PNAS
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Supplementary Information for

The evolution of ancestral and species-specific adaptations in snowfinches at the Qinghai-Tibet Plateau

Yanhua Qu[a,1,2], Chunhai Chen[b,1], Xiumin Chen[a,1], Yan Hao[a,c,1], Huishang She[a,c], Mengxia Wang[a,c], Per G. P. Ericson[d], Haiyan Lin[a], Tianlong Cai[a], Gang Song[a], Chenxi Jia[a], Chunyan Chen[a], Hailin Zhang[b], Jiang Li[b], Liping Liang[b], Tianyu Wu[b], Jinyang Zhao[b], Qiang Gao[b], Guojie Zhang[e,f,g,h], Weiwei Zhai[a,g], Chi Zhang[b,2], Yong E. Zhang[a,c,g,i,2], and Fumin Lei[a,c,g,2]

[a]Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, 100101 Beijing, China; [b]BGI Genomics, BGI-Shenzhen, 518084 Shenzhen, China; [c]College of life science, University of Chinese Academy of Sciences, 100049 Beijing, China; [d]Department of Bioinformatics and Genetics, Swedish Museum of Natural History, SE-104 05 Stockholm, Sweden; [e]BGI-Shenzhen, 518083 Shenzhen, China; [f]State Key Laboratory of Genetic Resources and Evolution, Kunming Institute of Zoology, Chinese Academy of Sciences, 650223 Kunming, China; [g]Center for Excellence in Animal Evolution and Genetics, Chinese Academy of Sciences, 650223 Kunming, China; [h]Section for Ecology and Evolution, Department of Biology, University of Copenhagen, DK-2100 Copenhagen, Denmark; and [i]Chinese Institute for Brain Research, 102206 Beijing, China.

[1]Y.Q., C.C., X.C., and Y.H. contributed equally to this work.
[2]To whom correspondence may be addressed. Email: quyh@ioz.ac.cn, zhangchi2@bgi.com, zhangyong@ioz.ac.cn, or leifm@ioz.ac.cn.

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Supplementary Information Text

SI Text 1. Genome sequencing, assembly and annotation

Results

We prepared four (*rufico* and *adamsi*) and five (*taczan*) pair-end libraries spanning several insert sizes to generate short pair-end reads (*SI Appendix*, Table S1). A total 184.8, 181.2 and 201.3 Gb of sequencing data were generated, which provide a coverage $171\times$, $168\times$ and $195\times$ with total assembly lengths of 1,037, 1,052 and 1,053 Mb for *taczan*, *rufico* and *adamsi*, respectively (*SI Appendix*, Table S1-S3). The genome sizes approximate to 1,027, 1,139 and 1,247 Mb estimated using 17-mer frequency method (*SI Appendix*, Table S2-S3 and Fig. S5). The contig N50 sizes are 665, 513 and 365 Kb, and scaffold N50 sizes are 9.07, 9.59 and 10.06 Mb for *taczan*, *rufico* and *adamsi*, respectively, with the largest scaffolds spanning 36.15, 32.22 and 34.21 Mb (*SI Appendix*, Table S3). BUSCO estimated that the assemblies of the three showfinches contained 95% eukaryote_odb9 BUSCO orthologues (*SI Appendix*, Table S9-11). Average guanine-cytosine (GC) contents of the three species of snowfinches (appr. 42%, *SI Appendix*, Fig. S6) are similar to those of the Eurasian Tree Sparrow, *Passer montanus* (*montan*) and the Zebra finch, *Taeniopygia guttata*. In addition, nearly 377 million transcriptomic reads from cardiac and flight muscles of *taczan* and *rufico* were generated to complement the genomic annotations (*SI Appendix*, Table S4).

We annotated the protein-coding genes by genome-wide search and homology prediction against the Repbase database (version 16.10). We found that 10.89%, 11.40% and 11.67% of *taczan*, *rufico* and *adamsi* genomes consisted of transposable element (TE) families (*SI Appendix*, Table S17), of which LINE elements were the most abundant (*SI Appendix*, Table S18 and Fig. S7). After masking the repetitive regions, we annotated the genes using a combinational method based on homology search, ab initio prediction, EST/cDNA evidences and direct mRNA sequencing evidence (*SI Appendix*, Table S4). This generated a total of 15,585, 15,206 and 15,136 protein-coding genes and 970, 1,175 and 940 non-coding RNA genes for *taczan*, *rufico* and *adamsi*, respectively (*SI Appendix*, Tables S7 and S19). Of the protein-coding genes, 99.80 % have homolog in the protein databases (including Swissprot, TrEMBL, InterPro, KEGG and GO databases, *SI Appendix*, Table S8). BUSCO analysis showed that gene-sets of the three species of snowfinches contain about 94.1% (*taczan*), 90.4% (*rufico*) and 89.8% (*adamsi*) complete eukaryote_odb9 BUSCO orthologues (*SI Appendix*, Table S9-11).

Methods and materials

Whole genome sequencing

DNA was extracted from muscle using the Qiagen DNeasy Blood and Tissue Kit under the protocol provided by the manufacturer. The genomic DNA was sequenced by Illumina HiSeq2000 sequencing platform. Libraries with different insert sizes were constructed at BGI-Shenzhen. To facilitate the assembly of the genome, we constructed different short-insert (170 bp, 500 bp and 800 bp) and mate-pair (2 Kb and 5 Kb) libraries (*SI Appendix*, Table S1). We assembled the genome using SOAPdenovo (1) and SSPACE (2). The genomes were assembled via four steps: constructing contigs, constructing scaffolds, filling gaps and constructing super-scaffolds. Short insert libraries were split to construct de Bruijn graph, which was then simplified by removing tips, merging bubbles and solving repeats to get contigs. All clean reads were mapped onto the contigs to construct scaffolds. Subsequently, the clean data from short-insert size libraries were used to fill gaps. Finally, all clean reads were mapped onto the scaffolds to construct super-scaffolds by SSPACE. We used 17-mer to estimate the genome sizes of the three snowfinches. The genome size was estimated to be 1,027 Mb for *taczan*, 1,139Mb for *rufico* and 1,247Mb for *adamsi* (*SI Appendix*, Table S2). Assembly quality and completeness were assessed by checking Benchmarking Universal Single-Copy Orthologs v2 (BUSCO, aves_odb9, 3) and ESTs evidence. The final contig and scaffold sizes, N50 and N90, were calculated based on the minimum length of sequence. The sequencing coverage, depth and GC content of the assembled genomes were evaluated by mapping all sequencing reads of the short-insert-sized libraries back to the scaffolds using BWA (4).

Genome annotation

Tandem repeats were searched across the genome using Tandem Repeats Finder software (version 4.04, http://tandem.bu.edu/trf/trf.html). Transposable elements (TE) were identified in the genomes by a combination of homology-based and *de novo* approaches. We used *de novo* gene prediction, homology-based methods and RNA-seq data to identify protein-coding genes of the three species of snowfinches. For the homology-based prediction, all available protein sequences of Eurasian Tree Sparrow (*Passer montan*), Medium Ground Finch (*Geospiza fortis*), Zebra Finch (*Taeniopygia guttata*), Collared Flycatcher (*Ficedula albicollis*), Ground Tit (*Parus humilis*), American crow (*Corvus brachyrhynchos*), Golden-collared Manakin (*Manacus vitellinus*), were downloaded from Ensembl (release 64) and NCBI. We mapped them into genomes of three species of snowfinches using TblastN (5). Homologous sequences were aligned

with matched proteins using Genewise (6) to define gene models. Augustus was used to predict coding genes. For RNA-seq based prediction, we mapped transcriptomic reads to the assembled genomes using HISAT (hisat2-2.0.1-beta, 7). We combined HISAT mapping results and applied StringTie (8) to predict transcript structures. We used Glean (9) to integrate all predicted gene structures. We *de novo* predicted the tRNA genes using tRNAscan-SE software, with eukaryote parameters on the repeat pre-masked genome. We identified rRNA fragments by aligning the rRNA sequences using BlastN at E-value $1e^{-5}$. The snRNA and miRNA were searched by aligning and searching INFERNAL (version 0.81) against Rfam database (release 9.1).

Gene functional annotation

We annotated gene functions using Blastp based on the highest match to proteins in the SwissProt and TrEMBL databases (Uniprot release 2011-01). The motifs and domains in the protein-coding genes were determined by InterProScan (version 4.7). Gene Ontology (10) IDs for genes were obtained from the corresponding InterPro entry. All genes were aligned against KEGG database (11, Release 58).

Construction of gene families

We blasted and aligned all sequences of protein-coding genes from three snowfinches and seven other species using TreeFam (12) with an E-value threshold set as $1e^{-7}$ (Blastp). Solar was used to concatenate high-scoring pair segments of each protein pair and custom-scripts were applied to compute H-scores to evaluate the similarity among genes based on Bit-scores. We searched gene families by clustering of homologous gene sequences (minimum edge weight, 10; minimum edge density between a join for hierarchical clustering, 0.34; maximum size for hierarchical clustering, 500; breaking edge density: 0.1) using Hcluster_sg (Version 0.5.0). Then we searched single copy orthologous genes and obtained 784 genes, which were subsequently used for phylogenetic reconstruction.

SI Text 2. Functional experiment of snowfinch *DTL*s in response to UV irradiation

Cell culture, knockdown of endogenous DTL using lentivirus-delivered shRNAs and establishment of stable cell lines expressing DTLs

Great Tit embryo fibroblast (GEF) cells (the closest species from which the cell line was derived) were cultured in high glucose Dulbecco's Modified Eagle's medium supplemented with 10% fetal bovine serum, 100 units/ml penicillin and 100 μg/ml streptomycin at 37 °C with 5% CO_2. Sequence of shRNA (5'-GCACCAGCAAGCTCATCTTTA-3') targeting *DTL* was cloned into the pLVX-shRNA1 vector (Huaaobio, Beijing, China). The shRNAs were packaged into lentiviruses by co-transfecting with psPAX2 and pMD2.G plasmids (Huaaobio, China) into 293T cells. Forty-eight hours after transfection, the supernatant was collected to infect the GEF cells, which were subsequently subjected to puromycin selection to obtain a stable *DTL*-knockdown cell line (Fig. S1*A*).

DTL sequences of the three snowfinches (*taczan*, *rufico* and *adamsi*), the *ancestor* and the Eurasian Tree Sparrow (*montan*) were cloned into the pCDH-CMV-MCS-EF1-copGFP vector (Huaaobio, China) separately. These individual vector plasmids, along with psPAX2 and pMD2.G (Huaaobio, China), were co-transfected into packaging 293T cells for forty-eight hours. Infectious lentiviruses in the supernatant were collected to transduce the *DTL*-knockdown GEF cells for another 48 hours. Cells were sorted using fluorescence-activated cell sorting (FACS), colonized and verified by western blot analysis of protein expression of *DTL* constructs (DTL_{rufico}, DTL_{adamsi}, DTL_{taczan}, $DTL_{ancestor}$ and DTL_{montan}, Fig. S1*B* and *C*).

DNA damage determination by slot blot assay of pyrimidine (6-4) pyrimidone photoproducts (6-4PP) and cyclobutane pyrimidine dimers (CPD)

GEF cells were irradiated with UVB at 100 J/m^2 for 2 min, and were subsequently harvested at 0, 1.5 and 6 h post-UVB for 6-4PP quantitation and 0, 6 and 24 h post-UVB for CPD assay, respectively. We used a slot blot assay to determine 6-4PP and CPD levels as described previously (13). Equal amounts of genomic DNAs extracted from cells expressing DTL_{taczan}, DTL_{rufico}, DTL_{adamsi}, $DTL_{ancestor}$ and DTL_{montan} were denatured at 95 °C for 10 min and spotted on nitrocellulose membranes. After being baked at UV-light cross-linker (254 nm) for 10 min, the membranes were blocked in 5% BSA in PBS containing 0.5% Tween 20 for 1 h at room temperature, incubated with anti-CPD antibody (232202, Cell Biolabs, Inc. San Diego, USA) or anti-6-4PP antibody (232301, Cell Biolabs) at a 1:1000 dilution at 4 °C overnight, washed and

incubated with horseradish peroxidase (HRP)-conjugated secondary antibodies. Signals were developed using an enhanced chemiluminescence (ECL) detection system (Thermo Scientific, USA). To determine DNA repair kinetics, percentage (%) repair was calculated by measuring quantitative densities of the bands at specified times and comparing to that at zero time point, which was defined as the presence of 100% damage after UV exposure.

