2	chr16	3307869	G	A	ZNF75A	.	NA	NA	NA	NA	synonymous SNV	NM_153028	exon6	c.G890A	p.X297X
Tumor Subclone 2	chr11	107611693	G	C	ATM	.	NA	ATM	0.999	0	nonsynonymous SNV	NM_000051	exon5	c.G418C	p.D140H
Tumor Subclone 2	chr17	39831667	C	G	GPATCH8	.	NA	NA	0.813	0.18	nonsynonymous SNV	NM_001002909	exon8	c.G3304C	p.V1102L
Tumor Subclone 2	chr5	154256030	C	G	GEMIN5	.	NA	NA	0.061	0.16	nonsynonymous SNV	NM_015465	exon24	c.G3412C	p.E1138Q
Tumor Subclone 2	chr1	12778431	G	A	PRAMEF1	.	NA	NA	0.006	1	nonsynonymous SNV	NM_023013	exon4	c.G1124A	p.R375Q
Tumor Subclone 3	chr16	23553821	C	G	PALB2	.	NA	PALB2	0.998	0.07	nonsynonymous SNV	NM_024675	exon4	c.G1547C	p.R516T
Tumor Subclone 3	chr2	179321628	G	C	TTN	.	NA	NA	0.413091	NA	nonsynonymous SNV	NM_133379	exon46	c.C13744G	p.Q4582E
Tumor Subclone 3	chr17	23878491	G	A	FOXN1	.	NA	NA	NA	NA	synonymous SNV	NM_003593	exon3	c.G684A	p.Q228Q
Tumor Subclone 3	chr2	231047372	C	T	SP100	.	NA	NA	NA	NA	synonymous SNV	NM_001080391	exon17	c.C1566T	p.N522N
Tumor Subclone 3	chr17	71136789	C	T	RECQL5	.	NA	NA	0	1	nonsynonymous SNV	NM_004259	exon16	c.G2309A	p.R770Q
Tumor Subclone 3	chr9	115171866	G	A	BSPRY	.	NA	NA	0	0.56	nonsynonymous SNV	NM_017688	exon6	c.G832A	p.A278T
Tumor Subclone 3	chr15	32183389	C	T	PGBD4	.	NA	NA	NA	NA	synonymous SNV	NM_152595	exon1	c.C1365T	p.F455F
Tumor Subclone 3	chr7	72789510	C	T	ABHD11	.	NA	NA	0.011	0.55	nonsynonymous SNV	NM_148912	exon4	c.G610A	p.E204K
Tumor Subclone 3	chr6	154777212	C	T	CNKSR3	.	NA	NA	0.063	0.46	nonsynonymous SNV	NM_173515	exon10	c.G983A	p.S328N
Tumor Subclone 3	chr1	207945884	C	T	HSD11B1	.	NA	NA	1	0	nonsynonymous SNV	NM_181755	exon3	c.C194T	p.A65V
Tumor Subclone 3	chr1	89221226	G	A	RBMXL1	.	NA	NA	0.012	0.44	nonsynonymous SNV	NM_019610	exon2	c.C872T	p.S291L

Supplementary Table ST4.3 Somatic Mutations Detected in ALL

Classification	Chromosome	Coordinate	Ref	Var	Gene Name	dbSNP ID	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr19	57579730	A	G	ZNF880	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001145434	exon4	c.A1085G	p.N362S
Clonal	chr9	131856117	T	G	GPR107	.	NA	NA	0.036	0.03	nonsynonymous SNV	NM_001136558	exon1	c.T85G	p.L29V
Clonal	chr9	21176964	A	T	IFNA4	.	NA	NA	0	0.52	nonsynonymous SNV	NM_021068	exon1	c.T567A	p.D189E
Clonal	chr12	112315276	G	A	SDS	.	NA	NA	NA	NA	synonymous SNV	NM_006843	exon8	c.C840T	p.H280H
Clonal	chr20	49668729	G	A	ATP9A	.	NA	NA	NA	NA	synonymous SNV	NM_006045	exon21	c.C2229T	p.V743Y
Clonal	chr2	51108665	G	A	NRXN1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_004801	exon2	c.C251T	p.T84M
Clonal	chr7	18650918	C	T	HDAC9	.	NA	NA	NA	0.05	nonsynonymous SNV	NM_001204144	exon10	c.C997T	p.P333S
Clonal	chr11	48303970	G	T	OR4C3	.	NA	NA	0.532064	0.01	nonsynonymous SNV	NM_001004702	exon1	c.G902T	p.G301V
Clonal	chr9	115398920	G	A	RGS3	.	NA	NA	0.182	0.33	nonsynonymous SNV	NM_130795	exon16	c.G2620A	p.V874I
Subclone 1	chrX	51655281	C	G	MAGED1	.	NA	NA	0.553348	0.05	nonsynonymous SNV	NM_001005332	exon3	c.C438G	p.F146L
Subclone 1	chr19	10262936	C	G	ICAM5	.	NA	NA	0.37	0.26	nonsynonymous SNV	NM_003259	exon2	c.C271G	p.R91G
Subclone 1	chr3	148613964	C	T	ZIC1	.	NA	NA	0.09	0.01	nonsynonymous SNV	NM_003412	exon3	c.C1280T	p.S427F
Subclone 1	chr2	196426356	C	T	DNAH7	.	NA	NA	0.783	0	nonsynonymous SNV	NM_018897	exon46	c.G8737A	p.G2913R
Subclone 1	chr4	159787427	G	A	RXFP1	.	NA	NA	NA	NA	synonymous SNV	NM_001253732	exon17	c.G984A	p.V328V
Subclone 1	chr19	12744719	G	A	HOOKE2	.	NA	NA	0.001	0.11	nonsynonymous SNV	NM_013312	exon5	c.C263T	p.A88V
Subclone 1	chr11	1204857	G	A	MUC5B	.	NA	NA	NA	NA	nonsynonymous SNV	NM_002458	exon5	c.G482A	p.R161H
Subclone 1	chr3	182158387	G	C	FXR1	.	NA	NA	0.074	0.11	nonsynonymous SNV	NM_001013439	exon11	c.G712C	p.E238Q
Subclone 2	chr4	48582288	C	G	OC1AD2	.	NA	NA	0.08	0.47	nonsynonymous SNV	NM_001014446	exon7	c.G435C	p.E145D
Subclone 2	chr10	118304718	G	C	PNLIP	.	NA	NA	0.003	0.55	nonsynonymous SNV	NM_000936	exon7	c.G610C	p.E204Q
Subclone 2	chr1	245653902	G	C	NLRP3	.	NA	NA	NA	NA	synonymous SNV	NM_183395	exon3	c.G534C	p.R178R
Subclone 2	chr19	57579840	C	G	ZNF880	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001145434	exon4	c.C1195G	p.H399D