Western blotting analysis

Cells were harvested, rinsed twice with PBS, lysed in a denaturing lysis buffer containing protease inhibitors (total protein extraction kit, KeyGen Biotech, Nanjing, China) for 30 min on ice, and centrifuged (12, 000 rpm) for 15 min at 4 ℃. Protein concentration of the lysates was determined using a BCA protein assay kit (Vazyme Biotech, Nanjing, China). Proteins were separated on an 8% sodium dodecyl sulfide-polyacrylamide gel and transferred to a polyvinylidene fluoride membrane (Merck Millipore). Blots were blocked using 5% non-fat dried milk in Tris-buffered saline with 0.1% Tween 20 (pH 7.6) for 1 h at room temperature and then incubated with antibodies against *DTL* (1:200, Thermofisher, PA542842) or β-actin (1:1000, Sigma, A2228) overnight at 4 ℃. Immunoreactive proteins were further detected with HRP-conjugated secondary antibodies and a detection system as described above.
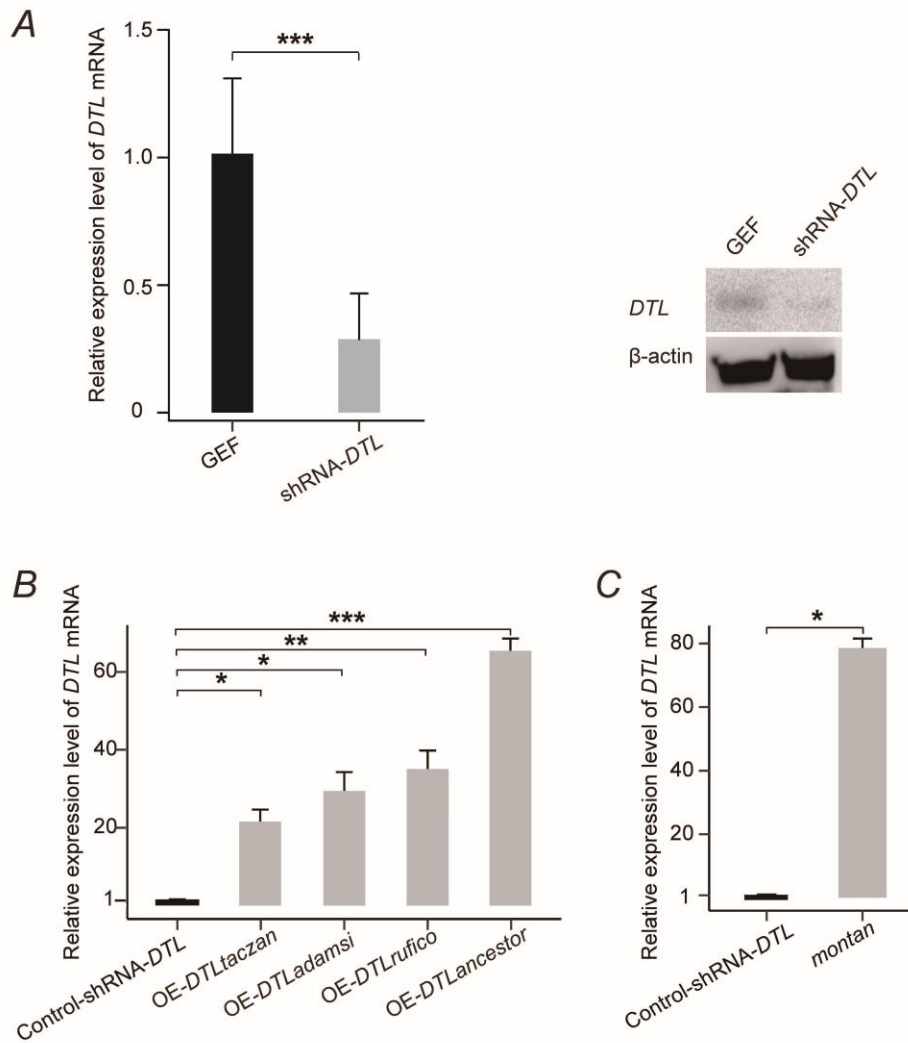
Fig. S1. *A*, Q-PCR and western blot showed that shRNA *DTL* has reduced endogenous *DTL* mRNA and protein expression in embryonic fibroblasts of the Great tit (GEF) cells. (*B*) and (*C*) Q-PCR shows mRNA expression levels of overexpressed (OE) DTL_{taczan}, DTL_{rufico}, DTL_{adamsi}, $DTL_{ancestor}$ and DTL_{montan} are significantly higher than that of the control shRNA *DTL*. Note, snowfinch *DTL*s and DTL_{montan} are amplified by different primers thus they are shown separately. T-tests are used for statistical comparisons. *, $P<0.05$; **, $P<0.01$, ***, $P<0.001$.
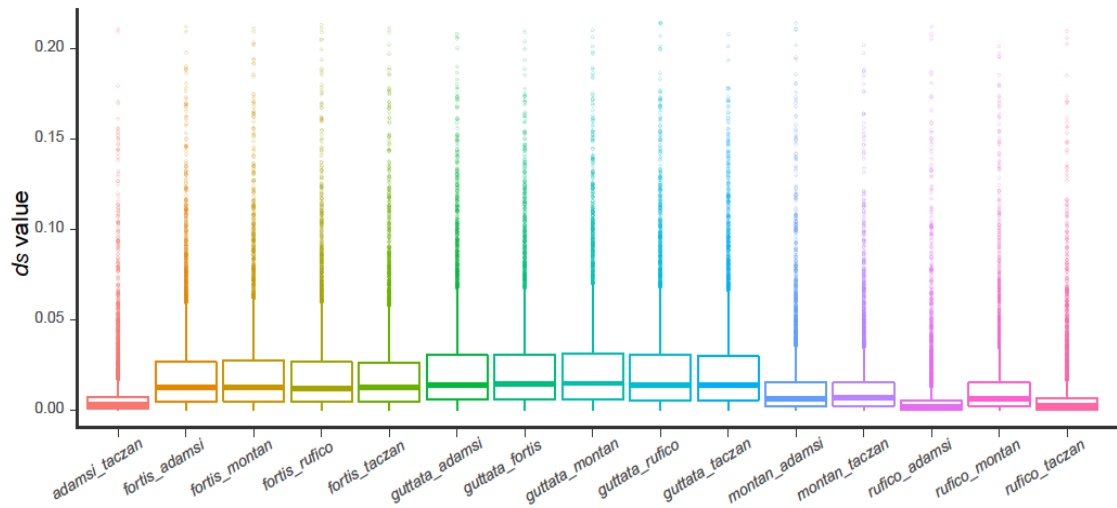
Fig. S2. The median pairwise d_S values of 6,572 genes used for positive selection analyses ranged from 0.002 (*i.e.*, *adamsi* and *rufico*) to 0.015 (*i.e.*, *montan* and *guttata*). *fortis*, Medium Ground Finch (*Geospiza fortis*); *guttata*, Zebra finch (*Taeniopygia guttata*); *rufico*, Rufous-necked Snowfinch (*Pyrgilauda ruficollis*); *adamsi*, the Black-winged Snowfinch (*Montifringilla adamsi*); *taczan*, White-rumped Snowfinch (*Onychostruthus taczanowskii*); *montan*, Eurasian Tree Sparrow (*Passer montanus*).
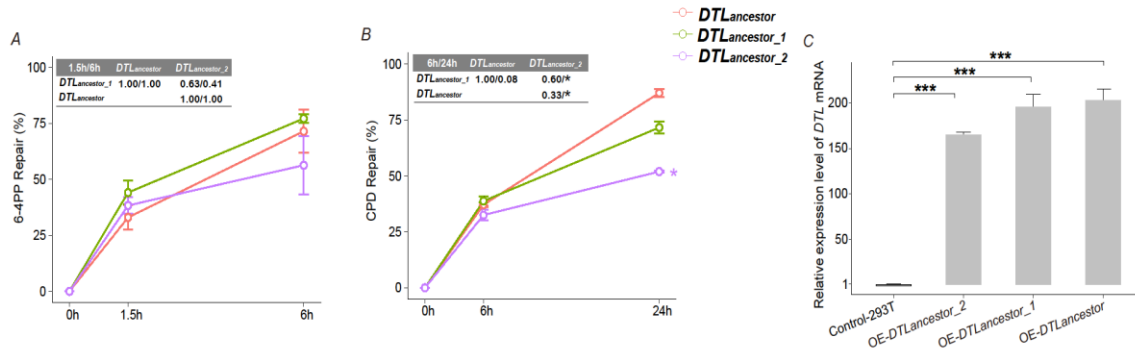
Fig.S3. The functional assays of the three ancestral *DTL* sequences using 293T cell line. *A*, pyrimidine (6-4) pyrimidone photoproduct (6-4PP), *B*, cyclobutane pyrimidine dimers (CPD). Pairwise T-tests and Bonferroni-Holm correction are used for statistical comparisons. *, $P<0.05$. Three ancestral *DTL* sequences displayed similar repair capacities of DNA damage at all checking time points in 6-4PP and CPD assays, except that the $DTL_{ancestor\_2}$ (the least likely ancestral sequence) shows lower repair capacity than those of other ancestral sequences at the 24h time point of CPD assay. Note, the repair capacities of the ancestral *DTLs* using 293T cell line (this figure) are slightly lower than the repair capacities of the ancestral *DTLs* using embryo fibroblast cells of the Great Tit (Fig. 3). *C*, Q-PCR shows mRNA expression levels of overexpressed (OE) $DTL_{ancestor}$, $DTL_{ancestor\_1}$ and $DTL_{ancestor\_2}$ are significantly higher than that of the control 293T. T-tests are used for statistical comparisons. ***, $P<0.001$.
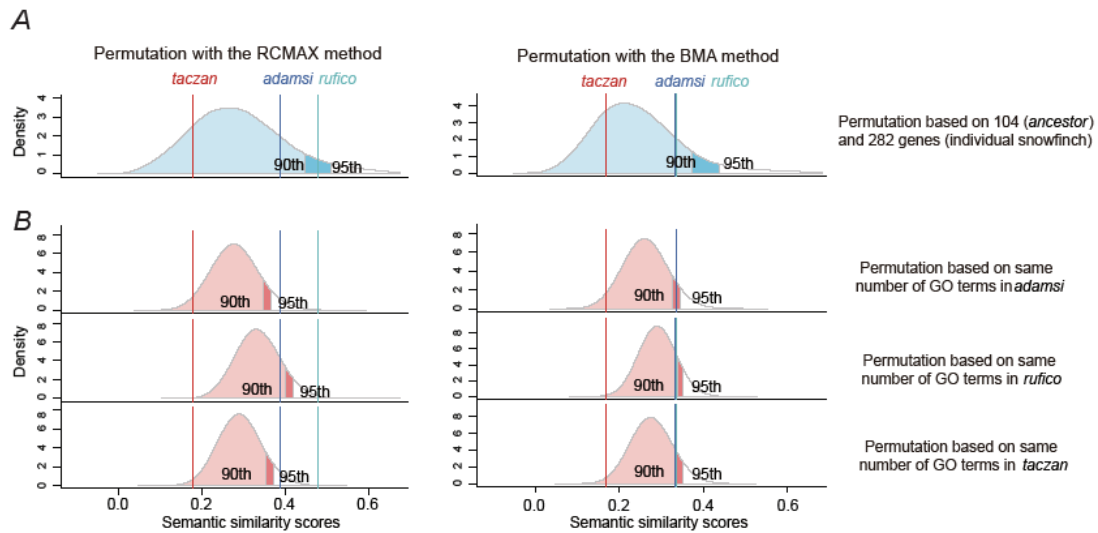
Fig. S4. *A*) and *B*) The observed and permutated semantic similarity scores based on a more stringent dataset with the empirical GO terms of *P*<0.005 and enrichment scores >2. Both RCMAX (left) and BMA (right) measures were used for pairwise comparisons between *ancestor* and each of the descendant snowfinches. Dark blue, light blue and red vertical lines show the observed pairwise semantic similarity values between *ancestor* and each of the snowfinches (*adamsi*, *rufico* and *taczan*, respectively). Blue (permutation based on same number of genes) and red shades (permutation based on same number of GO terms) show the 10,000 permutated semantic similarity values and 95th and 90th percentiles are indicated.
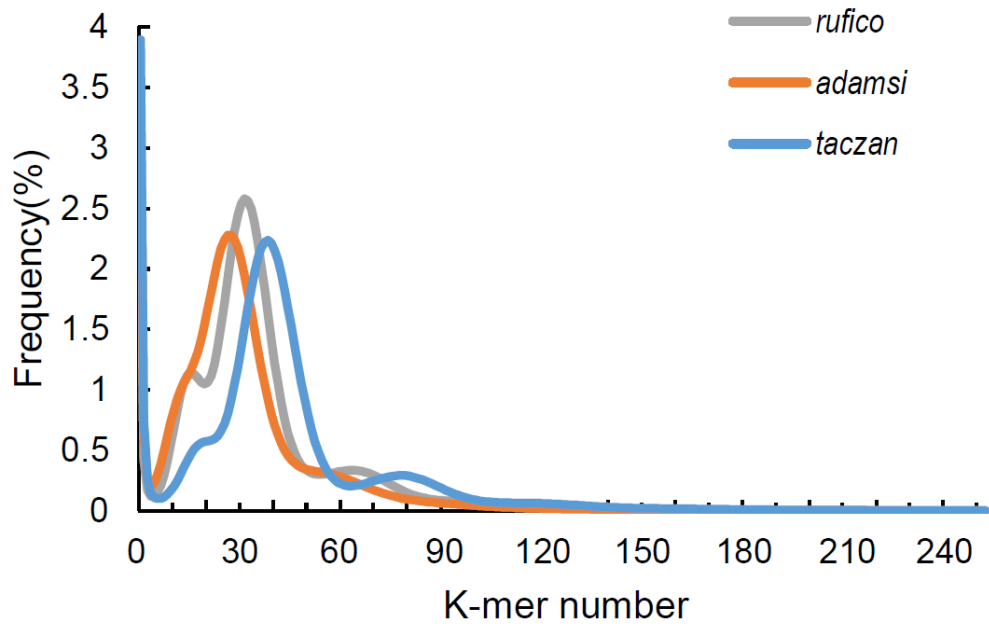
Fig. S5. K-mer frequency distributions of the three species of snowfinches. Frequency of each K-mer in raw sequencing reads was calculated, and here K=17. White-rumped Snowfinch (*taczan*). Rufous-necked Snowfinch (*rufico*). Black-winged Snowfinch (*adamsi*).
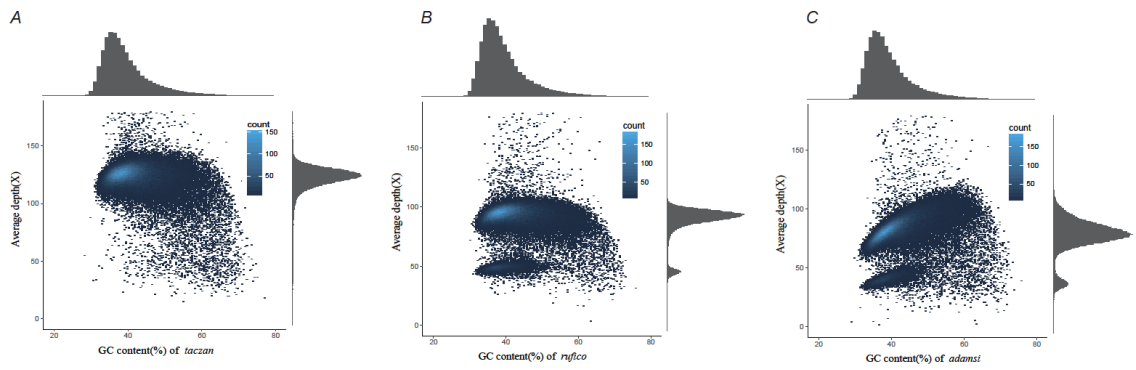
Fig. S6. Depth and GC contents of assembled genomes of three snowfinches. *A*) White-rumped Snowfinch (*taczan*). *B*) Rufous-necked Snowfinch (*rufico*). *C*) Black-winged Snowfinch (*adamsi*).
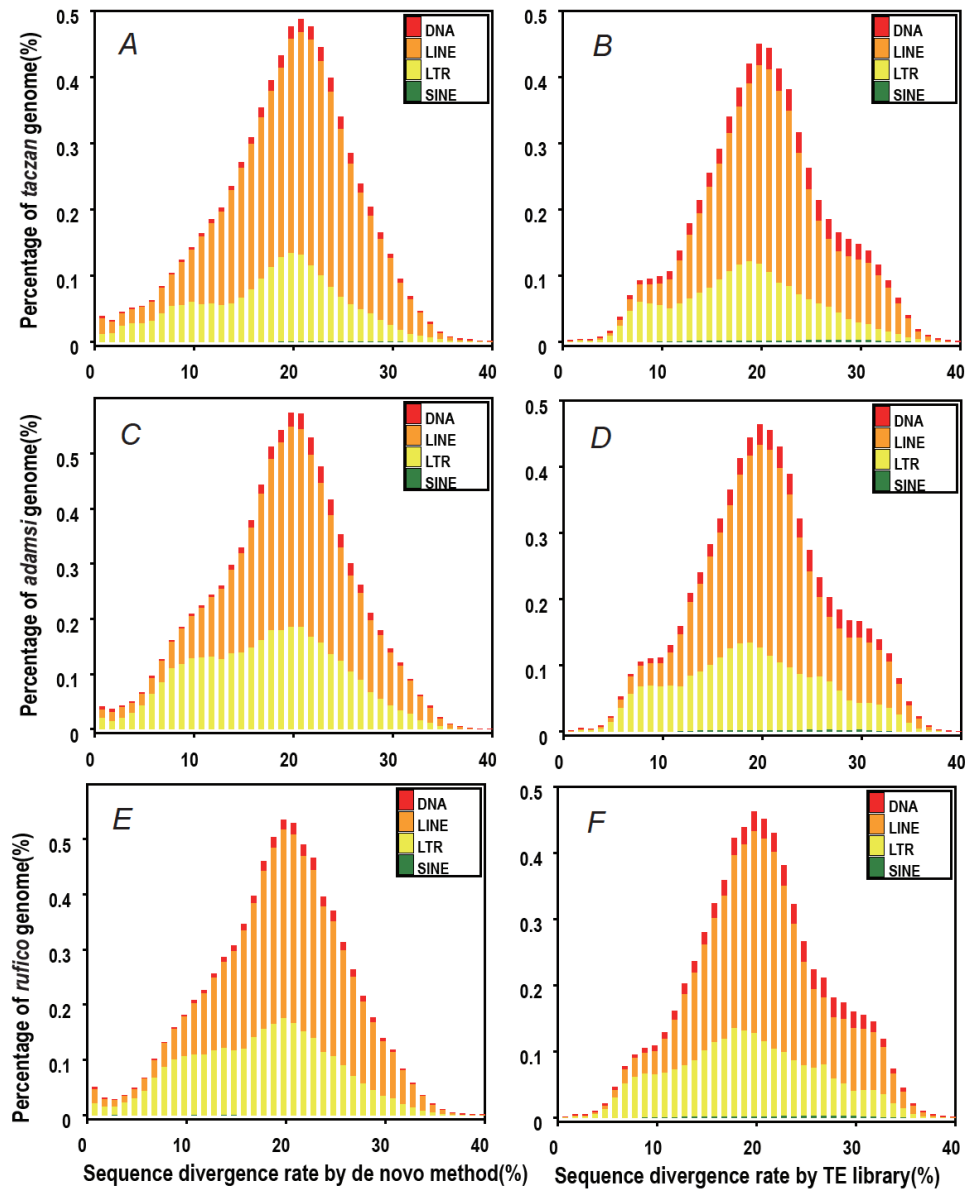
Fig. S7. Transposable elements in the genomes of the three species of snowfinches. *A*) and *B*) White-rumped Snowfinch (*taczan*). *C*) and *D*) Rufous-necked Snowfinch (*rufico*). *E*) and *F*) Black-winged Snowfinch (*adamsi*).

Tables S1 to S19

Table S1. Summary of DNA libraries and sequencing data of the genomes of the three species of snowfinches.

Pair-end libraries	Insert size	Read length	Total Raw data (G)	Total Clean Raw data (G)	Raw Sequence coverage (×)	Clean Sequence coverage (×)
White-rumped Snowfinch						
Illumina reads	170bp	90_90	70.31	62.25	65.10	57.64
	500bp	90_90	71.46	62.12	66.17	57.52
	800bp	90_90	14.41	11.57	13.34	10.71
	2Kb	49_49	14.99	9.31	13.88	8.62
	5Kb	49_49	13.63	7.38	12.62	6.84
Total			184.8	152.63	171.11	141.33
Rufous-necked Snowfinch						
Illumina reads	170bp	90_90	33.04	33.84	30.59	31.33
	170bp	100_100	38.44	33.32	35.59	30.85
	500bp	90_90	22.61	19.92	20.94	18.45
	500bp	100_100	16.77	11.69	15.53	10.82
	2Kb	49_49	17.68	11.41	16.37	10.56
	5Kb	49_49	52.64	8.36	48.74	7.74
Total			181.18	118.54	167.76	109.75
Black-winged Snowfinch						
Illumina reads	170bp	90_90	86.49	79.26	80.08	73.39
	500bp	90_90	51.76	43.05	47.93	39.86
	2Kb	49_49	21.07	10.67	19.51	9.88
	5Kb	49_49	51.01	6.79	47.23	6.28
Total			210.33	139.77	194.75	129.41

Table S2. Estimated genome sizes with 17Kmer analyses of the three species of snowfinches.

Species	K-mer num	Peak depth	Genome size (M)	Used Bases (M)	Used Reads	Depth (×)
White-rumped Snowfinch	45,205,593,822	44	1,027	54,979	610	54
Rufous-necked Snowfinch	37,617,471,614	33	1,139	45,750	508	40
Black-winged Snowfinch	36,170,174,804	29	1,247	43,991	488	35

Table S3. Statistics of the genomes of the three species of snowfinches.

Species	Contig		Scaffold	
	Length(bp)	number	Length(bp)	Number
White-rumped Snowfinch				
Total_length	1,035,689,888		1,037,660,651	
Max_len	3,967,782		36,148,806	
number>=100bp		47,857		43,017
number>=2000bp		5,267		1,862
N50	665,102	448	9,074,114	33
N60	520,661	626	7,349,975	46
N70	394,256	855	5,579,808	62
N80	261,243	1,174	3,518,719	84
N90	143,484	1,700	1,314,334	133
Rufous-necked Snowfinch				
Total_length	1,049,655,789		1,051,766,259	
Max_len	3,566,990		32,219,291	
number>=100bp		76,850		71,334
number>=2000bp		6,900		3,177
N50	513,765	561	9,593,645	35
N60	397,425	793	7,010,658	47
N70	289,630	1,101	4,556,229	66
N80	194,731	1,538	2,104,769	100
N90	92,707	2,293	841,176	177
Black-winged Snowfinch				
Total_length	1,049,590,203		1,053,015,869	
Max_len	2,075,544		34,205,674	
number>=100bp		69,209		60,645
number>=2000bp		8,430		2,539
N50	365,380	837	10,056,867	31
N60	278,797	1,168	7,630,653	43
N70	200,896	1,610	5,275,940	59
N80	135,910	2,243	3,090,561	85
N90	68,106	3,299	1,072,163	142

Table S4. Statistics of transcriptome sequencing data.