Subclone 2	chr4	4327202	C	T	LYAR	.	NA	NA	0.952	0.62	nonsynonymous SNV	NM_001145725	exon7	c.G625A	p.E209K
Subclone 2	chr2	108731916	C	G	RANBP2	.	NA	NA	0.065	0.06	nonsynonymous SNV	NM_006267	exon9	c.C1172G	p.S391C
Subclone 2	chr17	40674620	C	T	FMNL1	.	NA	NA	0.949	0.78	nonsynonymous SNV	NM_005892	exon14	c.C1421T	p.S474L
Subclone 4	chr2	51108670	A	G	NRXN1	.	NA	NA	NA	NA	synonymous SNV	NM_004801	exon2	c.T246C	p.I82I
Subclone 4	chr17	10367226	G	A	MYH2	.	NA	NA	0.053	0.07	nonsynonymous SNV	NM_001100112	exon39	c.C5579T	p.T1860M
Subclone 4	chr17	7345687	C	G	POLR2A	.	NA	NA	0.04	NA	nonsynonymous SNV	NM_000937	exon14	c.C2264G	p.S755C
Subclone 4	chrX	70278525	A	G	MED12	.	NA	NA	0.755449	0.06	nonsynonymous SNV	NM_005120	exon44	c.A6476G	p.Q2159R
Subclone 4,5	chr9	115398966	T	C	RGS3	.	NA	NA	0.851	0	nonsynonymous SNV	NM_130795	exon16	c.T2666C	p.L889P
Subclones 2, 4, 5	chr5	80675402	G	C	ACOT12	.	NA	NA	0.002	0.25	nonsynonymous SNV	NM_130767	exon10	c.C1035G	p.I345M
Subclones 2, 4, 5	chr14	44634345	G	A	PRPF39	.	NA	NA	NA	NA	synonymous SNV	NM_017922	exon2	c.G153A	p.V51V
Subclones 2, 4, 5	chr19	42852580	G	C	ZNF781	.	NA	NA	0.787	0	nonsynonymous SNV	NM_152605	exon4	c.C310G	p.L104V
Subclones 2, 4, 5	chr14	41426224	T	A	LRFN5	.	NA	NA	0.999	0.03	nonsynonymous SNV	NM_152447	exon3	c.T646A	p.F216I
Subclones 2, 4, 5	chr9	131856058	C	G	GPR107	.	NA	NA	0.001	0.06	nonsynonymous SNV	NM_001136558	exon1	c.C26G	p.S9C
Subclones 2, 4, 5	chr9	135285000	C	T	ADAMTS13	.	NA	NA	NA	NA	synonymous SNV	NM_139025	exon8	c.C945T	p.F315F
Subclones 2, 4, 5	chr10	102044827	G	A	PKD2L1	.	NA	NA	0.997	0	nonsynonymous SNV	NM_001253837	exon8	c.C1259T	p.S420F
Subclones 2, 4, 5	chr10	61616665	C	T	ANK3	.	NA	NA	NA	NA	synonymous SNV	NM_001204403	exon18	c.G1881A	p.T627T
Subclones 2, 4, 5	chr6	56448938	C	T	DST	.	NA	NA	NA	0.17	nonsynonymous SNV	NM_015548	exon73	c.G13963A	p.E4655K
Multiple Subclones	chr10	129792276	T	C	MKI67	.	NA	NA	NA	NA	synonymous SNV	NM_001145966	exon12	c.A6738G	p.T2246T
Multiple Subclones	chr9	21156062	T	C	IFNA21	.	NA	NA	0.018	0.05	nonsynonymous SNV	NM_002175	exon1	c.A550G	p.R184G
Multiple Subclones	chr9	135285026	T	C	ADAMTS13	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_139025	exon8	c.T971C	p.F324S
Multiple Subclones	chr19	12744712	A	G	HOOKE2	.	NA	NA	NA	NA	synonymous SNV	NM_013312	exon5	c.T270C	p.P90P
Multiple Subclones	chr9	33788041	T	C	PRSS3	.	NA	NA	1	0	nonsynonymous SNV	NM_001197098	exon3	c.T394C	p.C132R
Multiple Subclones	chr19	57579885	G	A	ZNF880	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001145434	exon4	c.G1240A	p.G414S
Multiple Subclones	chr19	10262915	G	A	ICAM5	.	NA	NA	0.008	0.35	nonsynonymous SNV	NM_003259	exon2	c.G250A	p.A84T
Multiple Subclones	chr12	112315280	C	G	SDS	.	NA	NA	0.916	0.33	nonsynonymous SNV	NM_006843	exon8	c.G836C	p.S279T
Multiple Subclones	chr10	102044809	C	T	PKD2L1	.	NA	NA	1	0	nonsynonymous SNV	NM_001253837	exon8	c.G1277A	p.C426Y
Multiple Subclones	chr17	40674598	C	T	FMNL1	.	NA	NA	0.143	0.7	nonsynonymous SNV	NM_005892	exon14	c.C1399T	p.P467S
Multiple Subclones	chrX	51655233	G	A	MAGED1	.	NA	NA	NA	NA	synonymous SNV	NM_001005332	exon3	c.G390A	p.Q130Q
Multiple Subclones	chr9	33788046	C	T	PRSS3	.	NA	NA	NA	NA	synonymous SNV	NM_001197098	exon3	c.C399T	p.L133L
Multiple Subclones	chr19	10262918	C	T	ICAM5	.	NA	NA	0.983	0.12	nonsynonymous SNV	NM_003259	exon2	c.C253T	p.R85W
Multiple Subclones	chrX	46357671	G	A	SLC9A7	.	NA	NA	NA	NA	synonymous SNV	NM_001257291	exon16	c.C1926T	p.Y642Y
Multiple Subclones	chr19	42852573	C	T	ZNF781	.	NA	NA	0.912	0.85	nonsynonymous SNV	NM_152605	exon4	c.G317A	p.R106Q
Multiple Subclones	chr19	42852557	A	G	ZNF781	.	NA	NA	NA	NA	synonymous SNV	NM_152605	exon4	c.T333C	p.H111H
Multiple Subclones	chrX	32473355	G	A	DMD	.	NA	NA	NA	NA	synonymous SNV	NM_004009	exon17	c.C1998T	p.T666T
Multiple Subclones	chr7	56141556	C	T	CHCHD2	.	NA	NA	NA	NA	synonymous SNV	NM_016139	exon1	c.G45A	p.P15P
Multiple Subclones	chr15	81289050	G	A	WHAMM	.	NA	NA	NA	0.09	nonsynonymous SNV	NM_001080435	exon6	c.G1415A	p.R472Q

Supplementary Table ST5.1 New Mutations Detected in TNBC

Classification	Chromosome	Coordinate	Ref	Var	Gene Name	dbSNP ID	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr4	77447102	C	T	STBD1	.	NA	NA	NA	NA	synonymous SNV	NM_003943	exon1	c.C156T	p.G52G