Species	Tissue	Clean reads	Mapped reads	Percent mapped to genome (%)
White-rumped Snowfinch	Cardiac muscle_2	47,196,092	44,515,354	94.32%
	Cardiac muscle_2	47,133,300	44,441,989	94.29%
	Flight muscle_1	46,924,968	42,795,571	91.20%
	Flight muscle_2	47,184,114	43,466,006	92.12%
Rufous-necked Snowfinch	Cardiac muscle_1	47,298,618	43,450,237	92.14%
	Cardiac_muscle_2	47,156,758	43,037,013	90.99%
	Flight muscle_1	46,750,206	42,100,481	89.69%
	Flight muscle_2	46,939,994	41,140,181	88.00%

Table S5. Summary of gene annotation models. P, *ab* initio prediction; H, homology-based; C, cDNA/EST/RNA expressed genes. Single, supported by only one method; more, supported by more than one method.

Evidence	>=20% overlap		>=50% overlap		>=80% overlap	
	Number	% of total	Number	% of total	Number	% of total
White-rumped Snowfinch						
C(single)		0	17	0.11	48	0.31
C(more)		0		0		0
H(single)		0	74	0.47	407	2.61
H(more)	564	3.62	814	5.22	1,865	11.97
P(single)		0	112	0.72	721	4.63
P(more)		0		0		0
HC	264	1.69	315	2.02	608	3.90
PC	16	0.10	28	0.18	78	0.50
PH	9,489	60.89	10,206	65.49	8,665	55.60
PHC	5,252	33.70	3,911	25.09	2,475	15.88
Rufous-necked Snowfinch						
C(single)		0.00	38	0.25	118	0.78
C(more)		0.00		0.00		0.00
H(single)		0.00	55	0.36	345	2.27
H(more)	519	3.41	654	4.30	1,333	8.77
P(single)		0.00	99	0.65	681	4.48
P(more)		0.00		0.00		0.00
HC	251	1.65	259	1.70	588	3.87
PC	34	0.22	53	0.35	123	0.81
PH	9,011	59.26	9,728	63.97	8,508	55.95
PHC	5,391	35.45	4,235	27.85	2,912	19.15
Black-winged Snowfinch						
H(single)		0	61	0.40	378	2.50
H(more)	670	4.43	795	5.25	1,689	11.16
P(single)		0	120	0.79	814	5.38
P(more)		0		0		0
PH	14,466	95.57	14,068	92.94	11,635	76.87

Table S6. Summary of predicted protein-coding genes and their characteristics.

Gene set		Number	Average gene length (bp)	Average CDS length (bp)	Average exons per gene	Average exon length (bp)	Average intron length (bp)
White-rumped Snowfinch							
De Novo	*Augustus*	20,109	14,529	1,354	8	177	1,986
Homolog	Rock Pigeon	17,074	16,295	1,335	8	170	2,180
	American crow	16,929	16,080	1,309	8	168	2,175
	Saker Falcon	16,720	15,207	1,411	8	179	2,005
	Medium Ground Finch	17,465	16,008	1,309	8	167	2,156
	Golden-collared manakin	16,699	16,442	1,331	8	168	2,189
	Wild Turkey	14,853	17,427	1,497	9	173	2,079
	Ground Tit	18,246	16,312	1,317	8	170	2,219
	Zebra finch	16,466	17,793	1,388	8	168	2,260
GLEAN		14,262	15,893	1,558	9	183	1,903
Final set		15,585	20,543	1,662	9	180	2,275
Rufous-necked Snowfinch							
De Novo	*Augustus*	16,764	20,913	1,579	9	171	2,347
Homolog	Rock Pigeon	17,319	15,965	1,318	8	170	2,167
	American crow	17,331	15,674	1,287	8	169	2,168
	Saker Falcon	16,985	14,929	1,391	8	179	2,002
	Medium Ground Finch	18,076	15,414	1,281	8	169	2,144
	Golden-collared manakin	16,987	16,057	1,314	8	169	2,,173
	Wild Turkey	15,338	17,009	1,474	9	173	2,067
	Ground Tit	18,579	16,011	1,298	8	170	2,221
	Zebra finch	16,791	17,444	1,366	8	168	2,258
GLEAN		13,835	16,561	1,679	9	179	1,916
Final set		15,206	21,249	1,680	9	179	2,303

Black-winged Snowfinch							
De Novo	*Augustus*	16,774	20,984	1,601	9	171	2,323
Homolog	Rock Pigeon	17,215	16,151	1,332	8	170	2,168
	American crow	17,246	15,874	1,299	8	168	2,172
	Saker Falcon	16,879	15,135	1,407	8	179	2,006
	Medium Ground Finch	17,938	15,580	1,294	8	168	2,139
	Golden-collared manakin	16,929	16,185	1,325	8	169	2,170
	Wild Turkey	15,207	17,289	1,493	9	173	2,068
	Ground Tit	18,482	16,154	1,313	8	170	2,206
	Zebra finch	16,622	17,643	1,382	8	168	2,249
GLEAN		13,820	16,667	1,587	9	179	1,918
Final set		15,136	20,703	1,686	9	180	2,272

Table S7. Orthologous genes in the three species of snowfinches and other seven birds.

Species	Total gene number	Ortholog number
White-rumped Snowfinch	15,585	15,259
Rufous-necked Snowfinch	15,206	14,994
Black-winged Snowfinch	15,136	14,932
Eurasian Tree Sparrow	16,925	16,210
Medium Ground Finch	14,503	14,460
Collared Flycatcher	15,969	15,408
Zebra Finch	17,470	16,820
Ground Tit	16,144	15,864
American Crow	15,374	14,764
Golden-collared Manakin	14,412	10,863

Table S8. Functional classification of genes of the three species of snowfinches using different databases.

	White-rumped Snowfinch		Black-winged Snowfinch		Rufous-necked Snowfinch	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
Total	15,585		15,136		15,206	
Nr	15,544	99.74	15,125	99.93	15,167	99.74
Swissprot	15,133	97.10	14,715	97.22	14,720	96.80
KEGG	13,609	87.32	13,148	86.87	13,246	87.11
TrEMBL	15,517	99.56	15,102	99.78	15,135	99.53
InterPro	15,086	96.80	14,704	97.15	14,698	96.66
GO	11,227	72.04	10,978	72.53	10,945	71.97
Annotated	15,554	99.80	15,132	99.97	15,176	99.80
Unanotated	31	0.20	4	0.03	30	0.20

Table S9. Completeness of the genome assemblies of the snowfinches evaluated by BUSCO.

BUSCO benchmark	White-rumped Snowfinch		Rufous-necked Snowfinch		Black-winged Snowfinch	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
Total BUSCO groups searched	4915		4915		4915	
Complete single-copy BUSCOs	4627	94.1	4616	93.9	4618	94
Complete duplicated BUSCOs	56	1.1	53	1.1	59	1.2
Fragmented BUSCOs	143	2.9	151	3.1	140	2.8
Missing BUSCOs	89	1.9	95	1.9	98	2

Note: BUSCO version is: 2.0. The lineage dataset is: aves_odb9 (Creation date: 2016-02-13, number of species: 40, number of BUSCOs: 4915)

Table S10. Summarized benchmarks in the genomes using the transcripts of the snowfinches.

Data set	Number	Total length	Bases covered	Sequences covered	with >90% sequence in one scaffold		with >50% sequence in one scaffold	
		(bp)	by assembly(%)	by assembly(%)	Number	Percent	Number	Percent
White-rumped Snowfinch								
>0bp	48,154	43,653,617	95	93	40,548	84.20	43,460	90.25
>200bp	48,154	43,653,617	95	93	40,548	84.20	43,460	90.25
>500bp	22,275	35,452,001	97	97	19,797	88.88	21,041	94.46
>1000bp	12,048	28,291,319	97	99	11,025	91.51	11,636	96.58
Rufous-necked Snowfinch								
>0bp	65,576	65,351,754	96	97	56,910	86.78	61,959	94.48
>200bp	65,576	65,351,754	96	97	56,910	86.78	61,959	94.48
>500bp	30,965	54,966,782	97	99	27,259	88.03	29,575	95.51
>1000bp	19,508	46,938,185	97	100	17,575	90.09	18,854	96.65

Table S11. Completeness of three snowfinches genesets as assessed by BUSCO.

BUSCO benchmark	White-rumped Snowfinch		Black-winged Snowfinch		Rufous-necked Snowfinch	
	Number	Percentage	Number	Percentage	Number	Percentage
Total BUSCO groups searched	303		303		303	
Complete single-copy BUSCOs	285	94.1%	272	89.8%	274	90.4%
Complete duplicated BUSCOs	4	1.3%	5	1.7	6	2.0%
Fragmented BUSCOs	4	1.3%	7	2.3	7	2.3%
Missing BUSCOs	10	3.3%	19	6.2	16	5.3%

Note: BUSCO version is: 2.0. The lineage dataset is: eukaryota_odb9 (Creation date: 2016-02-13, number of species: 100, number of BUSCOs: 303)

Table S12. Positively selected genes identified in the *ancestor* and the individual species. Note that the blanks in column "Gene symbol" represent "not annotated". The gene ID of positively selected gene in the *ancestor* used the gene ID of the *adamsi* as proxy.

Gene ID	Gene symbol	Alternative_lnL	Null_lnL	*P* value	FDR
Ancestor					
MAD011671	*THRAP3*	-6354.31	-6544.41	1.12E-84	6.74E-81
MAD011116	*CHL1*	-6929.97	-7081.96	4.48E-68	1.34E-64
MAD005608	*SPTAN1*	-12034.1	-12163.4	3.55E-58	7.10E-55
MAD001762		-5181.72	-5294.83	3.99E-51	5.98E-48
MAD011175	*CNTN4*	-5220.69	-5307.52	1.17E-39	1.40E-36
MAD006009	*SLIT2*	-5766.84	-5852.15	5.40E-39	5.39E-36
MAD006083	*PI4K2B*	-2134.98	-2213.48	5.13E-36	4.40E-33
MAD013938	*PSMD13*	-1990.28	-2067.14	2.66E-35	2.00E-32
MAD012525	*SH3RF3*	-3271.27	-3346.55	1.32E-34	8.76E-32
MAD010393	*RB1*	-4301.66	-4370.13	1.25E-31	7.50E-29
MAD011308	*MCM8*	-4392.24	-4460.48	1.56E-31	8.49E-29
MAD001408	*GYLTL1B*	-3989.15	-4054.53	2.81E-30	1.41E-27
MAD007136	*PLEKHM2*	-5497.6	-5561.51	1.24E-29	5.70E-27
MAD007997	*NECAB1*	-2687.25	-2750.31	2.89E-29	1.24E-26
MAD011110		-3812.13	-3874.11	8.63E-29	3.45E-26
MAD013320	*OTOG*	-8389.39	-8449.9	3.78E-28	1.42E-25
MAD011427	*CAP1*	-2543.71	-2604.03	4.61E-28	1.63E-25
MAD012910	*NEDD1*	-3458.69	-3515.26	2.01E-26	6.68E-24
MAD010703	*SGCD*	-1475.76	-1530.08	1.95E-25	6.14E-23
MAD002071	*MCCC1*	-3628.28	-3681.96	3.69E-25	1.05E-22
MAD009063	*LANCL1*	-2172.46	-2226.16	3.62E-25	1.05E-22
MAD014956	*PCSK5*	-2936.15	-2987.64	3.39E-24	9.24E-22
MAD005126	*RASL12*	-1893.54	-1943.96	1.01E-23	2.62E-21
MAD012804	*LMBRD1*	-2506.06	-2553.47	2.08E-22	5.19E-20
MAD010717	*PDLIM7*	-2185.17	-2232.04	3.59E-22	8.61E-20
MAD005571	*WDR31*	-1869.46	-1912.71	1.39E-20	3.21E-18
MAD006283	*TOP3A*	-5572.77	-5615.98	1.46E-20	3.25E-18
MAD005623	*COL5A1*	-4347.67	-4389.8	4.33E-20	9.27E-18
MAD007750		-1803.06	-1843.86	1.67E-19	3.46E-17
MAD001253	*TAF2*	-4193.85	-4234.53	1.89E-19	3.78E-17
MAD012687	*COLGALT2*	-2860.36	-2900.57	3.04E-19	5.88E-17
MAD006010	*TTC29*	-2385.8	-2425.84	3.61E-19	6.76E-17
MAD014512	*ENTPD6*	-2208.58	-2248.34	4.77E-19	8.66E-17
MAD011467	*TCEB3*	-4096.91	-4136.59	5.15E-19	9.08E-17
MAD009384	*ASAH2*	-4172.41	-4211.49	9.49E-19	1.62E-16
MAD006744	*ARHGEF18*	-5086.13	-5124.03	3.13E-18	5.21E-16
MAD006954	*NEK8*	-2435.96	-2472.91	8.27E-18	1.34E-15
MAD009726	*MED1*	-8373.27	-8409.82	1.24E-17	1.95E-15
MAD004500	*RPRD1A*	-1291.23	-1327.52	1.61E-17	2.47E-15
MAD002038		-1511.14	-1546.81	3.01E-17	4.51E-15
MAD010597	*BRD8*	-6821.8	-6856.87	5.50E-17	8.03E-15

MAD014038	*STRIP2*	-4149.94	-4184.84	6.58E-17	9.39E-15
MAD008791	*TBX2*	-2884.49	-2919.25	7.59E-17	1.06E-14
MAD003600		-2380.99	-2415.19	1.33E-16	1.81E-14
MAD007917	*TECPR2*	-7600.53	-7634.43	1.81E-16	2.41E-14
MAD011029	*OLFM4*	-2947.17	-2980.71	2.61E-16	3.40E-14
MAD005184	*IREB2*	-4389.74	-4422.9	3.86E-16	4.92E-14
MAD002709		-8206.6	-8239.12	7.31E-16	9.13E-14
MAD003772	*ANLN*	-5907.05	-5938.07	3.36E-15	4.11E-13
MAD002238	*B4GALNT3*	-4945.33	-4976.09	4.41E-15	5.28E-13
MAD008195	*TTC3*	-6791.3	-6821.48	7.85E-15	9.22E-13
MAD003638	*EXO1*	-4764.59	-4793.9	1.91E-14	2.20E-12
MAD006762		-8586.78	-8615.83	2.49E-14	2.81E-12
MAD005642	*PBX3*	-2539.93	-2567.71	9.03E-14	1.00E-11
MAD006567	*ATP2C1*	-4152.05	-4179.4	1.40E-13	1.52E-11
MAD010555	*CD74*	-1436.49	-1462.52	5.41E-13	5.79E-11
MAD005649	*UGDH*	-2863.03	-2888.81	6.90E-13	7.25E-11
MAD001871	*SLC16A12*	-2991	-3016.49	9.39E-13	9.70E-11
MAD002427	*CACNA2D4*	-4043.12	-4068.47	1.08E-12	1.10E-10
MAD007190	*PAK2*	-2533.72	-2558.82	1.39E-12	1.39E-10
MAD002752	*GALC*	-3053.67	-3078.06	2.84E-12	2.79E-10
MAD012543	*IL1R1*	-3394.5	-3418.68	3.52E-12	3.40E-10
MAD001782	*LRRC43*	-2091.03	-2115.2	3.58E-12	3.40E-10
MAD013465	*SCML2*	-3800.12	-3824.25	3.72E-12	3.48E-10
MAD002983	*RFX6*	-4865.03	-4888.9	4.88E-12	4.50E-10
MAD000261	*GPR50*	-1551.4	-1574.73	8.43E-12	7.66E-10
MAD010744		-1381.53	-1404.54	1.17E-11	1.05E-09
MAD006852		-2387.26	-2410	1.55E-11	1.36E-09
MAD009346	*MATR3*	-4321.42	-4344.06	1.70E-11	1.47E-09
MAD005689	*WWC2*	-6155.29	-6177.03	4.30E-11	3.68E-09
MAD013375	*BEND2*	-2781.89	-2803.19	6.72E-11	5.67E-09
MAD008230		-3780.67	-3801.92	7.06E-11	5.87E-09
MAD010741	*PANK3*	-1698.73	-1719.97	7.17E-11	5.89E-09
MAD003096	*MAML3*	-2415.7	-2436.56	1.05E-10	8.50E-09
MAD007455	*TTF2*	-5644.89	-5665.71	1.10E-10	8.79E-09
MAD004239	*DHRS7*	-1617.23	-1638.02	1.14E-10	8.96E-09
MAD010258	*CRYBA2*	-1415.9	-1435.85	2.66E-10	2.07E-08
MAD000278	*SMARCA1*	-4476.47	-4495.58	6.29E-10	4.83E-08
MAD008505	*PIGZ*	-2826.45	-2845.39	7.49E-10	5.68E-08
MAD001903		-2801.07	-2819.44	1.35E-09	1.01E-07
MAD006049	*HAND2*	-621.967	-639.956	2.00E-09	1.48E-07
MAD005939	*RNF220*	-1138.79	-1155.96	4.64E-09	3.39E-07
MAD009294	*CABP2*	-695.26	-711.578	1.11E-08	8.03E-07
MAD013323	*PTPRJ*	-6816.5	-6832.71	1.25E-08	8.89E-07
MAD006174	*TBL3*	-4191.59	-4207.76	1.29E-08	9.09E-07
MAD000453	*JAK1*	-6368.14	-6383.51	2.95E-08	2.05E-06
MAD003599	*C4H4orf29*	-2374.57	-2388.83	9.22E-08	6.35E-06
MAD011334	*ZFAND3*	-717.442	-731.555	1.08E-07	7.36E-06
MAD012511	*SLC9A4*	-3177.92	-3191.78	1.41E-07	9.50E-06