Clonal	chr16	30701629	C	T	ZNF629	.	NA	NA	NA	NA	synonymous SNV	NM_001080417	exon3	c.G1521A	p.T507T
Clonal	chr19	45232719	A	G	ZNF780B	.	NA	NA	NA	NA	synonymous SNV	NM_001005851	exon5	c.T1887C	p.N629N
Clonal	chrX	106970866	C	T	MID2	.	NA	NA	NA	NA	synonymous SNV	NM_012216	exon2	c.C315T	p.R105R
Clonal	chr14	72229640	G	C	DPF3	.	NA	NA	NA	NA	synonymous SNV	NM_012074	exon7	c.C639G	p.L213L
Clonal	chr4	56875862	C	T	KIAA1211	.	NA	NA	NA	NA	synonymous SNV	NM_020722	exon8	c.C1437T	p.P479P
Clonal	chr19	47723143	G	A	CEACAM1	.	NA	NA	0.001	0	nonsynonymous SNV	NM_001712	exon2	c.C314T	p.A105V
Clonal	chr3	184728396	C	T	KLHL6	.	NA	NA	NA	NA	synonymous SNV	NM_130446	exon2	c.G390A	p.T130T
Clonal	chr13	50753147	G	A	FAM124A	.	NA	NA	NA	NA	synonymous SNV	NM_001242312	exon4	c.G1395A	p.L465L
Clonal	chr3	102445981	C	T	IMPG2	.	NA	NA	NA	NA	synonymous SNV	NM_016247	exon13	c.G1884A	p.L628L
Clonal	chr7	47843113	G	A	PKD11	.	NA	NA	NA	NA	synonymous SNV	NM_138295	exon37	c.C5874T	p.T1958T
Clonal	chr3	64557585	G	A	ADAMTS9	.	NA	NA	NA	NA	synonymous SNV	NM_182920	exon27	c.C4140T	p.S1380S
Clonal	chr14	75975794	C	T	ESRRB	.	NA	NA	NA	NA	synonymous SNV	NM_004452	exon4	c.C345T	p.Y115Y
Clonal	chr6	42998906	C	A	PTCRA	.	NA	NA	0.792	0	nonsynonymous SNV	NM_001243169	exon3	c.C147A	p.F49L
Clonal	chr11	66835862	C	A	SSH3	.	NA	NA	NA	NA	synonymous SNV	NM_017857	exon14	c.C1908A	p.S636S
Clonal	chr5	178961579	C	T	RUFY1	.	NA	NA	NA	NA	synonymous SNV	NM_025158	exon15	c.C1842T	p.G614G
Clonal	chr11	60805108	G	A	VWCE	.	NA	NA	NA	NA	synonymous SNV	NM_152718	exon8	c.C963T	p.P321P
Clonal	chrX	53241916	C	A	KDM5C	.	NA	NA	NA	NA	synonymous SNV	NM_004187	exon20	c.G3027T	p.A1009A
Clonal	chr20	51632206	C	T	ZNF217	.	NA	NA	NA	NA	synonymous SNV	NM_006526	exon1	c.G567A	p.Q189Q
Clonal	chr7	55527565	C	T	VOPP1	.	NA	NA	NA	NA	nonsynonymous SNV	NM_030796	exon4	c.G232A	p.G78S
Clonal	chr19	17953670	C	T	KCNN1	.	NA	NA	NA	NA	synonymous SNV	NM_002248	exon5	c.C651T	p.Y217Y
Clonal	chr5	140187946	G	A	PCDHA6	.	NA	NA	0.559211	0	nonsynonymous SNV	NM_018909	exon1	c.G86A	p.G29D
Clonal	chr8	121306627	T	C	COL14A1	.	NA	NA	NA	NA	synonymous SNV	NM_021110	exon15	c.T1857C	p.F619F
Clonal	chr19	45012991	G	A	DYRK1B	.	NA	NA	0.09	0.07	nonsynonymous SNV	NM_006483	exon4	c.C236T	p.S79L
Clonal	chr20	533252	G	A	TCF15	.	NA	NA	0.698278	0.02	stopgain SNV	NM_004609	exon2	c.C583T	p.R195X
Clonal	chr19	12896481	G	A	FARSA	.	NA	NA	NA	NA	synonymous SNV	NM_004461	exon10	c.C1167T	p.G389G
Clonal	chr19	60848088	G	T	ZNF581	.	NA	NA	0.968	0.01	nonsynonymous SNV	NM_016535	exon2	c.G339T	p.K113N
Clonal	chr1	179170880	C	T	KIAA1614	.	NA	NA	NA	NA	synonymous SNV	NM_020950	exon5	c.C1212T	p.G404G
Clonal	chr16	9770251	G	A	GRIN2A	.	NA	NA	NA	NA	synonymous SNV	NM_001134408	exon12	c.C2553T	p.G851G
Clonal	chr17	69836175	G	A	KIF19	.	NA	NA	NA	0	nonsynonymous SNV	NM_153209	exon2	c.G56A	p.R19Q
Clonal	chr16	54080129	G	A	MMP2	.	NA	NA	0.932	0.25	nonsynonymous SNV	NM_004530	exon6	c.G1006A	p.A336T
Clonal	chr17	39992097	G	A	FZD2	.	NA	NA	NA	NA	synonymous SNV	NM_001466	exon1	c.G1515A	p.P505P
Clonal	chr22	40425560	C	G	MEI1	.	NA	NA	NA	0	nonsynonymous SNV	NM_152513	exon1	c.C72G	p.F24L
Clonal	chr10	100140401	G	A	PYROXD2	.	NA	NA	NA	NA	synonymous SNV	NM_032709	exon12	c.C1236T	p.D412D
Clonal	chr16	56633668	C	T	MMP15	.	NA	NA	NA	NA	synonymous SNV	NM_002428	exon7	c.C1197T	p.R399R
Clonal	chr11	45789078	C	T	SLC35C1	.	NA	NA	NA	NA	synonymous SNV	NM_001145265	exon3	c.C672T	p.N224N
Clonal	chr8	119662258	A	G	SAMD12	.	NA	NA	NA	NA	synonymous SNV	NM_001101676	exon2	c.T69C	p.G23G
Clonal	chr19	47603350	G	A	LIPE	.	NA	NA	NA	NA	synonymous SNV	NM_005357	exon6	c.C1953T	p.H651H
Clonal	chr1	12809901	C	T	PRAMEF11	.	NA	NA	NA	NA	synonymous SNV	NM_001146344	exon3	c.G543A	p.L181L
Clonal	chr4	38474861	C	A	TLR1	.	NA	NA	0	0.01	nonsynonymous SNV	NM_003263	exon4	c.G1987T	p.G663C
Clonal	chr2	73530918	C	A	ALMS1	.	NA	NA	NA	NA	synonymous SNV	NM_015120	exon8	c.C3753A	p.V1251V
Clonal	chr11	4901738	G	A	OR51G1	.	NA	NA	NA	NA	synonymous SNV	NM_001005237	exon1	c.C408T	p.T136T
Clonal	chr6	50918917	C	T	TFAP2B	.	NA	NA	NA	NA	synonymous SNV	NM_003221	exon7	c.C1236T	p.A412A