MAD007857	ARFGEF2	-9556.41	-9570.03	1.80E-07	1.20E-05
MAD000080		-3486.47	-3499.97	2.05E-07	1.35E-05
MAD009722	PLAA	-3491.34	-3504.72	2.29E-07	1.49E-05
MAD001288	KATNBL1	-1473.03	-1486.27	2.66E-07	1.71E-05
MAD002531	PLXNB2	-9943.09	-9956.22	2.99E-07	1.90E-05
MAD006404	INTS8	-4741.38	-4754.44	3.20E-07	2.02E-05
MAD006935	GAS2L2	-1480.45	-1493.5	3.27E-07	2.04E-05
MAD013117	E2F4	-2095.86	-2108.7	4.01E-07	2.48E-05
MAD002786	ETV4	-2315.16	-2327.65	5.76E-07	3.52E-05
MAD000192		-3225.66	-3237.98	6.88E-07	4.17E-05
MAD010734	PPARGC1B	-5940.93	-5953.05	8.44E-07	5.06E-05
MAD006426	TERF1	-2399.93	-2411.74	1.18E-06	7.00E-05
MAD006639	USP42	-1467.84	-1479.25	1.77E-06	0.000104
MAD005779	TEC	-3532.62	-3543.56	2.89E-06	0.000168
MAD011616	PABPC4	-3457.75	-3468.44	3.79E-06	0.000218
MAD010281	FAM117B	-1666.47	-1676.98	4.51E-06	0.000257
MAD014874	SYK	-3254.88	-3265.35	4.74E-06	0.000268
MAD008022	PLCG1	-6174.37	-6184.78	5.06E-06	0.000283
MAD000597		-6324.98	-6335.21	6.12E-06	0.00034
MAD012212	CYTH4	-2063.49	-2073.67	6.42E-06	0.000353
MAD005539	SLC31A2	-582.203	-592.322	6.83E-06	0.000372
MAD002686	CFAP61	-7652.76	-7662.38	1.15E-05	0.00062
MAD006791	SIN3B	-4454.75	-4464.23	1.33E-05	0.000711
MAD002724	STON2	-4501.44	-4510.8	1.51E-05	0.000802
MAD000628	FAAH2	-2207.1	-2216.03	2.38E-05	0.00125
MAD014244		-695.931	-704.4	3.86E-05	0.002011
MAD003276	PIGQ	-2984.27	-2992.57	4.58E-05	0.002366
MAD002411	CDKN1B	-1315.12	-1323.39	4.78E-05	0.002449
MAD013511	TNNT3	-799.18	-807.158	6.48E-05	0.00329
MAD005651	PDS5A	-6074.65	-6082.52	7.29E-05	0.003671
MAD004661	SH3BP4	-5008.19	-5015.84	9.19E-05	0.004589
MAD005199	TMC3	-5618.05	-5625.67	9.49E-05	0.004698
MAD000304		-2996.45	-3003.91	0.000112	0.005501
MAD007578	UBA6	-4824.55	-4832	0.000113	0.005501
MAD008205	SYTL5	-3879.56	-3886.8	0.000141	0.00683
MAD012830	RPL27	-571.223	-578.431	0.000146	0.007023
MAD000280	MAMLD1	-5471.64	-5478.68	0.000175	0.00831
MAD000356		-3523.57	-3530.52	0.000193	0.009108
MAD000315	ENOX2	-2715.9	-2722.72	0.000222	0.01038
MAD011295	DTL	-3836.9	-3843.53	0.00027	0.012565
MAD008498	SLC9A9	-3424.32	-3430.92	0.000279	0.012845
MAD011531	TSC1	-5742.75	-5749.26	0.000306	0.014
MAD001194	SNX16	-1704.24	-1710.62	0.000356	0.016145
MAD007155	PLCH2	-4286.41	-4292.69	0.000396	0.017831
MAD012520	DHRSX	-1601.99	-1608.13	0.00046	0.020578
MAD000963	TSEN54	-2282.73	-2288.85	0.000466	0.02068
MAD011258	KCTD3	-2922.63	-2928.67	0.000506	0.022313
MAD002334		-1606.57	-1612.6	0.000512	0.022418

MAD012277	*METTL13*	-3266.56	-3272.4	0.00063	0.027359
MAD010728	*CYFIP2*	-4085.46	-4091.17	0.000727	0.031326
MAD000004	*ZRANB3*	-5549.23	-5554.89	0.000772	0.033066
MAD007683	*CEP290*	-12770.8	-12776.4	0.000797	0.033888
MAD000109	*WNT6*	-1810.74	-1816.28	0.000875	0.036938
MAD012022		-872.635	-878.152	0.000894	0.037481
MAD011428	*EPB41*	-4220.74	-4226.17	0.000987	0.041076
Adamsi					
MAD005807	*TGFBR3*	-4567.56	-4729.05	3.26E-72	1.95E-68
MAD004040	*PACS2*	-4223.65	-4357.09	5.44E-60	1.63E-56
MAD012169	*FBXO7*	-2885.04	-3017.15	2.08E-59	4.15E-56
MAD008523	*SLC16A14*	-2957.85	-3085.97	1.13E-57	1.69E-54
MAD007228	*TSPEAR*	-3372.3	-3498.96	4.94E-57	5.92E-54
MAD013389	*CDH9*	-4358.93	-4484.02	2.36E-56	2.36E-53
MAD014976	*SETD4*	-2845.52	-2966.88	1.01E-54	8.64E-52
MAD012555	*EIF5B*	-5788.59	-5907.36	1.35E-53	1.01E-50
MAD003260	*XPO6*	-5017.61	-5136.14	1.72E-53	1.15E-50
MAD002358	*INPP4A*	-4703.42	-4820.02	1.19E-52	7.16E-50
MAD002874	*SLC22A2*	-3319.06	-3433.63	9.10E-52	4.54E-49
MAD011132	*PLXNA1*	-7232.16	-7346.76	8.88E-52	4.54E-49
MAD014145	*SCNN1D*	-2957.84	-3072.33	1.00E-51	4.61E-49
MAD012019	*IGSF9B*	-3301.9	-3415.9	1.62E-51	6.93E-49
MAD008947	*UBE4B*	-5893.94	-6004.14	7.40E-50	2.96E-47
MAD012960	*SMAP1*	-2127.6	-2236.86	1.91E-49	7.16E-47
MAD014112	*TP63*	-3435.11	-3538.99	4.23E-47	1.49E-44
MAD009593	*FOCAD*	-6192.67	-6296.1	6.69E-47	2.23E-44
MAD013247	*OGDH*	-5264.14	-5367.16	1.01E-46	3.19E-44
MAD014450	*COBL*	-4773.7	-4876.65	1.08E-46	3.25E-44
MAD006811	*LRRC16A*	-5574.53	-5677.24	1.37E-46	3.90E-44
MAD002651	*ANAPC1*	-9987.22	-10084.3	4.07E-44	1.11E-41
MAD005876	*ROR1*	-3748.94	-3845.11	9.81E-44	2.56E-41
MAD013009	*ATMIN*	-3725.26	-3820.15	3.53E-43	8.83E-41
MAD000118	*HECW2*	-9030.22	-9123.9	1.20E-42	2.85E-40
MAD013663	*ERCC5*	-4225.8	-4319.45	1.24E-42	2.85E-40
MAD010576	*FBXO38*	-5934.79	-6027.23	4.19E-42	9.31E-40
MAD011712	*IFT81*	-3765.99	-3858.32	4.63E-42	9.92E-40
MAD009372		-4929.73	-5021.4	9.09E-42	1.88E-39
MAD006072	*LIMCH1*	-5680.22	-5771.16	1.88E-41	3.76E-39
MAD013529		-3329.31	-3420.1	2.20E-41	4.25E-39
MAD014399	*SLC35F4*	-2483.33	-2574.02	2.42E-41	4.54E-39
MAD005458	*AKAP13*	-6929.85	-7018.08	2.88E-40	5.23E-38
MAD011892	*FGFR3*	-3887.43	-3974.42	9.98E-40	1.76E-37
MAD002674	*PLCB4*	-6289.01	-6375.93	1.07E-39	1.83E-37
MAD006351		-7774.95	-7860.86	2.97E-39	4.94E-37
MAD004204	*DAAM1*	-5170.96	-5256.29	5.28E-39	8.55E-37
MAD008256	*SYNE3*	-4778.07	-4862.38	1.49E-38	2.35E-36
MAD004749		-13179.2	-13263.4	1.59E-38	2.44E-36
MAD004375	*GPI*	-2915.21	-2998.46	4.28E-38	6.41E-36

MAD011116	CHL1	-6999.61	-7082.24	8.05E-38	1.18E-35
MAD006888	CHD5	-7883.64	-7965.17	2.43E-37	3.47E-35
MAD007338	ITPR3	-12674.2	-12754.1	1.20E-36	1.67E-34
MAD002575	TBC1D22B	-2494.02	-2573.3	2.32E-36	3.17E-34
MAD008938	KIF1B	-9721.58	-9799.17	1.28E-35	1.71E-33
MAD008367	NRP1	-5119.97	-5197.37	1.55E-35	2.02E-33
MAD003362	ASH1L	-17196.4	-17273.3	2.46E-35	3.14E-33
MAD000043	MARCO	-3476.92	-3553.52	3.45E-35	4.30E-33
MAD011350	RPS6KC1	-5468.68	-5545.17	3.87E-35	4.73E-33
MAD001483	F2	-3507.79	-3582.96	1.46E-34	1.75E-32
MAD013095	CPNE2	-2839.22	-2914.06	2.04E-34	2.40E-32
MAD006877	MFN2	-4299.99	-4374.43	3.06E-34	3.53E-32
MAD002264	PARPBP	-3255.95	-3329.14	1.08E-33	1.22E-31
MAD012127	MME	-4206.15	-4278.38	2.81E-33	3.12E-31
MAD010615	LECT2	-1882.73	-1953.91	8.12E-33	8.85E-31
MAD011402	SCMH1	-2546.17	-2615.25	6.71E-32	7.18E-30
MAD002301		-2117.24	-2186.26	7.15E-32	7.52E-30
MAD009894	YTHDC2	-7073.92	-7142.39	1.24E-31	1.29E-29
MAD010246	TMBIM1	-2194.15	-2262.32	1.68E-31	1.71E-29
MAD001694	DLGAP1	-4912.08	-4980.02	2.11E-31	2.11E-29
MAD010249	OLA1	-1934.73	-2002.3	3.05E-31	3.00E-29
MAD006456	ADHFE1	-2206.93	-2272.55	2.18E-30	2.11E-28
MAD006463	WWP1	-3990.39	-4054.21	1.34E-29	1.28E-27
MAD006180	IL21R	-3447.81	-3511.13	2.23E-29	2.09E-27
MAD012386	SLC6A17	-3705.34	-3767.9	4.80E-29	4.42E-27
MAD000310	OCRL	-3811.99	-3874.21	6.71E-29	6.09E-27
MAD005642	PBX3	-2504.52	-2566.55	8.18E-29	7.32E-27
MAD005431	PARP6	-3486.98	-3548.52	1.34E-28	1.18E-26
MAD010924	EEFSEC	-2474.23	-2535.71	1.42E-28	1.23E-26
MAD012203	RFX4	-2527.12	-2587.29	5.31E-28	4.55E-26
MAD009467	HIPK3	-6477.03	-6536.98	6.61E-28	5.58E-26
MAD008831	MAP4K5	-2754.1	-2813.79	8.59E-28	7.15E-26
MAD007814	SLC12A4	-4766.53	-4825.95	1.14E-27	9.33E-26
MAD009625	TEAD4	-1362.05	-1421.38	1.25E-27	1.01E-25
MAD001980	RRP12	-6253.22	-6312.49	1.32E-27	1.06E-25
MAD013295	RIOK1	-3093.47	-3151.57	4.33E-27	3.37E-25
MAD003718	DNAJC5	-1075.27	-1133.36	4.30E-27	3.37E-25
MAD009726	MED1	-8349.63	-8407.64	4.70E-27	3.61E-25
MAD003285	SEC14L5	-3514.6	-3572.58	4.85E-27	3.68E-25
MAD002686	CFAP61	-7604.86	-7662.62	6.07E-27	4.54E-25
MAD013523	ALDH1L2	-4466.77	-4524.25	7.99E-27	5.91E-25
MAD014609	PLCXD3	-1518.99	-1576.3	9.56E-27	6.98E-25
MAD010282	PLEKHM3	-4188.65	-4245.93	9.82E-27	7.09E-25
MAD007154		-2554.64	-2610.78	3.10E-26	2.21E-24
MAD006353	SNX29	-1696.12	-1751.84	4.72E-26	3.33E-24
MAD013467	CTPS2	-2806.54	-2862.06	5.79E-26	4.04E-24
MAD007304	SLC22A15	-2946.55	-3001.59	9.39E-26	6.47E-24
MAD004577	ARHGEF39	-1807.61	-1861.01	4.88E-25	3.33E-23

MAD010608	*HMMR*	-3597.41	-3650.39	7.53E-25	5.07E-23
MAD011367	*MTFR1L*	-2040.12	-2092.64	1.19E-24	7.95E-23
MAD008485	*TRAPPC12*	-4114.04	-4166.29	1.57E-24	1.04E-22
MAD006730	*RAB31*	-1028.37	-1079.68	4.06E-24	2.64E-22
MAD014461	*ASCC3*	-10079.7	-10130.6	6.11E-24	3.94E-22
MAD003149		-3644.37	-3695.26	6.18E-24	3.94E-22
MAD007858	*COL20A1*	-8009.21	-8059.71	9.25E-24	5.83E-22
MAD005709	*PPAT*	-2508.96	-2559.43	9.53E-24	5.95E-22
MAD007229	*ATG4B*	-1841.64	-1891.37	1.99E-23	1.23E-21
MAD011767	*ADGRD1*	-4187.65	-4237.06	2.77E-23	1.69E-21
MAD009912	*CHD1*	-6514.02	-6563.26	3.29E-23	1.99E-21
MAD006494	*ZNF804B*	-3884.36	-3933.23	4.79E-23	2.87E-21
MAD006350	*SMG1*	-14041.1	-14089.9	5.39E-23	3.20E-21
MAD013254	*GMCL1*	-2087.73	-2136.37	6.06E-23	3.56E-21
MAD003374	*HDGF*	-1062.47	-1110.28	1.39E-22	8.07E-21
MAD003252	*IFT122*	-5487.19	-5534.78	1.74E-22	1.00E-20
MAD013418		-1789.11	-1836.67	1.78E-22	1.02E-20
MAD009695	*TRIP13*	-2177.51	-2224.79	2.36E-22	1.33E-20
MAD007650	*LIN7A*	-1157.91	-1204.72	3.84E-22	2.15E-20
MAD001896	*KNDC1*	-3012.67	-3059.33	4.42E-22	2.45E-20
MAD012554	*UNC50*	-1416.61	-1463.1	5.27E-22	2.90E-20
MAD005395	*CLN6*	-1224.88	-1271.11	6.83E-22	3.72E-20
MAD012956	*TTK*	-2984.82	-3030.97	7.44E-22	4.02E-20
MAD005770	*ASAH1*	-1523.86	-1569.85	8.74E-22	4.68E-20
MAD007651	*PPFIA2*	-4274.32	-4320.15	1.03E-21	5.48E-20
MAD002856	*ARID1B*	-7419.62	-7464.97	1.66E-21	8.74E-20
MAD012289	*SOAT1*	-2663.14	-2708.4	1.82E-21	9.49E-20
MAD005420	*SCAPER*	-6419.03	-6464.28	1.84E-21	9.52E-20
MAD013406	*USP54*	-5674.07	-5718.79	3.16E-21	1.62E-19
MAD007578	*UBA6*	-4785.07	-4829.37	4.83E-21	2.45E-19
MAD011863	*SFXN5*	-1250.2	-1294.42	5.27E-21	2.66E-19
MAD013332	*GTF2H1*	-2861.76	-2905.3	1.04E-20	5.19E-19
MAD007077	*UBN2*	-5845.66	-5889.09	1.16E-20	5.73E-19
MAD008233	*BCL11B*	-3386.49	-3429.81	1.30E-20	6.41E-19
MAD006663	*STT3A*	-3425.96	-3469.13	1.52E-20	7.43E-19
MAD002953	*ATP9A*	-4533.92	-4577.04	1.59E-20	7.68E-19
MAD002457	*SPPL3*	-1931.04	-1974.05	1.77E-20	8.50E-19
MAD002335	*CNGA3*	-3889.76	-3932.27	2.96E-20	1.41E-18
MAD009385	*TMEM26*	-2068.13	-2109.66	7.93E-20	3.74E-18
MAD000485	*NDC1*	-2626.02	-2667.17	1.17E-19	5.48E-18
MAD013007		-868.839	-909.78	1.45E-19	6.71E-18
MAD001775	*KNTC1*	-12485	-12525.7	1.74E-19	8.02E-18
MAD012053	*GRIK4*	-2038.09	-2078.76	1.89E-19	8.67E-18
MAD000782	*HGS*	-3663.29	-3703.9	2.01E-19	9.14E-18
MAD006472	*NDUFAF6*	-1001.25	-1041.7	2.38E-19	1.07E-17
MAD008648		-1534.8	-1575.09	2.78E-19	1.24E-17
MAD006071	*SLC30A9*	-2100.98	-2140.97	3.78E-19	1.68E-17
MAD010774	*CANX*	-3025.03	-3064.75	5.00E-19	2.20E-17

MAD001227	*MYBL1*	-2401.19	-2440.27	9.53E-19	4.17E-17
MAD011694		-737.942	-776.837	1.15E-18	4.98E-17
MAD006782	*RNF126*	-1447.86	-1486.66	1.26E-18	5.42E-17
MAD000837	*HEXDC*	-2943.92	-2982.7	1.30E-18	5.56E-17
MAD008013	*TRPC4AP*	-3660.51	-3699.09	1.57E-18	6.67E-17
MAD004064	*KLHDC1*	-1970.76	-2009	2.22E-18	9.36E-17
MAD011580	*AK8*	-1763.62	-1801.36	3.70E-18	1.55E-16
MAD011148	*SEMA3F*	-2653.47	-2691.16	3.86E-18	1.61E-16
MAD009722	*PLAA*	-3453.82	-3491.5	3.94E-18	1.63E-16
MAD008786	*AKAP1*	-2554.56	-2591.41	9.14E-18	3.75E-16
MAD001067	*TOPAZ1*	-2948.99	-2984.27	4.50E-17	1.83E-15
MAD002057	*RARRES1*	-1070.83	-1105.85	5.81E-17	2.35E-15
MAD004132	*FBXO18*	-2753.77	-2788.69	6.40E-17	2.57E-15
MAD011980	*SORCS2*	-4038.87	-4073.35	1.00E-16	4.01E-15
MAD012953	*ORC3*	-1885.01	-1918.87	1.88E-16	7.46E-15
MAD003408	*DIS3*	-4533.18	-4566.67	2.74E-16	1.08E-14
MAD004475		-1383.89	-1417.37	2.77E-16	1.08E-14
MAD007819	*C11H16orf70*	-1601.24	-1634.53	3.36E-16	1.31E-14
MAD013458	*ACOT9*	-1652.01	-1685.14	3.96E-16	1.52E-14
MAD009542	*ADSSL1*	-1948.87	-1982	3.95E-16	1.52E-14
MAD010283	*MDH1B*	-2466.32	-2499.27	4.77E-16	1.82E-14
MAD005649	*UGDH*	-2855.53	-2888.46	4.87E-16	1.85E-14
MAD014457	*MMS22L*	-6986.73	-7019.37	6.51E-16	2.45E-14
MAD007143	*PHC2*	-1186.63	-1219.21	6.93E-16	2.59E-14
MAD003151	*PAK1IP1*	-1967.88	-2000.19	9.06E-16	3.37E-14
MAD013283	*NUP153*	-7491.25	-7523.19	1.33E-15	4.91E-14
MAD009065	*NUP35*	-1107.6	-1139.5	1.38E-15	5.07E-14
MAD012477	*PNPT1*	-4388.5	-4420.02	2.02E-15	7.40E-14
MAD014292		-1586.44	-1617.36	3.72E-15	1.35E-13
MAD011313	*ETAA1*	-4589.53	-4620.4	3.91E-15	1.41E-13
MAD010324	*PDIA5*	-1628.74	-1659.61	3.94E-15	1.41E-13
MAD013943	*MED19*	-1053.65	-1084.44	4.22E-15	1.50E-13
MAD014008	*CCAR1*	-6489.72	-6520.51	4.23E-15	1.50E-13
MAD001205	*NOL4*	-2453.78	-2484.49	4.58E-15	1.62E-13
MAD000859	*UTP6*	-3547.46	-3578.02	5.36E-15	1.88E-13
MAD003739	*LPCAT1*	-2615.14	-2645.45	6.92E-15	2.41E-13
MAD012296	*DHX9*	-2675.82	-2706.1	7.12E-15	2.47E-13
MAD003017	*LACE1*	-2340.16	-2370.02	1.10E-14	3.79E-13
MAD012368	*RNF10*	-3959.18	-3988.86	1.32E-14	4.53E-13
MAD009151	*DZANK1*	-3797.22	-3826.7	1.60E-14	5.46E-13
MAD008766	*DDX49*	-1476.63	-1505.96	1.87E-14	6.34E-13
MAD001628	*GREB1L*	-3557.9	-3587.12	2.09E-14	7.05E-13
MAD007641	*AMOTL2*	-4085.46	-4114.19	3.44E-14	1.15E-12
MAD000345	*MTMR1*	-2485.02	-2513.73	3.51E-14	1.17E-12
MAD004666	*USP40*	-6693.73	-6722.38	3.76E-14	1.24E-12
MAD001654	*HSD11B1L*	-2244.28	-2272.9	3.87E-14	1.27E-12
MAD013325	*SBF2*	-7659.98	-7688.44	4.57E-14	1.50E-12
MAD006357	*ZC3H7A*	-3793.88	-3822.02	6.28E-14	2.05E-12

MAD010276	*CFLAR*	-2707.55	-2735.66	6.51E-14	2.11E-12
MAD005154	*MYO9A*	-13582.7	-13610.4	9.64E-14	3.11E-12
MAD001975	*DNTT*	-2696.15	-2723.47	1.46E-13	4.66E-12
MAD013574	*C1H21orf59*	-1440.31	-1467.55	1.57E-13	5.01E-12
MAD000177	*SNX4*	-1886.7	-1913.82	1.78E-13	5.63E-12
MAD009698	*TNS3*	-4973.25	-5000.19	2.14E-13	6.74E-12
MAD009729	*FBXO47*	-2371.43	-2398.13	2.72E-13	8.53E-12
MAD007481	*ALDH18A1*	-4310.4	-4336.99	3.06E-13	9.55E-12
MAD010808	*TSEN2*	-3007.16	-3033.44	4.19E-13	1.30E-11
MAD012998	*WFDC1*	-1360.89	-1387.08	4.57E-13	1.41E-11
MAD009149	*RRBP1*	-5127.77	-5153.91	4.84E-13	1.49E-11
MAD007718	*PDPR*	-4238.15	-4263.8	7.95E-13	2.43E-11
MAD002531	*PLXNB2*	-9930.7	-9956.22	9.03E-13	2.75E-11
MAD007429		-2449.16	-2474.55	1.03E-12	3.13E-11
MAD000638	*C4AH8orf48*	-631.871	-657.144	1.16E-12	3.50E-11
MAD007309	*BOC*	-2306.63	-2331.65	1.50E-12	4.50E-11
MAD000175	*CCDC14*	-1779.47	-1804.45	1.56E-12	4.66E-11
MAD003545		-4025.65	-4050.59	1.63E-12	4.85E-11
MAD007060	*TEX33*	-476.951	-501.54	2.34E-12	6.90E-11
MAD014486	*SLC45A2*	-1752.11	-1776.69	2.35E-12	6.91E-11
MAD006602	*PRTFDC1*	-844.653	-869.186	2.48E-12	7.24E-11
MAD009703	*MAMDC2*	-3207.53	-3231.76	3.38E-12	9.84E-11
MAD006831	*TTC34*	-3177.9	-3201.93	4.11E-12	1.19E-10
MAD004799		-2133.55	-2157.53	4.38E-12	1.26E-10
MAD003455	*TM9SF4*	-3026.59	-3050.3	5.74E-12	1.65E-10
MAD003743	*ZNF830*	-1760.12	-1783.74	6.27E-12	1.79E-10
MAD003368	*GON4L*	-8121.16	-8144.53	8.10E-12	2.30E-10
MAD002046	*KPNA4*	-2754.36	-2777.53	9.98E-12	2.82E-10
MAD012676	*MGST3*	-1087.21	-1110.23	1.16E-11	3.26E-10
MAD013660	*CLYBL*	-1144.26	-1167.02	1.52E-11	4.24E-10
MAD001716	*TMX3*	-1681.33	-1704.07	1.53E-11	4.27E-10
MAD001238	*FABP4*	-1003.88	-1026.5	1.74E-11	4.83E-10
MAD004175	*DLL1*	-2649.99	-2672.38	2.20E-11	6.06E-10
MAD005598		-834.695	-856.642	3.47E-11	9.53E-10
MAD010292	*ATF2*	-2274.92	-2296.71	4.06E-11	1.11E-09
MAD013724	*PKHD1*	-8804.88	-8826.32	5.83E-11	1.59E-09
MAD000471	*PIK3R3*	-3125.49	-3146.86	6.25E-11	1.69E-09
MAD013669	*IFNG*	-1329.5	-1350.8	6.67E-11	1.80E-09
MAD014483	*PRLR*	-4626.84	-4647.95	8.19E-11	2.20E-09
MAD008137		-4936.83	-4957.72	1.02E-10	2.73E-09
MAD011161	*PPP4R2*	-1909.15	-1929.54	1.71E-10	4.55E-09
MAD012370	*SRRM4*	-1655.19	-1675.45	1.95E-10	5.16E-09
MAD005653	*YIPF7*	-1725.39	-1745.52	2.22E-10	5.87E-09
MAD003145	*GMPR*	-1694.26	-1714.32	2.38E-10	6.25E-09
MAD004290	*LGALS3*	-1008.05	-1027.87	3.06E-10	8.00E-09
MAD012605	*SLC16A4*	-3041.69	-3061.48	3.13E-10	8.16E-09
MAD006073	*UCHL1*	-1211.65	-1231.25	3.81E-10	9.90E-09
MAD001485	*C5H11orf49*	-1289.43	-1309.02	3.87E-10	1.00E-08

MAD005305	*PGPEP1L*	-1111.25	-1130.82	3.96E-10	1.02E-08
MAD000626	*HDAC8*	-1779.6	-1798.75	6.08E-10	1.56E-08
MAD007693	*CAPS2*	-978.324	-997.4	6.55E-10	1.66E-08
MAD003529	*KIDINS220*	-8069.12	-8088.2	6.53E-10	1.66E-08
MAD007756	*FTO*	-2102.04	-2120.85	8.56E-10	2.16E-08
MAD012680	*ACBD6*	-1187.36	-1206.08	9.42E-10	2.37E-08
MAD014580		-1103.12	-1121.29	1.67E-09	4.18E-08
MAD006722	*NAPG*	-1381.05	-1399.17	1.75E-09	4.37E-08
MAD010343	*MTMR2*	-3204.3	-3222.24	2.10E-09	5.22E-08
MAD013795	*TERF2*	-2511.28	-2528.91	2.88E-09	7.13E-08
MAD008950	*PEX14*	-2290.41	-2307.92	3.24E-09	7.98E-08
MAD008230		-3783.13	-3800.61	3.37E-09	8.28E-08
MAD004081	*ADARB1*	-3563.07	-3580.31	4.32E-09	1.06E-07
MAD006747	*PSMG2*	-1673.67	-1690.83	4.68E-09	1.14E-07
MAD003938	*POLR3F*	-1633.1	-1650.06	5.77E-09	1.40E-07
MAD008775	*HNRNPM*	-2344.77	-2361.48	7.45E-09	1.80E-07
MAD006013	*BANK1*	-1075.19	-1091.77	8.41E-09	2.02E-07
MAD006589	*PHF14*	-2929.83	-2946.31	9.43E-09	2.26E-07
MAD011110		-3860.26	-3876.7	9.83E-09	2.35E-07
MAD011978	*NELFA*	-1932.6	-1949.01	1.01E-08	2.41E-07
MAD009969	*RBM8A*	-792.911	-809.282	1.05E-08	2.49E-07
MAD004336	*SAMM50*	-1187.3	-1203.62	1.11E-08	2.63E-07
MAD010295		-4736.84	-4753.11	1.16E-08	2.74E-07
MAD001493	*LRRC56*	-607.681	-623.386	2.09E-08	4.89E-07
MAD008338	*SEC63*	-2460	-2475.47	2.64E-08	6.16E-07
MAD010254	*RIF1*	-6600.66	-6616.12	2.68E-08	6.23E-07
MAD012506	*GAS6*	-3458.83	-3474.22	2.89E-08	6.69E-07
MAD009247	*ITGA1*	-4440.1	-4455.39	3.20E-08	7.38E-07
MAD004833	*POGZ*	-2204.84	-2220	3.69E-08	8.47E-07
MAD001785	*RIMBP2*	-9072.85	-9087.97	3.83E-08	8.77E-07
MAD009547		-1191.93	-1207	4.01E-08	9.13E-07
MAD012727	*PABPC1L*	-3837.76	-3852.7	4.61E-08	1.05E-06
MAD006594	*STEAP2*	-3024.05	-3038.89	5.09E-08	1.15E-06
MAD010717	*PDLIM7*	-2217.91	-2232.75	5.10E-08	1.15E-06
MAD002835	*MYB*	-2813.82	-2828.57	5.62E-08	1.26E-06
MAD005788	*SEL1L3*	-4108.72	-4123.39	6.11E-08	1.37E-06
MAD002056	*LXN*	-1073.18	-1087.67	7.30E-08	1.62E-06
MAD001360	*NUSAP1*	-2635.94	-2650.43	7.28E-08	1.62E-06
MAD002261	*IPO8*	-4527.95	-4542.16	9.80E-08	2.17E-06
MAD001217	*RB1CC1*	-6772.21	-6786.33	1.08E-07	2.37E-06
MAD005132	*RCN2*	-1092.32	-1106.23	1.34E-07	2.94E-06
MAD001058	*HOXA10*	-1438.26	-1452.01	1.58E-07	3.46E-06
MAD003291		-3513.18	-3526.91	1.60E-07	3.49E-06
MAD006347	*TMC7*	-2144.54	-2158.23	1.68E-07	3.65E-06
MAD007543		-2787.92	-2801.56	1.76E-07	3.82E-06
MAD003737	*SCGN*	-1607.13	-1620.67	1.95E-07	4.21E-06
MAD003779		-1309.35	-1322.86	2.00E-07	4.30E-06
MAD011775	*MORN3*	-1418.33	-1431.8	2.10E-07	4.50E-06

MAD003473	*STXBP5*	-6115.29	-6128.73	2.18E-07	4.65E-06
MAD014075	*NOLC1*	-3609.64	-3623.03	2.30E-07	4.89E-06
MAD006791	*SIN3B*	-4449.61	-4462.97	2.37E-07	5.01E-06
MAD001164	*ATP6V1H*	-2435.65	-2448.67	3.33E-07	7.03E-06
MAD007857	*ARFGEF2*	-9556.58	-9569.59	3.41E-07	7.17E-06
MAD006381	*OSR2*	-1764.13	-1777.02	3.82E-07	8.01E-06
MAD012113	*EIF2A*	-3188.73	-3201.58	3.98E-07	8.32E-06
MAD001078	*NGLY1*	-3034.58	-3047.41	4.09E-07	8.52E-06
MAD012432	*CSDE1*	-3448.05	-3460.54	5.79E-07	1.20E-05
MAD014654	*NEDD4L*	-4164.77	-4177.25	5.82E-07	1.20E-05
MAD006448	*DTNA*	-3232.4	-3244.78	6.50E-07	1.34E-05
MAD005245	*CHRNA5*	-1891.47	-1903.37	1.06E-06	2.18E-05
MAD002557	*COG5*	-2165.32	-2177.22	1.07E-06	2.19E-05
MAD007241	*MYO7A*	-11248.6	-11260.5	1.08E-06	2.20E-05
MAD008225	*MORC3*	-4895.55	-4907.31	1.23E-06	2.51E-05
MAD000390	*RPE65*	-3098.69	-3110.41	1.29E-06	2.59E-05
MAD010315	*ATG9A*	-3668.03	-3679.75	1.28E-06	2.59E-05
MAD004931	*TYRP1*	-2372.49	-2383.67	2.26E-06	4.54E-05
MAD005924	*TCEANC2*	-1296.57	-1307.25	3.81E-06	7.63E-05
MAD008716	*LGR5*	-3930.52	-3941.09	4.27E-06	8.52E-05
MAD010606	*PSD2*	-3132.72	-3143.24	4.48E-06	8.93E-05
MAD003810	*LRRTM4*	-1048.63	-1058.71	7.15E-06	0.000142
MAD005207		-3030.68	-3040.5	9.33E-06	0.000185
MAD000005	*DPP10*	-3244.38	-3254.15	9.79E-06	0.000193
MAD007152	*TPRG1L*	-819.341	-829.061	1.04E-05	0.000204
MAD013593	*ARL6*	-1019.4	-1028.86	1.37E-05	0.000267
MAD005911	*SGIP1*	-1404.05	-1413.46	1.44E-05	0.000281
MAD006217		-1684.28	-1693.63	1.54E-05	0.0003
MAD012032	*RNF214*	-2435.65	-2444.97	1.58E-05	0.000306
MAD006049	*HAND2*	-629.246	-638.463	1.76E-05	0.00034
MAD011589	*C5*	-7940.38	-7949.52	1.90E-05	0.000366
MAD013570	*TIMMDC1*	-882.785	-891.895	1.97E-05	0.000378
MAD012854	*TTC25*	-1938.27	-1947.32	2.09E-05	0.000401
MAD001468	*PLEKHD1*	-2291.43	-2300.4	2.27E-05	0.000433
MAD013889	*ZPLD1*	-2537.08	-2546.04	2.31E-05	0.00044
MAD000777	*TMC6*	-4172.55	-4181.36	2.67E-05	0.000507
MAD005240	*LRRK1*	-9747.32	-9756.06	2.91E-05	0.000549
MAD005549	*SNAPC4*	-2627.29	-2635.95	3.16E-05	0.000596
MAD001891	*CEP55*	-3178.22	-3186.85	3.25E-05	0.00061
MAD010926	*DNAH12*	-9279.73	-9288.3	3.47E-05	0.000649
MAD010901	*CRBN*	-1793.59	-1802.09	3.70E-05	0.000692
MAD009374		-1583.62	-1592.08	3.92E-05	0.000729
MAD009704	*FAM189A1*	-1404.18	-1412.62	4.00E-05	0.000742
MAD010814		-940.336	-948.604	4.78E-05	0.000884
MAD012899		-896.923	-905.127	5.11E-05	0.000942
MAD008091	*CFAP46*	-522.551	-530.715	5.33E-05	0.000979
MAD000280	*MAMLD1*	-5470.59	-5478.68	5.76E-05	0.001055
MAD008760	*PTPRD*	-9103.58	-9111.59	6.27E-05	0.001146