Clonal	chr19	13802590	G	A	ZSWIM4	.	NA	NA	0.874	0.36	nonsynonymous SNV	NM_023072	exon13	c.G2696A	p.R899H
Clonal	chr13	97626985	C	T	RNF113B	.	NA	NA	NA	NA	synonymous SNV	NM_178861	exon1	c.G507A	p.S169S
Clonal	chr21	44795059	G	A	KRTAP10-2	.	NA	NA	NA	NA	synonymous SNV	NM_198693	exon1	c.C711T	p.P237P
Clonal	chr4	103737794	C	T	NFKB1	.	NA	NA	NA	NA	synonymous SNV	NM_001165412	exon15	c.C1572T	p.D524D
Clonal	chr21	44795071	G	A	KRTAP10-2	.	NA	NA	NA	NA	synonymous SNV	NM_198693	exon1	c.C699T	p.L233L
Clonal	chr5	161048856	C	T	GABRA6	.	NA	NA	NA	NA	synonymous SNV	NM_000811	exon5	c.C465T	p.D155D
Clonal	chr11	64513555	G	T	BATF2	.	NA	NA	NA	NA	synonymous SNV	NM_138456	exon3	c.C447A	p.L149L
Clonal	chrX	54486634	C	T	TSR2	.	NA	NA	NA	NA	synonymous SNV	NM_058163	exon3	c.C249T	p.D83D
Clonal	chr15	62578773	C	G	ZNF609	.	NA	NA	NA	NA	synonymous SNV	NM_015042	exon1	c.C102G	p.L34L

Clonal	chr16	30643283	G	A	SRCAP	.	NA	NA	NA	NA	synonymous SNV	NM_006662	exon25	c.G5037A	p.Q1679Q
Clonal	chr14	23975446	T	C	KHNYN	.	NA	NA	NA	NA	synonymous SNV	NM_015299	exon7	c.T1698C	p.F566F
Clonal	chr1	32276060	C	T	KHDRBS1	.	NA	NA	0.854	0.01	nonsynonymous SNV	NM_006559	exon6	c.C943T	p.R315C
Clonal	chr1	172139794	A	G	SERPINC1	.	NA	NA	NA	NA	synonymous SNV	NM_000488	exon7	c.T1251C	p.S417S
Clonal	chr12	76939694	G	A	NAV3	.	NA	NA	NA	NA	synonymous SNV	NM_014903	exon9	c.G1944A	p.S648S
Clonal	chr19	7870931	C	A	LRRC8E	.	NA	NA	NA	NA	synonymous SNV	NM_001268285	exon2	c.C1137A	p.G379G
Clonal	chr1	20517689	T	C	VWA5B1	.	NA	NA	NA	NA	synonymous SNV	NM_001039500	exon6	c.T729C	p.H243H
Clonal	chr16	30685336	C	G	RNF40	.	NA	NA	0.469	0.1	nonsynonymous SNV	NM_014771	exon10	c.C1249G	p.L417V
Clonal	chr19	60133783	G	T	NLRP7	.	NA	NA	NA	NA	synonymous SNV	NM_139176	exon9	c.C2622A	p.A874A
Clonal	chr5	178071778	C	G	ZNF354A	.	NA	NA	0.012	0	nonsynonymous SNV	NM_005649	exon5	c.G1707C	p.Q569H
Clonal	chr9	128495387	G	A	LMX1B	.	NA	NA	NA	NA	synonymous SNV	NM_002316	exon4	c.G705A	p.K235K
Clonal	chr11	6610301	A	G	DCHS1	.	NA	NA	NA	NA	synonymous SNV	NM_003737	exon6	c.T3018C	p.R1006R
Clonal	chr1	151922589	C	T	NPR1	.	NA	NA	NA	NA	synonymous SNV	NM_000906	exon6	c.C1377T	p.N459N
Clonal	chr16	19396335	T	C	TMCS	.	NA	NA	NA	NA	synonymous SNV	NM_024780	exon9	c.T1425C	p.G475G
Clonal	chr14	75300805	C	T	TLL5	.	NA	NA	NA	NA	synonymous SNV	NM_015072	exon19	c.C1645T	p.L549L
Clonal	chr15	64397992	G	A	DIS3L	.	NA	NA	NA	NA	synonymous SNV	NM_001143688	exon8	c.G1146A	p.Q382Q
Clonal	chr11	74224338	C	T	RNF169	.	NA	NA	1	NA	nonsynonymous SNV	NM_001098638	exon6	c.C1042T	p.R348C
Clonal	chr19	7713933	G	C	CD209	.	NA	NA	0.271898	0.24	nonsynonymous SNV	NM_001144894	exon5	c.C1075G	p.P359A
Clonal	chr1	151928920	C	T	NPR1	.	NA	NA	NA	NA	synonymous SNV	NM_000906	exon19	c.C2772T	p.G924G
Clonal	chr16	4431493	C	T	DNAJA3	.	NA	NA	NA	NA	synonymous SNV	NM_001135110	exon4	c.C546T	p.P182P
Clonal	chr16	30278031	C	T	TBC1D10B	.	NA	NA	NA	NA	synonymous SNV	NM_015527	exon7	c.G1605A	p.A535A
Clonal	chr16	3433149	C	T	ZNF597	.	NA	NA	NA	NA	synonymous SNV	NM_152457	exon2	c.G6A	p.A2A
Clonal	chr1	78875334	G	A	IFI44L	.	NA	NA	NA	NA	synonymous SNV	NM_006820	exon6	c.G906A	p.E302E
Clonal	chr13	100510177	T	C	NALCN	.	NA	NA	NA	NA	synonymous SNV	NM_052867	exon42	c.A4899G	p.Q1633Q
Clonal	chr4	1923647	G	A	WHSC1	.	NA	WHSC1	NA	NA	synonymous SNV	NM_133331	exon12	c.G2028A	p.P676P
Clonal	chr15	68912309	C	T	LARP6	.	NA	NA	NA	NA	synonymous SNV	NM_018357	exon3	c.G612A	p.Q204Q
Clonal	chr14	34304053	G	A	BAZ1A	.	NA	NA	NA	NA	synonymous SNV	NM_013448	exon22	c.C3474T	p.G1158G
Clonal	chr1	155205752	C	T	ARHGEF11	.	NA	NA	NA	NA	synonymous SNV	NM_198236	exon10	c.G771A	p.Q257Q
Clonal	chr20	2794141	G	A	VPS16	.	NA	NA	NA	NA	synonymous SNV	NM_080413	exon18	c.G1839A	p.L613L
Clonal	chr6	31702873	G	A	PRRC2A	.	NA	NA	NA	NA	synonymous SNV	NM_004638	exon11	c.G1209A	p.P403P
Clonal	chr1	120267911	C	T	NOTCH2	.	NA	NA	NA	NA	synonymous SNV	NM_024408	exon26	c.G4731A	p.L1577L
Clonal	chr6	111042482	C	T	CDK19	.	NA	NA	NA	NA	synonymous SNV	NM_015076	exon13	c.G1458A	p.S486S
Clonal	chr6	149436760	G	A	UST	.	NA	NA	0.617	0.01	nonsynonymous SNV	NM_005715	exon8	c.G1036A	p.E346K
Clonal	chr6	36036768	G	A	SLC26A8	.	NA	NA	NA	NA	synonymous SNV	NM_052961	exon13	c.C1548T	p.I516I