MAD001466	*RYR3*	-19267	-19275	6.34E-05	0.001155
MAD005525	*PKN3*	-4537.25	-4545.02	8.08E-05	0.001468
MAD002417		-2585.55	-2593.3	8.28E-05	0.001499
MAD011689	*FNDC5*	-789.866	-797.591	8.47E-05	0.001529
MAD007568	*FGB*	-2849.5	-2857.1	9.64E-05	0.001735
MAD011770	*TCTN2*	-1168	-1175.45	0.000113	0.002027
MAD013589	*MAEL*	-1422.69	-1430.08	0.000121	0.00216
MAD005627	*SEC16A*	-9807	-9814.22	0.000145	0.002585
MAD002637	*TMEM63A*	-3543.43	-3550.62	0.000151	0.002679
MAD007000	*TXN2*	-744.008	-751.164	0.000155	0.002746
MAD009517	*EEF1D*	-3072.89	-3079.86	0.000188	0.003331
MAD006419	*CSPP1*	-5503.77	-5510.72	0.000193	0.003405
MAD005864		-3193.77	-3200.71	0.000195	0.003423
MAD008689	*CAND1*	-5059.08	-5065.98	0.000203	0.003561
MAD004975		-4070.8	-4077.67	0.00021	0.003669
MAD001777	*EP400*	-15891.9	-15898.6	0.000253	0.004402
MAD006369	*MTFR1*	-1927.66	-1934.27	0.000275	0.004779
MAD014541	*EPHB6*	-5092.45	-5099.04	0.000281	0.004875
MAD014880	*SYT9*	-1306.52	-1313.09	0.000289	0.004983
MAD006651	*ETS1*	-1586.68	-1593.06	0.000355	0.006113
MAD009531	*SUGP1*	-1848.97	-1854.86	0.0006	0.010299
MAD006636	*SPA17*	-365.234	-370.807	0.000842	0.014424
MAD007697	*C1AH12orf50*	-499.198	-504.725	0.000885	0.015115
MAD009899	*NUP155*	-5435.02	-5440.39	0.001056	0.017982
MAD003197	*TADA2A*	-1772.39	-1777.68	0.001135	0.019271
MAD008056		-1130.08	-1135.09	0.001553	0.026298
MAD001069	*MRPL3*	-1185.59	-1190.53	0.001671	0.028202
MAD002966	*YTHDF1*	-2474.18	-2479.07	0.001769	0.029781
MAD009788	*GHR*	-2652.97	-2657.72	0.002037	0.034191
MAD006239	*PTCD1*	-3291.11	-3295.87	0.002044	0.034222
MAD003054	*DDHD2*	-2541.07	-2545.74	0.002233	0.037273
MAD000663	*DOCK11*	-6913	-6917.61	0.002395	0.039876
MAD011593	*LHX6*	-931.551	-935.979	0.002923	0.048531
Rufico					
PRU012784	*INSR*	-7519.43	-7712.32	6.88E-86	4.12E-82
PRU012309	*BRCA2*	-17984.1	-18164	3.15E-80	9.45E-77
PRU005201	*DNAH3*	-21640.4	-21786.4	1.79E-65	3.58E-62
PRU004086	*PDE6B*	-4629.05	-4772.59	2.16E-64	3.23E-61
PRU013106	*ADAMTS8*	-4010.64	-4153.42	4.65E-64	5.58E-61
PRU000634	*DOCK3*	-9868.1	-10007.1	2.00E-62	1.99E-59
PRU013114	*RBBP8*	-4112.74	-4247.59	1.32E-60	1.13E-57
PRU004359	*MFSD4*	-2677.98	-2809.43	3.97E-59	2.98E-56
PRU014137	*NUP98*	-8319.88	-8447.17	2.60E-57	1.73E-54
PRU005721	*MYO5C*	-4770.46	-4890.32	4.52E-54	2.71E-51
PRU013479	*CD101*	-4309.73	-4429.4	5.48E-54	2.99E-51
PRU011694	*NRP1*	-5070.35	-5185.06	7.99E-52	3.99E-49
PRU007489	*KPNA2*	-3068.21	-3180.18	1.25E-50	5.77E-48
PRU002696	*CAMTA1*	-7456.53	-7564.03	1.11E-48	4.76E-46

PRU013173	PDE3A	-4420.36	-4525.89	8.06E-48	3.22E-45
PRU001767	MOXD1	-3024.69	-3128.19	6.19E-47	2.32E-44
PRU009551	FAR1	-2834.03	-2937.35	7.40E-47	2.61E-44
PRU006297	BIRC6	-21110.8	-21213	2.10E-46	6.99E-44
PRU003349	ADCY2	-5137.16	-5238.71	4.41E-46	1.39E-43
PRU009086	DHTKD1	-4781.9	-4879.2	3.15E-44	9.44E-42
PRU012649		-2594.63	-2690.36	1.53E-43	4.37E-41
PRU012372	HEPHL1	-5614.79	-5707.6	2.88E-42	7.86E-40
PRU001958	PCDH15	-10266.3	-10359	3.29E-42	8.58E-40
PRU011496	BLZF1	-2218.76	-2311.06	4.77E-42	1.19E-39
PRU013650	RGL1	-3645.4	-3737.35	6.84E-42	1.64E-39
PRU002256	SLCO2A1	-3646.78	-3738.6	7.75E-42	1.79E-39
PRU002634	ASH1L	-17181.1	-17269	3.73E-40	8.28E-38
PRU009304	RIF1	-6526.55	-6613.44	1.10E-39	2.36E-37
PRU007229		-2309.24	-2395.58	1.93E-39	3.99E-37
PRU001421	FAM114A2	-2342.15	-2427.5	5.20E-39	1.04E-36
PRU004109	AP5M1	-2036.83	-2120.55	2.68E-38	5.19E-36
PRU006558	SNX9	-2822.65	-2902.94	8.43E-37	1.58E-34
PRU004700	ALDH18A1	-4240.73	-4320.26	1.82E-36	3.30E-34
PRU004116	CGRRF1	-1966.2	-2044.77	4.73E-36	8.34E-34
PRU009409	GTF2E2	-1628.88	-1707.03	7.30E-36	1.25E-33
PRU005802	TRIP4	-3335.21	-3413.11	9.37E-36	1.55E-33
PRU003488	KPNA6	-3040.6	-3118.48	9.55E-36	1.55E-33
PRU008210	RIPK1	-4672.68	-4749.65	2.38E-35	3.65E-33
PRU002437	MCM3	-4648.58	-4725.58	2.33E-35	3.65E-33
PRU003556	SLC4A9	-4770.31	-4846.38	5.91E-35	8.86E-33
PRU004917	POFUT2	-2342.75	-2418.63	7.16E-35	1.05E-32
PRU007482	NOL11	-3899.96	-3975.51	9.91E-35	1.41E-32
PRU005677	IQCH	-3572.78	-3648.18	1.16E-34	1.61E-32
PRU001236	SPTAN1	-12111.4	-12185.9	2.82E-34	3.84E-32
PRU000334	RIMBP2	-9008.84	-9082.8	4.98E-34	6.63E-32
PRU004440	INPP5D	-6100.53	-6174.2	6.67E-34	8.70E-32
PRU006158	CRISPLD2	-3237.13	-3309.62	2.15E-33	2.75E-31
PRU011701	ARMC4	-3019.47	-3091.25	4.44E-33	5.54E-31
PRU003708	SLC39A8	-2309.53	-2379.6	2.48E-32	3.04E-30
PRU013258	CDK5RAP1	-2594.45	-2663.89	4.67E-32	5.60E-30
PRU001619	SVIL	-9443.35	-9511.88	1.17E-31	1.38E-29
PRU013109	GRIK4	-1991.75	-2060.23	1.23E-31	1.41E-29
PRU012239	PRRC2C	-13390.2	-13458.6	1.37E-31	1.55E-29
PRU012126	COL14A1	-7076.94	-7145.17	1.59E-31	1.77E-29
PRU002346	MYT1	-4975.59	-5043.15	3.08E-31	3.36E-29
PRU005625	CDK15	-2191.83	-2257.98	1.28E-30	1.37E-28
PRU002435		-1992.53	-2057.94	2.69E-30	2.83E-28
PRU014983	EDIL3	-2094.56	-2159.72	3.49E-30	3.61E-28
PRU007795	CASP9	-2684.49	-2748.25	1.43E-29	1.46E-27
PRU000015	THOC5	-4234.25	-4297.48	2.44E-29	2.44E-27
PRU005546	IFIH1	-5185.66	-5248.8	2.67E-29	2.62E-27
PRU014010	TRIM2	-3967.01	-4029.97	3.20E-29	3.09E-27

PRU003748	*POLR3F*	-1581.81	-1644.39	4.67E-29	4.44E-27
PRU010920	*RPSA*	-1644.5	-1706.99	5.15E-29	4.82E-27
PRU014698	*FAM13A*	-4559.56	-4621.34	1.05E-28	9.66E-27
PRU006536	*ENPP1*	-2396.92	-2458.69	1.07E-28	9.69E-27
PRU011154	*RSPRY1*	-2819.03	-2880.53	1.39E-28	1.24E-26
PRU004387		-4972.57	-5033.44	2.64E-28	2.33E-26
PRU000066	*CHEK2*	-3123.95	-3184.54	3.51E-28	3.05E-26
PRU003061	*SLC6A13*	-3134.73	-3195.1	4.35E-28	3.67E-26
PRU007598	*HPS5*	-2881.13	-2941.5	4.32E-28	3.67E-26
PRU012477	*FAM35A*	-3257.68	-3317.75	5.92E-28	4.93E-26
PRU009483	*ENTPD6*	-2186.59	-2246.04	1.10E-27	9.03E-26
PRU003282	*DDX20*	-4098.96	-4158.26	1.29E-27	1.04E-25
PRU000487	*CBL*	-4480.71	-4539.74	1.69E-27	1.35E-25
PRU007375	*CFAP61*	-7604.65	-7662.62	4.89E-27	3.86E-25
PRU001362	*ECT2*	-4956.09	-5013.18	1.19E-26	9.29E-25
PRU008441	*TERF2*	-2455.8	-2510.85	9.35E-26	7.19E-24
PRU000329	*KNTC1*	-12471.5	-12526.2	1.27E-25	9.66E-24
PRU008182	*AGFG1*	-2515.51	-2569.73	2.15E-25	1.61E-23
PRU010456	*PON2*	-1947.03	-2001.16	2.36E-25	1.74E-23
PRU010779	*HOOK1*	-2301.09	-2355.19	2.41E-25	1.76E-23
PRU001603	*ACVR2B*	-2066.73	-2120.13	4.93E-25	3.56E-23
PRU009696	*ABHD12*	-1723.48	-1776.59	6.55E-25	4.67E-23
PRU007181	*SCPEP1*	-1983.95	-2036.72	9.23E-25	6.51E-23
PRU014321	*NEB*	-19291.9	-19344.1	1.74E-24	1.21E-22
PRU006673	*PABPC1*	-2635.72	-2687.79	1.90E-24	1.31E-22
PRU012690	*C5H14orf79*	-2272.01	-2324	2.04E-24	1.39E-22
PRU009297	*CSTF2*	-3124.42	-3175.95	3.24E-24	2.18E-22
PRU005332	*NEURL1*	-1836.49	-1887.86	3.85E-24	2.56E-22
PRU012903	*PPP1R12A*	-4162.33	-4213.65	4.05E-24	2.65E-22
PRU004175	*FUT10*	-2753.9	-2805.21	4.06E-24	2.65E-22
PRU012520	*DDX19A*	-2244.05	-2294.97	6.02E-24	3.88E-22
PRU000282	*IQCD*	-2378.38	-2428.45	1.41E-23	9.00E-22
PRU011583	*LTN1*	-5782.56	-5832.5	1.61E-23	1.02E-21
PRU002165	*RALGAPA2*	-10241.5	-10290.8	3.11E-23	1.94E-21
PRU009259	*TBCE*	-2840.41	-2888.03	1.67E-22	1.03E-20
PRU003804	*DOPEY2*	-10894.2	-10941.8	1.74E-22	1.06E-20
PRU008552	*MRPL1*	-1721.48	-1768.95	1.96E-22	1.18E-20
PRU014347	*LRBA*	-8267.12	-8313.83	4.21E-22	2.52E-20
PRU006178	*ANKRD27*	-5378.78	-5425.42	4.53E-22	2.69E-20
PRU005720	*GNB5*	-2211.53	-2257.75	6.91E-22	4.06E-20
PRU013531	*ST7*	-2668.97	-2715.04	8.08E-22	4.70E-20
PRU006038	*ITGA11*	-3838.87	-3884.52	1.24E-21	7.07E-20
PRU003652	*GNPTAB*	-6511.27	-6556.92	1.24E-21	7.07E-20
PRU012475	*ASAH2*	-4162.77	-4208.28	1.42E-21	8.03E-20
PRU011802	*SMAD5*	-2322.28	-2367.43	2.05E-21	1.15E-19
PRU004262		-945.447	-990.491	2.28E-21	1.26E-19
PRU003536	*MAP4K5*	-2783.42	-2828.29	2.69E-21	1.48E-19
PRU011303	*TEC*	-3503.21	-3548.06	2.77E-21	1.51E-19

PRU008849	*SLC35D2*	-1306.39	-1350.77	4.45E-21	2.40E-19
PRU001903	*EPB41*	-4181.82	-4226.17	4.62E-21	2.47E-19
PRU005741	*TRPM3*	-7733.36	-7777.47	5.89E-21	3.12E-19
PRU007518	*ASB11*	-2102.97	-2146.98	6.48E-21	3.40E-19
PRU000113	*ADGRD1*	-4194.58	-4238.31	8.54E-21	4.45E-19
PRU009446	*CAST*	-2713.07	-2756.46	1.21E-20	6.27E-19
PRU005730	*PRTG*	-5560.39	-5603.66	1.37E-20	7.02E-19
PRU008289	*PIGN*	-5315.97	-5358.93	1.87E-20	9.50E-19
PRU007719	*ADGRF5*	-7010.32	-7053.23	1.97E-20	9.83E-19
PRU012334	*DYNC2H1*	-16947.9	-16990.9	1.96E-20	9.83E-19
PRU008466	*CSPP1*	-5466.39	-5509.1	2.41E-20	1.19E-18
PRU012014	*EYA3*	-2152.54	-2195.23	2.48E-20	1.21E-18
PRU005927	*SGSM2*	-5656.35	-5699.03	2.48E-20	1.21E-18
PRU014121	*CPTP*	-1186.51	-1229.03	2.93E-20	1.42E-18
PRU011917	*TBCK*	-2516.08	-2558.47	3.35E-20	1.60E-18
PRU001130	*CWH43*	-2264.41	-2306.37	5.12E-20	2.44E-18
PRU003060		-2852.1	-2893.25	1.17E-19	5.51E-18
PRU009028	*TJP2*	-6074.39	-6115.49	1.23E-19	5.75E-18
PRU001616	*KLF6*	-1375.19	-1415.72	2.19E-19	1.02E-17
PRU013613	*ACE*	-6992.22	-7032.74	2.22E-19	1.02E-17
PRU008227	*RNF144B*	-1836.74	-1877.08	2.66E-19	1.22E-17
PRU008482	*DTNA*	-3202.75	-3242.63	4.22E-19	1.92E-17
PRU012940	*CA2*	-910.479	-950.32	4.40E-19	1.98E-17
PRU013079	*SNX19*	-3662.44	-3701.96	6.10E-19	2.73E-17
PRU011706	*ARHGAP21*	-9381.37	-9420.2	1.22E-18	5.40E-17
PRU010966	*AKAP9*	-8776.79	-8815.09	2.10E-18	9.26E-17
PRU010538	*OSBPL10*	-3545.34	-3582.84	4.71E-18	2.06E-16
PRU008113	*CALB1*	-991.815	-1028.38	1.22E-17	5.28E-16
PRU006642		-563.168	-598.89	2.85E-17	1.23E-15
PRU002757	*FRMPD4*	-5866.27	-5901.87	3.22E-17	1.38E-15
PRU007323	*SLX4IP*	-2230.94	-2265.93	5.97E-17	2.54E-15
PRU002856	*SLC22A16*	-2711.32	-2745.71	1.10E-16	4.65E-15
PRU005372	*GAB3*	-1817.82	-1852.17	1.14E-16	4.78E-15
PRU006440	*MMGT1*	-874.484	-908.572	1.50E-16	6.22E-15
PRU002078	*C5H14orf159*	-1781.12	-1815.01	1.82E-16	7.53E-15
PRU008573	*PDXK*	-1328.99	-1362.63	2.37E-16	9.74E-15
PRU002507	*EYA2*	-2930.34	-2963.94	2.46E-16	1.00E-14
PRU000521	*CNTN3*	-4181.14	-4214.67	2.63E-16	1.06E-14
PRU008163	*ARNT*	-3373.47	-3406.53	4.25E-16	1.71E-14
PRU000873	*NDC1*	-2632.74	-2665.63	5.05E-16	2.02E-14
PRU014116	*PLCH2*	-4259.23	-4291.74	7.45E-16	2.96E-14
PRU001622	*YME1L1*	-2663.6	-2696.07	7.78E-16	3.07E-14
PRU001872	*PSMB2*	-816.902	-849.358	7.83E-16	3.07E-14
PRU001426	*ADAM19*	-4101.39	-4133.78	8.38E-16	3.26E-14
PRU003686	*SLC4A4*	-5004.58	-5036.94	8.63E-16	3.34E-14
PRU004263	*PTH1R*	-1992.32	-2024.64	8.94E-16	3.44E-14
PRU005617	*CCDC93*	-3381.04	-3413.18	1.08E-15	4.11E-14
PRU006849	*GALNT16*	-2322.14	-2354.19	1.18E-15	4.48E-14

PRU004474	*FADS2*	-2533.75	-2565.3	1.96E-15	7.37E-14
PRU014763	*ZDHHC13*	-1376.94	-1408.26	2.49E-15	9.33E-14
PRU004313	*NFYA*	-1356.17	-1387.44	2.63E-15	9.77E-14
PRU011505	*UPK1B*	-1869.86	-1901	2.98E-15	1.10E-13
PRU011472	*KPNA4*	-2746.92	-2777.55	5.00E-15	1.84E-13
PRU008123	*CERS2*	-1299.99	-1330.52	5.52E-15	2.02E-13
PRU012941		-1067.77	-1097	2.07E-14	7.52E-13
PRU011641	*CBLB*	-5296.25	-5325.1	3.06E-14	1.10E-12
PRU008831	*FANCM*	-2780.41	-2808.96	4.15E-14	1.49E-12
PRU005735	*ADAM10*	-3057.48	-3085.42	7.72E-14	2.75E-12
PRU014030	*DOCK9*	-10084.6	-10112.5	8.09E-14	2.87E-12
PRU005297	*MYH11*	-9940.97	-9968.64	1.02E-13	3.60E-12
PRU008205		-3340.76	-3368.35	1.11E-13	3.87E-12
PRU004587	*SCAP*	-5996.7	-6024.21	1.19E-13	4.16E-12
PRU002577	*DSC1*	-2707.23	-2734.73	1.20E-13	4.16E-12
PRU006077	*USP10*	-3048.9	-3076.03	1.76E-13	6.01E-12
PRU004372	*PSCA*	-819.822	-846.956	1.75E-13	6.01E-12
PRU009264	*AICDA*	-1116.4	-1143.36	2.09E-13	7.12E-12
PRU002689	*SCGN*	-1590.95	-1617.76	2.43E-13	8.23E-12
PRU005175	*SMURF1*	-3357.21	-3383.9	2.77E-13	9.33E-12
PRU006107	*EXOC3L1*	-3751.29	-3777.89	3.03E-13	1.01E-11
PRU012712	*RBM27*	-3681.92	-3708.41	3.38E-13	1.12E-11
PRU006511	*DLG3*	-3858.14	-3884.53	3.74E-13	1.24E-11
PRU004826	*FGFR1OP*	-1227.13	-1253.16	5.39E-13	1.78E-11
PRU006425	*CHMP1B*	-866.751	-892.767	5.46E-13	1.79E-11
PRU004250	*TARBP1*	-3276.27	-3302.1	6.65E-13	2.17E-11
PRU007617		-2238.95	-2264.76	6.76E-13	2.19E-11
PRU003218	*NFAT5*	-7642.22	-7667.75	8.91E-13	2.87E-11
PRU008988	*TET2*	-7566.45	-7591.97	9.06E-13	2.90E-11
PRU003430		-1894.7	-1920.18	9.49E-13	3.03E-11
PRU010282	*SSFA2*	-5949.16	-5974.44	1.15E-12	3.65E-11
PRU013265	*BPIFB2*	-2726.92	-2751.66	2.01E-12	6.33E-11
PRU007689	*BRF1*	-2127.77	-2152.36	2.34E-12	7.34E-11
PRU009884	*GON4L*	-8120.77	-8144.68	4.69E-12	1.46E-10
PRU011912	*UBN2*	-5869.63	-5893.49	4.95E-12	1.54E-10
PRU003617	*IL10RA*	-4156.42	-4180.05	6.18E-12	1.91E-10
PRU011586	*TTF2*	-5642.15	-5665.71	6.71E-12	2.06E-10
PRU014657	*PCID2*	-2105.05	-2128.43	8.03E-12	2.45E-10
PRU008524	*WBSCR17*	-1895.98	-1919.35	8.11E-12	2.47E-10
PRU009058	*RBM26*	-3752.9	-3776.06	1.01E-11	3.05E-10
PRU006699	*FST*	-2325.23	-2348.24	1.17E-11	3.52E-10
PRU014246	*ABCG2*	-3187.82	-3210.3	2.00E-11	5.99E-10
PRU003813		-3779.51	-3801.92	2.15E-11	6.40E-10
PRU010991	*NEK11*	-3509.18	-3531.43	2.55E-11	7.55E-10
PRU009839	*TRPM8*	-3226.04	-3248.18	2.83E-11	8.36E-10
PRU011627	*C1R*	-4344.62	-4366.61	3.32E-11	9.75E-10
PRU014298		-3214.62	-3236.18	5.16E-11	1.51E-09
PRU001117	*WDR19*	-6159.58	-6181.03	5.81E-11	1.69E-09

PRU001500	*CENPC*	-4249.85	-4271.19	6.44E-11	1.87E-09
PRU008082	*IMPA1*	-1286.6	-1307.78	7.60E-11	2.19E-09
PRU002953		-1215.15	-1236.31	7.77E-11	2.23E-09
PRU007378	*TASP1*	-2444.05	-2464.68	1.34E-10	3.82E-09
PRU006741	*ZDHHC12*	-825.726	-845.758	2.46E-10	6.98E-09
PRU000935	*JAK1*	-6363.73	-6383.62	2.83E-10	8.01E-09
PRU000161	*FOXN4*	-2744.68	-2764.18	4.25E-10	1.20E-08
PRU002791	*PPEF2*	-3168.94	-3188.41	4.34E-10	1.22E-08
PRU013485	*TMEM14A*	-721.716	-740.913	5.78E-10	1.61E-08
PRU002657	*TP73*	-3114.29	-3133.43	6.14E-10	1.70E-08
PRU002952	*ARSD*	-3872.25	-3891.09	8.36E-10	2.31E-08
PRU004414	*CZH5orf34*	-4013.41	-4031.91	1.17E-09	3.23E-08
PRU005657	*TMBIM1*	-2256.14	-2274.53	1.32E-09	3.62E-08
PRU012724	*PPARGC1B*	-5934.82	-5953.05	1.55E-09	4.23E-08
PRU007599	*PHRF1*	-7991.3	-8009	2.67E-09	7.24E-08
PRU013509	*MYO6*	-6318.02	-6335.69	2.77E-09	7.49E-08
PRU001335	*ECEL1*	-2890.34	-2907.81	3.41E-09	9.16E-08
PRU012000	*AADAT*	-1182.7	-1199.98	4.14E-09	1.11E-07
PRU010147	*NPNT*	-2131.09	-2148.3	4.40E-09	1.17E-07
PRU012787		-5127.36	-5144.57	4.43E-09	1.18E-07
PRU010197		-3220.88	-3237.98	4.96E-09	1.31E-07
PRU010219	*ITGB5*	-3949.71	-3966.76	5.23E-09	1.37E-07
PRU012051	*DNALI1*	-767.713	-784.656	5.84E-09	1.53E-07
PRU009305	*B3GNTL1*	-786.634	-803.514	6.23E-09	1.62E-07
PRU013472	*NSUN3*	-1931.4	-1948.28	6.23E-09	1.62E-07
PRU006234	*YIPF4*	-883.647	-900.35	7.48E-09	1.93E-07
PRU002892	*MDM2*	-1403.06	-1419.57	9.09E-09	2.34E-07
PRU000380	*DCLRE1A*	-5788.84	-5805.12	1.16E-08	2.97E-07
PRU003826	*GRHL1*	-3628.67	-3644.87	1.26E-08	3.21E-07
PRU011752	*P4HA2*	-2553.57	-2569.71	1.34E-08	3.40E-07
PRU009866	*ITPR2*	-7661	-7676.84	1.82E-08	4.61E-07
PRU001489		-609.419	-625.182	1.97E-08	4.96E-07
PRU000784	*C12H3orf18*	-1109.85	-1125.37	2.55E-08	6.39E-07
PRU008985	*GSTCD*	-3354.27	-3369.73	2.69E-08	6.73E-07
PRU012073	*MIER3*	-1005.57	-1020.74	3.60E-08	8.95E-07
PRU004093	*PHYH*	-2018.05	-2032.9	5.06E-08	1.25E-06
PRU008119	*RMDN1*	-1466.99	-1481.69	5.90E-08	1.45E-06
PRU005333	*PVRL1*	-766.25	-780.897	6.22E-08	1.53E-06
PRU009317	*OGFOD3*	-1497.08	-1511.41	8.68E-08	2.12E-06
PRU013881	*SYT10*	-2656.24	-2670.55	8.74E-08	2.13E-06
PRU001065	*ZFAND3*	-727.838	-742.003	1.02E-07	2.48E-06
PRU008948	*GPC6*	-1171.59	-1185.42	1.45E-07	3.50E-06
PRU000517	*RAD18*	-3071.17	-3084.9	1.60E-07	3.86E-06
PRU001399	*SKP1*	-736.359	-750.077	1.62E-07	3.89E-06
PRU008642	*DHDDS*	-1135.51	-1149.18	1.70E-07	4.06E-06
PRU013422		-1269.87	-1283.37	2.04E-07	4.84E-06
PRU012653	*DYNC1H1*	-13581.7	-13595.1	2.18E-07	5.18E-06
PRU010288	*ICOS*	-1195.85	-1209.19	2.39E-07	5.63E-06

PRU009440	*FSD1L*	-2896.58	-2909.84	2.60E-07	6.11E-06
PRU002241	*RBP1*	-916.352	-929.411	3.21E-07	7.52E-06
PRU012001	*HDAC2*	-1646.94	-1659.95	3.38E-07	7.88E-06
PRU001484	*ING2*	-1125.3	-1137.98	4.74E-07	1.10E-05
PRU014282	*CAD*	-10099.1	-10111.6	5.64E-07	1.31E-05
PRU000398	*FAM178A*	-1223.18	-1235.63	6.01E-07	1.39E-05
PRU008845		-964.081	-976.482	6.35E-07	1.46E-05
PRU004005	*CTNNA3*	-2898.5	-2910.87	6.54E-07	1.50E-05
PRU014196	*PLAA*	-3492.5	-3504.72	7.64E-07	1.74E-05
PRU006925	*RFX4*	-2585.9	-2598.02	8.53E-07	1.94E-05
PRU007652	*SLC6A18*	-3172.51	-3184.4	1.08E-06	2.45E-05
PRU005219	*ERCC4*	-4386.65	-4398.49	1.13E-06	2.55E-05
PRU013673	*CDC73*	-2542.12	-2553.88	1.24E-06	2.79E-05
PRU014323	*STAM2*	-1923.34	-1935.02	1.34E-06	2.99E-05
PRU006837	*INO80*	-7575.62	-7587.27	1.39E-06	3.10E-05
PRU013635	*C8H1orf27*	-2549.07	-2560.51	1.73E-06	3.83E-05
PRU007930	*AEBP1*	-1881.01	-1892.43	1.77E-06	3.92E-05
PRU005400	*EXOSC1*	-1062.55	-1073.89	1.92E-06	4.23E-05
PRU006315	*DACH2*	-1936.02	-1947.35	1.93E-06	4.24E-05
PRU008398	*ZPR1*	-2659.58	-2670.9	1.94E-06	4.25E-05
PRU012856	*PSMB7*	-1016.17	-1027.42	2.08E-06	4.54E-05
PRU012964	*ZFHX4*	-16409.6	-16420.8	2.21E-06	4.80E-05
PRU011404		-1299.33	-1310.49	2.32E-06	5.01E-05
PRU011705	*PRTFDC1*	-865.416	-876.543	2.39E-06	5.15E-05
PRU012892	*IFNG*	-1340.39	-1351.44	2.60E-06	5.58E-05
PRU008465		-1005.25	-1016.2	2.89E-06	6.19E-05
PRU007353	*ACBD3*	-2101.16	-2111.92	3.48E-06	7.41E-05
PRU005496	*C24H11orf53*	-1767.59	-1778.19	4.10E-06	8.72E-05
PRU009736	*SRF*	-1191.44	-1201.95	4.55E-06	9.64E-05
PRU011611		-12013.9	-12024.3	4.79E-06	0.000101
PRU008092	*ARFGEF1*	-4690.12	-4700.49	5.26E-06	0.00011
PRU014426	*SLC2A3*	-2690.77	-2701.14	5.27E-06	0.00011
PRU013492	*MCPH1*	-854.218	-864.424	6.25E-06	0.00013
PRU004272	*HDAC7*	-2700.55	-2710.62	7.20E-06	0.00015
PRU001347	*CCDC50*	-1018.82	-1028.84	7.62E-06	0.000158
PRU012469	*RASGEF1A*	-2224.91	-2234.9	7.80E-06	0.000161
PRU012221	*METTL13*	-3262.99	-3272.95	8.04E-06	0.000166
PRU002599	*CEP192*	-6586.51	-6596.3	9.67E-06	0.000198
PRU011289	*UGDH*	-2879.06	-2888.81	1.00E-05	0.000205
PRU013486	*CD109*	-6093.88	-6103.58	1.06E-05	0.000216
PRU012665	*ZFYVE21*	-1021.63	-1031.31	1.08E-05	0.00022
PRU007865	*CDON*	-2717.98	-2727.63	1.11E-05	0.000225
PRU006660	*TAF2*	-4228.88	-4238.51	1.14E-05	0.00023
PRU000336	*POLE*	-11032.1	-11041.7	1.23E-05	0.000247
PRU001210	*ANAPC2*	-3913.2	-3922.69	1.32E-05	0.000265
PRU003362	*NRCAM*	-5430.43	-5439.9	1.34E-05	0.000268
PRU002154	*XPO1*	-5319.55	-5328.7	1.88E-05	0.000375
PRU003137	*KIF21A*	-7226.7	-7235.66	2.28E-05	0.000453

PRU005681	*CLPX*	-3009.06	-3018	2.33E-05	0.000461
PRU001770	*SLC2A12*	-2924.22	-2933.02	2.73E-05	0.000538
PRU000590	*GNL3*	-2966.93	-2975.67	2.89E-05	0.000568
PRU000519	*SUMF1*	-1376.08	-1384.68	3.34E-05	0.000654
PRU013821	*DCAF6*	-3909.9	-3918.48	3.46E-05	0.000676
PRU003158	*TBC1D22A*	-2513.89	-2522.44	3.53E-05	0.000687
PRU008357	*PKP3*	-2380.5	-2389.02	3.67E-05	0.000713
PRU006705	*PIK3R1*	-3885.05	-3893.55	3.71E-05	0.000716
PRU013268	*TPD52L2*	-1491.73	-1500.15	4.05E-05	0.000781
PRU009066	*RBPMS*	-1227.64	-1236.01	4.31E-05	0.000827
PRU009624	*DHX30*	-2285.82	-2294.08	4.84E-05	0.000926
PRU011569	*ZPLD1*	-2537.87	-2546.04	5.32E-05	0.001015
PRU000300	*DHX37*	-6860.62	-6868.69	5.87E-05	0.001116
PRU001741	*PEX16*	-553.911	-561.543	9.35E-05	0.001768
PRU008610	*ICOSLG*	-2045.4	-2053.03	9.33E-05	0.001768
PRU011962	*VPS37A*	-1732.16	-1739.73	9.99E-05	0.001883
PRU005289	*HBAD*	-833.744	-841.282	0.000103	0.001941
PRU007754	*SUPT3H*	-1756.37	-1763.82	0.000113	0.002122
PRU001361	*LEKR1*	-1632.93	-1640.12	0.000149	0.002789
PRU007085	*ATXN3*	-1687.46	-1694.55	0.000167	0.003115
PRU007664	*BEGAIN*	-2893.67	-2900.63	0.000191	0.003552
PRU004002	*PBLD*	-1889.86	-1896.79	0.000197	0.003639
PRU003333	*FAM105A*	-1391.17	-1397.98	0.000225	0.004142
PRU009644	*ANKFY1*	-5878.18	-5884.9	0.000245	0.004512
PRU010954	*TAX1BP1*	-4175.55	-4182.22	0.00026	0.004769
PRU006561	*TAGAP*	-3117.78	-3124.39	0.000276	0.005043
PRU005575	*CERKL*	-1774.66	-1781.1	0.000334	0.006078
PRU011755	*SEC24A*	-5144.74	-5151.11	0.00036	0.006545
PRU012043	*PEF1*	-1004.38	-1010.65	0.000401	0.007253
PRU002974	*DHRSX*	-1601.99	-1608.13	0.00046	0.008305
PRU003777	*PPP6R2*	-3432.63	-3438.69	0.000502	0.009037
PRU000441	*FAM21C*	-4885.02	-4891.06	0.000514	0.009219
PRU006613	*FABP7*	-649.183	-655.055	0.00061	0.010912
PRU006133	*ORC6*	-1298.54	-1304.37	0.000641	0.011434
PRU013924	*FYB*	-617.954	-623.701	0.000698	0.012416
PRU008943	*NAALAD2*	-4238.74	-4244.19	0.000956	0.016951
PRU009087	*CDC123*	-1592.47	-1597.92	0.00096	0.016964
PRU009225	*MYO1B*	-4820.48	-4825.89	0.000995	0.017535
PRU013872		-1414.53	-1419.94	0.001009	0.017739
PRU001182	*FAM114A1*	-3035.45	-3040.85	0.00102	0.017879
PRU009102	*SLC44A1*	-2308.02	-2313.39	0.001046	0.018268
PRU005679	*RAB11A*	-378.853	-384.212	0.001061	0.018492
PRU009512	*BRIX1*	-1615.56	-1620.91	0.001081	0.018772
PRU005634	*MGAT5*	-3489.23	-3494.49	0.00118	0.020431
PRU011498	*BOC*	-2326.35	-2331.54	0.001274	0.021996
PRU012905	*LIN7A*	-1209.2	-1214.36	0.001319	0.022712
PRU010861	*CDK14*	-775.713	-780.715	0.001561	0.026802
PRU010343	*PGAP1*	-4895.63	-4900.56	0.00168	0.028766