Clonal	chr6	138686600	G	A	KIAA1244	.	NA	NA	NA	NA	synonymous SNV	NM_020340	exon30	c.G4866A	p.V1622V
Clonal	chr6	43520541	G	T	ABCC10	.	NA	NA	1	0	nonsynonymous SNV	NM_001198934	exon13	c.G2727T	p.W909C
Clonal	chr1	148794633	G	T	ADAMTSL4	.	NA	NA	0	1	nonsynonymous SNV	NM_019032	exon8	c.G1339T	p.A447S
Clonal	chr11	66149270	C	T	RBM14	.	NA	NA	NA	NA	synonymous SNV	NM_006328	exon2	c.C1347T	p.Y449Y
Clonal	chr19	16527182	C	T	SLC35E1	.	NA	NA	NA	NA	synonymous SNV	NM_024881	exon5	c.G783A	p.T261T
Clonal	chr6	138244039	G	A	TNFAIP3	.	p.0?	NA	0.027	0.28	nonsynonymous SNV	NM_006290	exon9	c.G2263A	p.E755K
Clonal	chr14	61611826	C	A	SYT16	.	NA	NA	NA	NA	synonymous SNV	NM_031914	exon3	c.C957A	p.S319S
Clonal	chr19	13889899	C	T	CC2D1A	.	NA	NA	NA	NA	synonymous SNV	NM_017721	exon7	c.C765T	p.G255G
Tumor Subclone 1	chr19	9385043	A	G	ZNF266	.	NA	NA	0.998	0	nonsynonymous SNV	NM_006631	exon11	c.T1558C	p.Y520H
Tumor Subclone 1	chr19	16180883	G	A	AP1M1	.	NA	NA	NA	NA	synonymous SNV	NM_001130524	exon5	c.G441A	p.P147P
Tumor Subclone 1	chr19	56964284	T	C	FPR2	.	NA	NA	NA	NA	synonymous SNV	NM_0011462	exon2	c.T561C	p.P187P
Tumor Subclone 1	chr19	59412890	T	C	LILRB3	.	NA	NA	0.986	0	nonsynonymous SNV	NM_006864	exon13	c.A1780G	p.T594A
Tumor Subclone 1	chrX	27676337	T	C	DCAF8L2	.	NA	NA	NA	NA	synonymous SNV	NM_001136533	exon1	c.T1404C	p.N468N
Tumor Subclone 1	chr9	136857541	A	G	COL5A1	.	NA	NA	NA	NA	synonymous SNV	NM_000093	exon63	c.A5037G	p.T1679T
Tumor Subclone 1	chr19	42881708	A	C	ZNF607	.	NA	NA	0.404	0	nonsynonymous SNV	NM_032689	exon5	c.T1164G	p.S388R
Tumor Subclone 1	chr11	62046756	T	G	AHNAK	.	NA	NA	0.001	0.02	nonsynonymous SNV	NM_001620	exon5	c.A11709C	p.Q3903H
Tumor Subclone 1	chr14	23711815	A	G	REC8	.	NA	NA	0.825	0.08	nonsynonymous SNV	NM_005132	exon3	c.A110G	p.N37S
Tumor Subclone 1	chr8	110371310	A	G	NUDCD1	.	NA	NA	NA	NA	synonymous SNV	NM_032869	exon5	c.T669C	p.R223R
Tumor Subclone 1	chr11	62277035	A	T	ZBTB3	.	NA	NA	NA	NA	synonymous SNV	NM_024784	exon2	c.T828A	p.T276T
Tumor Subclone 1	chr6	26343033	T	C	HIST1H1D	.	NA	NA	NA	NA	synonymous SNV	NM_005320	exon1	c.A108G	p.A36A
Tumor Subclone 1	chr11	67515634	A	G	UNKNOWN	.	NA	NA	NA	0	unknown				
Tumor Subclone 1	chr12	78713621	A	G	PPP1R12A	.	NA	NA	NA	NA	synonymous SNV	NM_001143886	exon18	c.T2250C	p.P750P

Tumor Subclone 1	chr19	22155111	A	G	ZNF676	.	NA	NA	NA	NA	synonymous SNV	NM_001001411	exon3	c.T1248C	p.T416T
Tumor Subclone 1	chr7	20410807	A	G	ITGB8	.	NA	NA	NA	NA	synonymous SNV	NM_002214	exon11	c.A1719G	p.Q573Q
Tumor Subclone 1	chr5	150703334	G	A	SLC36A2	.	NA	NA	NA	NA	synonymous SNV	NM_181776	exon3	c.C274T	p.L92L
Tumor Subclone 1	chr2	99354567	T	G	EIF5B	.	NA	NA	NA	NA	synonymous SNV	NM_015904	exon9	c.T1494G	p.T498T
Tumor Subclone 1	chr20	18091384	G	A	CSRP2BP	.	NA	NA	0.997	0.01	nonsynonymous SNV	NM_020536	exon6	c.G1466A	p.R489Q
Tumor Subclone 1	chr19	39524671	C	A	KIAA0355	.	NA	NA	NA	NA	synonymous SNV	NM_014686	exon10	c.C1992A	p.G664G
Tumor Subclone 1	chr8	88955052	T	C	DCAF4L2	.	NA	NA	NA	NA	synonymous SNV	NM_152418	exon1	c.A264G	p.T88T
Tumor Subclone 1	chr1	205934663	A	G	CR1L	.	NA	NA	NA	0.82	nonsynonymous SNV	NM_175710	exon5	c.A806G	p.H269R
Tumor Subclone 1	chr7	2284378	C	T	SNX8	.	NA	NA	NA	NA	synonymous SNV	NM_013321	exon2	c.G183A	p.P61P
Tumor Subclone 1	chr20	36789658	G	A	SLC32A1	.	NA	NA	NA	NA	synonymous SNV	NM_080552	exon2	c.G540A	p.V180V
Tumor Subclone 1	chr1	149203452	A	G	SETDB1	.	NA	NA	NA	NA	synonymous SNV	NM_001145415	exon22	c.A3864G	p.G1288G
Tumor Subclone 1	chr19	9223072	A	C	OR7E24	.	NA	NA	NA	0	nonsynonymous SNV	NM_001079935	exon1	c.A353C	p.Q118P
Tumor Subclone 1	chrX	9581713	A	G	TBL1X	.	NA	NA	NA	NA	synonymous SNV	NM_001139466	exon4	c.A87G	p.Q29Q
Tumor Subclone 1	chr1	151000008	A	G	KPRP	.	NA	NA	NA	NA	synonymous SNV	NM_001025231	exon2	c.A1320G	p.L440L
Tumor Subclone 1	chr2	241097450	A	G	ANKMY1	.	NA	NA	NA	NA	synonymous SNV	NM_016552	exon11	c.T2115C	p.S705S
Tumor Subclone 1	chr6	152374609	T	C	ESR1	.	NA	NA	NA	NA	synonymous SNV	NM_001122740	exon6	c.T1222C	p.L408L
Tumor Subclone 1	chr17	16038550	T	G	NCOR1	.	NA	NA	0.999	0.08	nonsynonymous SNV	NM_001190440	exon1	c.A59C	p.Y20S
Tumor Subclone 1	chr14	80372417	T	C	CEP128	.	NA	NA	NA	NA	synonymous SNV	NM_152446	exon11	c.A942G	p.T314T
Tumor Subclone 1	chr19	60403609	G	A	PTPRH	.	NA	NA	NA	NA	synonymous SNV	NM_002842	exon7	c.C1227T	p.P409P
Tumor Subclone 1	chr5	76006183	A	G	IQGAP2	.	NA	NA	NA	NA	synonymous SNV	NM_006633	exon27	c.A3420G	p.S1140S
Tumor Subclone 1	chr7	103564472	A	C	ORC5	.	NA	NA	NA	NA	synonymous SNV	NM_002553	exon13	c.T1254G	p.A418A
Tumor Subclone 1	chr9	137913423	G	T	CAMSAP1	.	NA	NA	NA	NA	synonymous SNV	NM_015447	exon3	c.C462A	p.A154A
Tumor Subclone 2	chr19	10063188	C	T	C19orf66	.	NA	NA	NA	NA	synonymous SNV	NM_018381	exon7	c.C525T	p.Y175Y
Tumor Subclone 2	chr4	5675245	C	T	EVC2	.	NA	NA	NA	NA	synonymous SNV	NM_001166136	exon14	c.G2181A	p.R727R
Tumor Subclone 2	chr19	19101983	C	T	TMEM161A	.	NA	NA	0.998	0.01	nonsynonymous SNV	NM_017814	exon6	c.G577A	p.E193K
Tumor Subclone 2	chr3	46698570	C	T	ALS2CL	.	NA	NA	NA	NA	synonymous SNV	NM_001190707	exon11	c.G1128A	p.P376P
Tumor Subclone 2	chr1	234036347	C	A	LYST	.	NA	NA	NA	NA	synonymous SNV	NM_000081	exon6	c.G2712T	p.V904V
Tumor Subclone 2	chr1	181122892	C	T	DHX9	.	NA	NA	NA	NA	synonymous SNV	NM_001357	exon28	c.C3513T	p.S1171S
Tumor Subclone 2	chr1	38038016	C	A	MANEAL	.	NA	NA	0.997	0.03	nonsynonymous SNV	NM_152496	exon2	c.C262A	p.H88N
Tumor Subclone 2	chr19	10126351	G	A	DNMT1	.	NA	NA	NA	NA	synonymous SNV	NM_001130823	exon21	c.C1743T	p.D581D
Tumor Subclone 2	chr1	202088131	C	G	ZC3H11A	.	NA	NA	0.646733	0.03	stopgain SNV	NM_014827	exon20	c.C2414G	p.S805X
Tumor Subclone 2	chr5	39170767	C	T	FYB	.	NA	NA	NA	NA	nonsynonymous SNV	NM_199335	exon8	c.G1622A	p.R541H
Tumor Subclone 2	chr1	179969344	G	A	CACNA1E	.	NA	NA	NA	0.38	nonsynonymous SNV	NM_001205293	exon21	c.G3097A	p.A1033T
Tumor Subclone 2	chr12	116777719	C	T	KSR2	.	NA	NA	NA	NA	synonymous SNV	NM_173598	exon3	c.G282A	p.T94T
Tumor Subclone 2	chr16	68284688	G	A	NFAT5	.	NA	NA	NA	NA	synonymous SNV	NM_173215	exon13	c.G3177A	p.Q1059Q
Tumor Subclone 2	chr19	47519622	G	A	TMEM145	.	NA	NA	NA	NA	synonymous SNV	NM_173633	exon14	c.G1242A	p.V414V
Tumor Subclone 2	chr12	54502636	C	T	DNAJC14	.	NA	NA	NA	NA	synonymous SNV	NM_032364	exon5	c.G1782A	p.V594V
Tumor Subclone 2	chr2	74543550	C	G	MOGS	.	NA	NA	0.799	0.05	nonsynonymous SNV	NM_001146158	exon5	c.G556C	p.A186P
Tumor Subclone 2	chr14	28307391	C	T	FOXG1	.	NA	NA	NA	NA	synonymous SNV	NM_005249	exon11	c.C1155T	p.A385A
Tumor Subclone 2	chr21	44818101	G	A	KRTAP10-4	.	NA	NA	0.401049	NA	nonsynonymous SNV	NM_198687	exon1	c.G38A	p.R13H
Tumor Subclone 2	chr14	23953810	A	G	NYNRIN	.	NA	NA	NA	NA	synonymous SNV	NM_025081	exon9	c.A3015G	p.R1005R
Tumor Subclone 2	chr6	24958912	G	A	FAM65B	.	NA	NA	NA	NA	synonymous SNV	NM_015864	exon10	c.C690T	p.G230G
Tumor Subclone 2	chr17	45152189	G	A	FAM117A	.	NA	NA	NA	NA	synonymous SNV	NM_030802	exon5	c.C640T	p.L214L
Tumor Subclone 3	chr8	67251997	G	A	CRH	.	NA	NA	NA	NA	synonymous SNV	NM_000756	exon2	c.C270T	p.A90A
Tumor Subclone 3	chr2	191721139	G	A	STAT4	.	NA	NA	NA	NA	synonymous SNV	NM_003151	exon2	c.C36T	p.I12I
Tumor Subclone 3	chrX	118487757	G	A	SLC25A5	.	NA	NA	0.1	0	nonsynonymous SNV	NM_001152	exon2	c.G217A	p.G73S
Tumor Subclone 3	chr1	243596900	C	T	KIF26B	.	NA	NA	NA	NA	synonymous SNV	NM_018012	exon3	c.C607T	p.L203L
Tumor Subclone 3	chr19	8703036	A	T	ORZ21	.	NA	NA	0.157	0.44	nonsynonymous SNV	NM_001004699	exon1	c.A646T	p.T216S
Tumor Subclone 3	chr18	28511245	T	C	KLHL14	.	NA	NA	NA	NA	synonymous SNV	NM_020805	exon8	c.A1635G	p.K545K
Tumor Subclone 3	chr9	131670394	T	C	USP20	.	NA	NA	0.51	0.38	nonsynonymous SNV	NM_001008563	exon11	c.T980C	p.M327T
Tumor Subclone 3	chr2	176744810	G	A	HOXD3	.	NA	NA	NA	NA	synonymous SNV	NM_006898	exon3	c.G861A	p.P287P
Tumor Subclone 3	chr19	6446473	G	A	TUBB4A	.	NA	NA	0.998	0	nonsynonymous SNV	NM_006087	exon4	c.C1037T	p.P346L
Tumor Subclone 3	chrX	46318834	G	A	CHST7	.	NA	NA	0.995	0	nonsynonymous SNV	NM_019886	exon1	c.G524A	p.G175E
Tumor Subclone 3	chr8	48802367	C	T	KIAA0146	.	NA	NA	NA	NA	synonymous SNV	NM_001080394	exon17	c.C2394T	p.D798D
Tumor Subclone 3	chr5	159276967	G	A	ADRA1B	.	NA	NA	NA	NA	synonymous SNV	NM_000679	exon1	c.G477A	p.R159R



Supplementary Table ST5.2 New Mutations Detected in Bladder Cancer

Classification	Chromosome	Coordinate	Ref	Var	Gene Name	dbSNP ID	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr1	109279013	G	A	CLCC1	.	NA	NA	NA	NA	synonymous SNV	NM_015127	exon11	c.C1308T	p.S436S
Clonal	chr9	39168337	C	G	CNTNAP3	.	NA	NA	0.992	0	nonsynonymous SNV	NM_033655	exon5	c.G559C	p.D187H
Clonal	chr4	2611320	G	C	FAM193A	.	NA	NA	0.015	0.03	nonsynonymous SNV	NM_003704	exon4	c.G226C	p.E76Q
Clonal	chr4	1773366	C	G	FGFR3	.	p.R248_S249del	FGFR3	0.522	0.01	nonsynonymous SNV	NM_022965	exon7	c.C746G	p.S249C
Clonal	chr5	156412146	C	T	HAVCR1	.	NA	NA	NA	NA	synonymous SNV	NM_001099414	exon4	c.G477A	p.T159T
Clonal	chr14	59020707	C	A	L3HYPDH	.	NA	NA	NA	NA	synonymous SNV	NM_144581	exon1	c.G81T	p.T27T
Clonal	chr8	105670255	G	A	LRP12	.	NA	NA	0.01	0.07	nonsynonymous SNV	NM_013437	exon1	c.C47T	p.A16V
Clonal	chr3	120933910	T	A	MAATS1	.	NA	NA	0.427	0.08	nonsynonymous SNV	NM_033364	exon9	c.T1098A	p.D366E
Clonal	chr8	134325811	G	T	NDRG1	.	NA	NA	0.196	0	nonsynonymous SNV	NM_001258432	exon12	c.G662A	p.A221E
Clonal	chr8	144991915	C	A	NRBP2	.	NA	NA	0.734689	NA	stopgain SNV	NM_178564	exon11	c.G841T	p.E281X
Clonal	chr17	70720800	C	T	NUP85	.	NA	NA	NA	NA	synonymous SNV	NM_024844	exon5	c.C396T	p.F132F
Clonal	chrX	55119822	A	C	PAGE2B	.	NA	NA	NA	NA	synonymous SNV	NM_001015038	exon3	c.A180C	p.A60A
Clonal	chr2	112864063	G	A	RGPD8	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001164463	exon20	c.C2930T	p.S977L
Clonal	chr19	4495381	G	A	SEMA6B	.	NA	NA	NA	NA	synonymous SNV	NM_032108	exon17	c.C1899T	p.R633R
Clonal	chr17	30704820	C	A	SLFN11	.	NA	NA	0.556597	0.09	stopgain SNV	NM_001104588	exon6	c.G1570T	p.E524X
Clonal	chr10	72206982	T	C	TBATA	.	NA	NA	0.002	0.3	nonsynonymous SNV	NM_152710	exon7	c.A623G	p.Q208R
Clonal	chrX	70386653	G	C	ZMYM3	.	NA	NA	0.588	0.02	nonsynonymous SNV	NM_001171163	exon6	c.C1199G	p.S400C
Clonal	chr19	21285269	C	T	ZNF708	.	NA	NA	0.958	0.06	nonsynonymous SNV	NM_021269	exon2	c.G4A	p.G2R
Tumor Subclone 1	chr1	225219372	G	A	ADCK3	.	NA	NA	0.011	0.03	nonsynonymous SNV	NM_020247	exon3	c.G226A	p.E76K
Tumor Subclone 1	chr6	38891314	G	C	DNAH8	.	NA	NA	NA	NA	synonymous SNV	NM_001206927	exon26	c.G3426C	p.G1142G
Tumor Subclone 1	chrX	65331711	C	T	HEPH	.	NA	NA	NA	NA	synonymous SNV	NM_138737	exon9	c.C1578T	p.F526F
Tumor Subclone 1	chr6	31430894	G	C	HLA-B	.	NA	NA	NA	NA	synonymous SNV	NM_005514	exon5	c.C981G	p.V327V
Tumor Subclone 1	chr16	22453366	G	C	LOC100132247	.	NA	NA	NA	NA	nonsynonymous SNV	NM_001135865	exon7	c.G1561C	p.A521P
Tumor Subclone 1	chr11	47600865	C	A	MTCH2	.	NA	NA	NA	NA	synonymous SNV	NM_014342	exon12	c.G789T	p.T263T
Tumor Subclone 1	chr5	180099203	C	G	OR2Y1	.	NA	NA	NA	NA	synonymous SNV	NM_001001657	exon1	c.G462C	p.V154V
Tumor Subclone 1	chrX	99549746	G	A	PCDH19	.	NA	NA	0.768	0	nonsynonymous SNV	NM_001105243	exon1	c.C506T	p.T169M
Tumor Subclone 1	chr5	55004159	C	G	SLC38A9	.	NA	NA	0.841	0.08	nonsynonymous SNV	NM_173514	exon4	c.G235C	p.D79H
Tumor Subclone 1	chr6	159098329	C	G	SYTL3	.	NA	NA	0.006	0.04	nonsynonymous SNV	NM_001242395	exon12	c.C1032G	p.I344M
Tumor Subclone 1	chr12	11065759	C	G	TAS2R19	.	NA	NA	0.616	NA	nonsynonymous SNV	NM_176888	exon1	c.G679C	p.A227P
Tumor Subclone 2	chr4	14643885	C	T	CPEB2	.	NA	NA	0.735404	0	stopgain SNV	NM_182485	exon5	c.C2128T	p.R710X
Tumor Subclone 2	chr8	7205184	G	A	ZNF705G	.	NA	NA	NA	NA	stopgain SNV	NM_001164457	exon3	c.C220T	p.Q74X
Tumor Subclone 2	chr16	30501393	C	G	ZNF785	.	NA	NA	0.903	0	nonsynonymous SNV	NM_152458	exon3	c.G1207C	p.E403Q
Tumor Subclone 3	chr7	72789510	C	T	ABHD11	.	NA	NA	0.011	0.55	nonsynonymous SNV	NM_148912	exon4	c.G610A	p.E204K
Tumor Subclone 3	chr9	115171866	G	A	BSPRY	.	NA	NA	0	0.56	nonsynonymous SNV	NM_017688	exon6	c.G832A	p.A278T
Tumor Subclone 3	chr6	154777212	C	T	CNKSR3	.	NA	NA	0.063	0.46	nonsynonymous SNV	NM_173515	exon10	c.G983A	p.S328N
Tumor Subclone 3	chr17	23878491	G	A	FOXN1	.	NA	NA	NA	NA	synonymous SNV	NM_003593	exon3	c.G684A	p.Q228Q
<b>Tumor Subclone 3</b>	<b>chr16</b>	<b>23553821</b>	<b>C</b>	<b>G</b>	<b>PALB2</b>	.	<b>NA</b>	<b>PALB2</b>	<b>0.998</b>	<b>0.07</b>	<b>nonsynonymous SNV</b>	<b>NM_024675</b>	<b>exon4</b>	<b>c.G1547C</b>	<b>p.R516T</b>
Tumor Subclone 3	chr15	32183389	C	T	PGBD4	.	NA	NA	NA	NA	synonymous SNV	NM_152595	exon1	c.C1365T	p.F455F
Tumor Subclone 3	chr1	89221226	G	A	RBMXL1	.	NA	NA	0.012	0.44	nonsynonymous SNV	NM_019610	exon2	c.C872T	p.S291L
Tumor Subclone 3	chr17	71136789	C	T	RECQL5	.	NA	NA	0	1	nonsynonymous SNV	NM_004259	exon16	c.G2309A	p.R770Q
Tumor Subclone 3	chr2	231047372	C	T	SP100	.	NA	NA	NA	NA	synonymous SNV	NM_001080391	exon17	c.C1566T	p.N522N
Tumor Subclone 3	chr2	179321628	G	C	TTN	.	NA	NA	0.413091	NA	nonsynonymous SNV	NM_133379	exon46	c.C13744G	p.Q4582E

Supplementary Table ST5.3 New Mutations Detected in ALL

Classification	Chromosome	Coordinate	Ref	Var	Gene Name	dbSNP ID	Cosmic	CancerGene	POLY	SIFT	Types	Gene ID	Exon	Nucleotide	Amino Acid
Clonal	chr9	131856117	T	G	GPR107	.	NA	NA	0.036	0.03	nonsynonymous SNV	NM_001136558	exon1	c.T85G	p.L29V
Clonal	chr9	21176964	A	T	IFNA4	.	NA	NA	0	0.52	nonsynonymous SNV	NM_021068	exon1	c.T567A	p.D189E
Clonal	chr11	48303970	G	T	OR4C3	.	NA	NA	0.532064	0.01	nonsynonymous SNV	NM_001004702	exon1	c.G902T	p.G301V
Multiple	chr9	135285026	T	C	ADAMTS13	.	NA	NA	0.999	0.01	nonsynonymous SNV	NM_139025	exon8	c.T971C	p.F324S
Multiple	chr7	56141556	C	T	CHCHD2	.	NA	NA	NA	NA	synonymous SNV	NM_016139	exon1	c.G45A	p.P15P
Multiple	chrX	32473355	G	A	DMD	.	NA	NA	NA	NA	synonymous SNV	NM_004009	exon17	c.C1998T	p.T666T
Multiple	chr17	40674598	C	T	FMN11	.	NA	NA	0.143	0.7	nonsynonymous SNV	NM_005892	exon14	c.C1399T	p.P467S
Multiple	chr19	12744712	A	G	HOOK2	.	NA	NA	NA	NA	synonymous SNV	NM_013312	exon5	c.T270C	p.P90P
Multiple	chr19	10262915	G	A	ICAM5	.	NA	NA	0.008	0.35	nonsynonymous SNV	NM_003259	exon2	c.G250A	p.A84T
Multiple	chr9	21156062	T	C	IFNA21	.	NA	NA	0.018	0.05	nonsynonymous SNV	NM_002175	exon1	c.A550G	p.R184G
Multiple	chrX	51655233	G	A	MAGED1	.	NA	NA	NA	NA	synonymous SNV	NM_001005332	exon3	c.G390A	p.Q130Q
Multiple	chr10	129792276	T	C	MKI67	.	NA	NA	NA	NA	synonymous SNV	NM_001145966	exon12	c.A6738G	p.T2246T
Multiple	chr10	102044809	C	T	PKD2L1	.	NA	NA	1	0	nonsynonymous SNV	NM_001253837	exon8	c.G1277A	p.C426Y
Multiple	chr9	33788041	T	C	PRSS3	.	NA	NA	1	0	nonsynonymous SNV	NM_001197098	exon3	c.T394C	p.C132R
Multiple	chr9	33788046	C	T	PRSS3	.	NA	NA	NA	NA	synonymous SNV	NM_001197098	exon3	c.C399T	p.L133L
Multiple	chr12	112315280	C	G	SDS	.	NA	NA	0.916	0.33	nonsynonymous SNV	NM_006843	exon8	c.G836C	p.S279T
Multiple	chrX	46357671	G	A	SLC9A7	.	NA	NA	NA	NA	synonymous SNV	NM_001257291	exon16	c.C1926T	p.Y642Y
Multiple	chr15	81289050	G	A	WHAMM	.	NA	NA	NA	0.09	nonsynonymous SNV	NM_001080435	exon6	c.G1415A	p.R472Q
Multiple	chr19	42852573	C	T	ZNF781	.	NA	NA	0.912	0.85	nonsynonymous SNV	NM_152605	exon4	c.G317A	p.R106Q
Multiple	chr19	42852557	A	G	ZNF781	.	NA	NA	NA	NA	synonymous SNV	NM_152605	exon4	c.T333C	p.H111H
Subclone 1	chr3	182158387	G	C	FXR1	.	NA	NA	0.074	0.11	nonsynonymous SNV	NM_001013439	exon11	c.G712C	p.E238Q
Subclone 1	chr19	12744719	G	A	HOOK2	.	NA	NA	0.001	0.11	nonsynonymous SNV	NM_013312	exon5	c.C263T	p.A88V
Subclone 1	chr11	1204857	G	A	MUC5B	.	NA	NA	NA	NA	nonsynonymous SNV	NM_002458	exon5	c.G482A	p.R161H
Subclone 1	chr4	159787427	G	A	RXFP1	.	NA	NA	NA	NA	synonymous SNV	NM_001253732	exon17	c.G984A	p.V328V
Subclone 2	chr4	48582288	C	G	OC1AD2	.	NA	NA	0.08	0.47	nonsynonymous SNV	NM_001014446	exon7	c.G435C	p.E145D
Subclone 4	chr2	51108670	A	G	NRXN1	.	NA	NA	NA	NA	synonymous SNV	NM_004801	exon2	c.T246C	p.I82I
Subclone 4,5	chr9	115398966	T	C	RGSS3	.	NA	NA	0.851	0	nonsynonymous SNV	NM_130795	exon16	c.T2666C	p.L889P
Subclones 2, 4, 5	chr10	61616665	C	T	ANK3	.	NA	NA	NA	NA	synonymous SNV	NM_001204403	exon18	c.G1881A	p.T627T

Supplementary Table 6: Prior probabilities for  $p_{\beta}^{g^{[1]},g^{[2]}}$ .

$g^{[1]}g^{[2]}$	$p_A^{g^{[1]},g^{[2]}}$	$p_C^{g^{[1]},g^{[2]}}$	$p_G^{g^{[1]},g^{[2]}}$	$p_T^{g^{[1]},g^{[2]}}$
AA	$1-3p_e$	$p_e$	$p_e$	$p_e$
CC	$p_e$	$1-3p_e$	$p_e$	$p_e$
GG	$p_e$	$p_e$	$1-3p_e$	$p_e$
TT	$p_e$	$p_e$	$p_e$	$1-3p_e$
AC	$\frac{1-2p_e}{2}$	$\frac{1-2p_e}{2}$	$p_e$	$p_e$
AG	$\frac{1-2p_e}{2}$	$p_e$	$\frac{1-2p_e}{2}$	$p_e$
AT	$\frac{1-2p_e}{2}$	$p_e$	$p_e$	$\frac{1-2p_e}{2}$
CG	$p_e$	$\frac{1-2p_e}{2}$	$\frac{1-2p_e}{2}$	$p_e$
CT	$p_e$	$\frac{1-2p_e}{2}$	$p_e$	$\frac{1-2p_e}{2}$
GT	$p_e$	$p_e$	$\frac{1-2p_e}{2}$	$\frac{1-2p_e}{2}$