PRU007123		-2157.5	-2162.42	0.001703	0.029076
PRU008083	*FABP4*	-1021.6	-1026.48	0.001791	0.030501
PRU011257	*NELFA*	-1941.07	-1945.68	0.002395	0.040667
PRU003168	*HGF*	-3231.56	-3236.05	0.002716	0.045974
PRU005742	*GTF2A2*	-597.772	-602.232	0.002822	0.047642
Taczan					
OTA005370	*RYR3*	-19106.8	-19254	5.61E-66	3.36E-62
OTA013539	*ASH1L*	-17114.9	-17252.6	7.52E-62	2.25E-58
OTA005581	*RPAP1*	-7805.98	-7936.33	1.21E-58	2.42E-55
OTA008817	*TBC1D30*	-3999.44	-4126.74	2.59E-57	3.88E-54
OTA014701	*ZFYVE16*	-4269.06	-4394.02	2.69E-56	3.23E-53
OTA011062	*MYH11*	-9843.07	-9963.33	3.03E-54	2.59E-51
OTA003674	*SPATA13*	-3591.88	-3712.17	2.95E-54	2.59E-51
OTA010855	*ACADSB*	-2772.7	-2892.36	5.54E-54	4.15E-51
OTA001050	*ELMO2*	-3877.31	-3987.16	1.05E-49	7.02E-47
OTA008058		-3977	-4077.74	9.95E-46	5.96E-43
OTA006342	*AGL*	-8284.05	-8383.98	2.24E-45	1.22E-42
OTA014267	*DST*	-20684	-20778.3	6.52E-43	3.26E-40
OTA013757	*ELF1*	-2956.26	-3043.18	1.07E-39	4.91E-37
OTA006672	*CCDC93*	-3321.11	-3407.85	1.29E-39	5.51E-37
OTA009332	*PYGL*	-3484.05	-3570.67	1.46E-39	5.85E-37
OTA005448	*TRIP11*	-10466.6	-10551.6	7.30E-39	2.74E-36
OTA001158	*PDK4*	-2154.26	-2238.59	1.45E-38	5.10E-36
OTA005813	*AFAP1*	-4614.18	-4698.45	1.54E-38	5.12E-36
OTA011736	*UBE2J2*	-1797.32	-1880.59	4.24E-38	1.34E-35
OTA006615	*DFNB31*	-4223.23	-4306.02	6.86E-38	2.06E-35
OTA009067	*RNGTT*	-2615.86	-2697.55	2.07E-37	5.91E-35
OTA006340	*JAK1*	-6289.86	-6371.3	2.65E-37	7.23E-35
OTA002844		-3857.94	-3938.79	4.81E-37	1.25E-34
OTA001655	*MCCC1*	-3605.04	-3684.63	1.72E-36	4.29E-34
OTA012297	*PIK3C2G*	-6805.52	-6884.26	3.99E-36	9.57E-34
OTA007192	*TANC2*	-6599.52	-6676.74	1.86E-35	4.30E-33
OTA009904	*IFNAR1*	-3292.33	-3367.13	2.12E-34	4.70E-32
OTA008725	*CELSR1*	-14603.5	-14678.2	2.35E-34	5.02E-32
OTA006899	*SPATS2L*	-2907.74	-2982.27	2.79E-34	5.76E-32
OTA011559	*NIPAL4*	-2187.16	-2261.48	3.44E-34	6.86E-32
OTA000308	*TBC1D9B*	-5567.15	-5636.79	3.83E-32	7.40E-30
OTA008987	*PKHD1*	-8755.86	-8825.4	4.21E-32	7.88E-30
OTA005562	*SYT13*	-2376.1	-2445.51	4.82E-32	8.75E-30
OTA012165	*GIT2*	-3517.37	-3586.15	9.02E-32	1.59E-29
OTA009196		-2291.95	-2360.53	1.11E-31	1.89E-29
OTA005869	*EVC2*	-7233.72	-7301.62	2.19E-31	3.65E-29
OTA002059	*ARID1B*	-7398.21	-7464.97	6.95E-31	1.13E-28
OTA010963	*SYT17*	-2604.55	-2671.27	7.28E-31	1.15E-28
OTA011470	*CHL1*	-7017.71	-7084.34	7.88E-31	1.21E-28
OTA002101	*TAGAP*	-3057.55	-3123.66	1.35E-30	2.02E-28
OTA009588	*ABCC9*	-8338.44	-8404.11	2.08E-30	3.05E-28
OTA002511	*RFX4*	-2525.97	-2591.1	3.59E-30	5.12E-28

OTA007365	UBA6	-4766.98	-4831.32	7.93E-30	1.11E-27
OTA009482	C5H11orf24	-1728.59	-1792.87	8.47E-30	1.15E-27
OTA013485	RLIM	-3191.62	-3255.87	8.78E-30	1.17E-27
OTA002487	SGSM3	-3834.42	-3898.16	1.46E-29	1.90E-27
OTA007213	KLHL11	-2770.22	-2832.15	8.98E-29	1.15E-26
OTA005586	EIF2AK4	-8352.31	-8414.04	1.10E-28	1.37E-26
OTA009838	DDX58	-4047.65	-4109.03	1.57E-28	1.92E-26
OTA011848	CCDC40	-4767.81	-4829.01	1.88E-28	2.25E-26
OTA008965	SF3A2	-1882.23	-1943.24	2.28E-28	2.67E-26
OTA001243	SMARCC1	-5216.77	-5277.33	3.58E-28	4.12E-26
OTA009686		-4971.54	-5031.28	8.27E-28	9.36E-26
OTA009734	CDH6	-3878.55	-3938.25	8.57E-28	9.51E-26
OTA009767	BRD9	-2970.34	-3029.51	1.46E-27	1.59E-25
OTA001152	MTPAP	-2466.32	-2525.42	1.57E-27	1.68E-25
OTA008982	BLK	-2332.82	-2391.73	1.90E-27	1.96E-25
OTA001185	GAD2	-2437.23	-2496.15	1.89E-27	1.96E-25
OTA004676	PHF2	-5606.18	-5665.03	2.01E-27	2.04E-25
OTA005913	PPP2R2C	-2060.4	-2118.59	3.92E-27	3.92E-25
OTA010740	MFGE8	-1801.5	-1859.35	5.52E-27	5.42E-25
OTA007291	EIF3I	-1879.19	-1936.97	5.93E-27	5.73E-25
OTA001637	ANKRD44	-4800.27	-4857.03	1.66E-26	1.58E-24
OTA007711	PAPSS2	-3617.37	-3673.99	1.91E-26	1.78E-24
OTA007975		-4500.59	-4555.51	1.06E-25	9.74E-24
OTA007650	PHACTR2	-2461.3	-2516.03	1.29E-25	1.17E-23
OTA003518	MYO10	-8931.07	-8985.48	1.77E-25	1.58E-23
OTA009180	TTL	-1834.11	-1888.27	2.28E-25	2.01E-23
OTA001843	SAMD11	-2046.02	-2100.11	2.45E-25	2.13E-23
OTA009642	RAI14	-3949.04	-4002.36	5.33E-25	4.57E-23
OTA015067	DNAJC25	-1427.64	-1478.32	7.66E-24	6.47E-22
OTA006362	IPO13	-4448.29	-4498.82	8.90E-24	7.41E-22
OTA008499	NRIP3	-1559.4	-1609.43	1.48E-23	1.22E-21
OTA010021	PLCB2	-4150.7	-4200.66	1.59E-23	1.28E-21
OTA005593	FAM20C	-1570.53	-1619.78	3.25E-23	2.59E-21
OTA002221	CSDE1	-3409.01	-3457.56	6.57E-23	5.18E-21
OTA006363	PIGK	-2130.36	-2178.78	7.52E-23	5.85E-21
OTA014009	RIPK1	-4701.3	-4749.65	7.99E-23	6.14E-21
OTA003052	NECAP1	-1397.89	-1446.09	9.36E-23	7.10E-21
OTA007847	CMTR1	-1990.22	-2038.37	9.95E-23	7.46E-21
OTA007185	CDC27	-4113.23	-4161.1	1.32E-22	9.77E-21
OTA008048	PRRC2C	-13410.9	-13458.6	1.55E-22	1.13E-20
OTA001605	EEF1B2	-1350.31	-1397.63	2.27E-22	1.64E-20
OTA002365	POLE	-10989.6	-11036.4	3.79E-22	2.71E-20
OTA006486	AKR1A1	-1704.6	-1751.4	3.87E-22	2.73E-20
OTA005916	FGFR3	-3931.69	-3978.45	4.02E-22	2.80E-20
OTA013182	HNRNPD	-1407	-1452.3	1.76E-21	1.21E-19
OTA014153	RIMS1	-3642.78	-3688.04	1.83E-21	1.24E-19
OTA002986	ABHD5	-1696.05	-1741.09	2.28E-21	1.54E-19
OTA014738		-1716.08	-1760.86	2.97E-21	1.98E-19

OTA011646	*PDLIM7*	-2175.67	-2220.19	3.88E-21	2.56E-19
OTA009201	*ARAP1*	-5440.26	-5484.31	6.22E-21	4.05E-19
OTA007341	*MYOM3*	-8378.18	-8421.78	9.77E-21	6.29E-19
OTA008729	*BRD1*	-6282.1	-6325.57	1.12E-20	7.13E-19
OTA014832		-1763.27	-1806.47	1.47E-20	9.29E-19
OTA008809	*DDX49*	-1462.99	-1506.01	1.76E-20	1.10E-18
OTA003636	*NAV3*	-12187.8	-12230.8	1.84E-20	1.14E-18
OTA003924	*PAN3*	-3645.47	-3688.29	2.16E-20	1.32E-18
OTA006058	*RAB7A*	-1216.03	-1258.65	2.63E-20	1.59E-18
OTA006364		-8491.71	-8534.29	2.74E-20	1.64E-18
OTA012694	*HGD*	-2381.26	-2423.32	4.64E-20	2.75E-18
OTA013901		-1133.11	-1175.08	5.12E-20	3.01E-18
OTA006669		-2308.94	-2350.75	6.02E-20	3.50E-18
OTA010188	*GATAD2A*	-4302.2	-4343.88	6.84E-20	3.94E-18
OTA006849	*GLS*	-2172.58	-2214.19	7.36E-20	4.20E-18
OTA001631	*HECW2*	-9080.34	-9121.73	9.19E-20	5.19E-18
OTA014859		-1506.47	-1547.8	9.67E-20	5.42E-18
OTA003431	*TBC1D20*	-2187.2	-2228.26	1.28E-19	7.10E-18
OTA002513	*TNRC6B*	-5734.34	-5775.21	1.56E-19	8.57E-18
OTA004163	*HK1*	-5297.58	-5337.95	2.56E-19	1.40E-17
OTA006354		-3664.67	-3704.9	2.97E-19	1.60E-17
OTA011766	*CEP104*	-5579.14	-5619.15	3.70E-19	1.98E-17
OTA012213	*TBX1*	-946.721	-986.142	6.73E-19	3.57E-17
OTA008161		-1691.73	-1731.09	7.15E-19	3.76E-17
OTA011754	*PIK3CD*	-5460.86	-5499.6	1.34E-18	6.97E-17
OTA002452	*USP54*	-5680.19	-5718.79	1.56E-18	8.06E-17
OTA000941	*MMADHC*	-2050.87	-2089.22	1.98E-18	1.01E-16
OTA004521		-3025.18	-3063.44	2.16E-18	1.10E-16
OTA014444	*SSRP1*	-3909.69	-3947.44	3.65E-18	1.84E-16
OTA014706	*TRPM3*	-7668.52	-7706.22	3.83E-18	1.91E-16
OTA003585	*SERTAD4*	-1531.13	-1568.81	3.94E-18	1.95E-16
OTA012654	*STYXL1*	-2125.47	-2162.71	6.10E-18	2.99E-16
OTA008522	*OTOG*	-8415.77	-8452.93	6.67E-18	3.25E-16
OTA008929	*LRRFIP1*	-2147.55	-2184.52	8.09E-18	3.91E-16
OTA015205	*KMO*	-2392.11	-2428.87	9.92E-18	4.76E-16
OTA004618	*DISP2*	-6841.55	-6878.06	1.28E-17	6.10E-16
OTA003082	*NOX4*	-2921.4	-2957.89	1.31E-17	6.20E-16
OTA013635	*MAGI3*	-4695.03	-4731.06	2.09E-17	9.81E-16
OTA008966	*ANKRD66*	-930.465	-966.091	3.15E-17	1.46E-15
OTA007166	*CLDN16*	-1160.1	-1195.23	5.19E-17	2.39E-15
OTA003598	*PLB1*	-4114.56	-4149.67	5.31E-17	2.43E-15
OTA009133	*BBX*	-4670.17	-4705.15	6.07E-17	2.76E-15
OTA011460	*CACNA2D3*	-2001.28	-2035.91	8.68E-17	3.91E-15
OTA015269	*SLC30A10*	-2651.72	-2686.32	8.88E-17	3.97E-15
OTA000667	*RALGPS1*	-3258.43	-3292.79	1.13E-16	5.03E-15
OTA003668	*FLT1*	-3172.28	-3206.4	1.45E-16	6.38E-15
OTA009319	*POLE2*	-2408.65	-2442.66	1.62E-16	7.07E-15
OTA003327	*CCDC86*	-710.134	-744.068	1.75E-16	7.59E-15

OTA001523	*CSTF2*	-3141.11	-3174.65	2.62E-16	1.13E-14
OTA009614	*TMEM52B*	-918.498	-951.865	3.11E-16	1.33E-14
OTA006050	*BAP1*	-3566.89	-3599.83	4.79E-16	2.04E-14
OTA009758	*PHF14*	-2913.07	-2945.79	6.02E-16	2.54E-14
OTA000956	*MARCO*	-3520.7	-3553.4	6.13E-16	2.57E-14
OTA012755		-3820.55	-3853.09	7.18E-16	2.99E-14
OTA010037	*DCP2*	-1407.84	-1440.2	8.64E-16	3.57E-14
OTA010909	*ZRANB1*	-3720.54	-3752.19	1.77E-15	7.28E-14
OTA000637	*C17H9orf96*	-1597.4	-1629	1.86E-15	7.58E-14
OTA012583	*SUN2*	-3779.81	-3811.06	2.68E-15	1.08E-13
OTA006949	*CDK15*	-2226.85	-2257.98	2.99E-15	1.20E-13
OTA009096	*ASCC3*	-10099.6	-10130.6	3.52E-15	1.41E-13
OTA014756	*CRLF2*	-1133.45	-1164.4	3.60E-15	1.43E-13
OTA007801	*SRD5A2*	-855.703	-886.552	4.01E-15	1.58E-13
OTA007261	*ETV4*	-2295.42	-2326.24	4.12E-15	1.61E-13
OTA000640	*COL5A1*	-4360.25	-4391.03	4.32E-15	1.68E-13
OTA008334		-5111.3	-5142.04	4.51E-15	1.74E-13
OTA014232	*TRMT1L*	-2785.7	-2816.2	5.70E-15	2.19E-13
OTA002128	*GINM1*	-1443.07	-1473.42	6.63E-15	2.53E-13
OTA013662	*USP49*	-3810.14	-3840.27	8.31E-15	3.15E-13
OTA006415	*EXTL2*	-871.807	-901.819	9.37E-15	3.53E-13
OTA013080	*SIM2*	-2471.57	-2501.41	1.11E-14	4.17E-13
OTA004344	*MTFR2*	-1113.46	-1143.08	1.39E-14	5.17E-13
OTA008584		-2008.32	-2037.36	2.51E-14	9.28E-13
OTA015013	*SLC4A5*	-5034.67	-5063.34	3.68E-14	1.35E-12
OTA007821	*AGPAT4*	-1888.85	-1917.44	3.99E-14	1.46E-12
OTA000396	*TNIP1*	-2951.33	-2979.86	4.21E-14	1.53E-12
OTA009778	*CTDP1*	-4342.48	-4370.75	5.54E-14	2.00E-12
OTA002749	*TM4SF19*	-1360.4	-1388.57	6.15E-14	2.21E-12
OTA002305	*LZTR1*	-3968.73	-3996.4	1.01E-13	3.60E-12
OTA006536	*CCBL1*	-2273.24	-2300.83	1.10E-13	3.89E-12
OTA006268	*HYI*	-964.292	-991.722	1.29E-13	4.56E-12
OTA006432	*ANGPTL3*	-2749.31	-2776.69	1.36E-13	4.77E-12
OTA009224	*NR2E1*	-668.202	-695.368	1.69E-13	5.90E-12
OTA002849	*NME8*	-3208.44	-3235.23	2.49E-13	8.63E-12
OTA000091	*TTLL5*	-6329.03	-6355.74	2.68E-13	9.22E-12
OTA002483	*ZC3H7B*	-4882.52	-4909.23	2.69E-13	9.22E-12
OTA007383	*ETFDH*	-2736.47	-2763.14	2.82E-13	9.62E-12
OTA010731	*IQCH*	-3622.69	-3649.34	2.86E-13	9.70E-12
OTA004219	*CHRNA3*	-1875.3	-1901.75	3.51E-13	1.18E-11
OTA014843	*IARS*	-6946.43	-6972.85	3.65E-13	1.22E-11
OTA003824	*MRPL48*	-1126.81	-1152.96	4.76E-13	1.58E-11
OTA011583	*PCBD2*	-640.832	-666.925	5.05E-13	1.67E-11
OTA009613		-3407.22	-3433.03	6.68E-13	2.20E-11
OTA013127	*PISD*	-1644.46	-1670.22	7.08E-13	2.32E-11
OTA014029	*TAF2*	-4213.72	-4238.96	1.21E-12	3.94E-11
OTA009479	*C5H11orf74*	-1147.29	-1172.23	1.62E-12	5.23E-11
OTA002934	*CPNE4*	-1687.12	-1712.07	1.62E-12	5.23E-11

OTA014731	MAMDC2	-3206.88	-3231.76	1.74E-12	5.57E-11
OTA008261	IWS1	-3424.29	-3449.16	1.77E-12	5.64E-11
OTA001804	PRKCZ	-2353.91	-2378.54	2.24E-12	7.11E-11
OTA004682	E2F2	-1234.92	-1259.45	2.48E-12	7.82E-11
OTA001938	AZIN2	-3211.2	-3235.08	4.80E-12	1.51E-10
OTA001140	SLC38A8	-2200.35	-2223.76	7.77E-12	2.43E-10
OTA008166	PABPC1L	-3829.23	-3852.5	9.02E-12	2.80E-10
OTA011953	NBN	-3044.18	-3067.4	9.42E-12	2.91E-10
OTA009817	HORMAD1	-788.204	-811.225	1.16E-11	3.56E-10
OTA007780	MCM8	-4433.94	-4456.48	1.90E-11	5.80E-10
OTA004104	MATR3	-4326.54	-4348.71	2.75E-11	8.36E-10
OTA000507	AKAP13	-6997.4	-7019.37	3.40E-11	1.02E-09
OTA007108		-2597.81	-2619.78	3.39E-11	1.02E-09
OTA002978	AOAH	-3505.68	-3527.53	3.85E-11	1.15E-09
OTA015383	SUGP1	-1841.63	-1863.44	3.95E-11	1.18E-09
OTA013689	SYNRG	-6911.17	-6932.96	4.06E-11	1.21E-09
OTA009092	SEC63	-2455.91	-2477.68	4.14E-11	1.22E-09
OTA006888	CARF	-3853.62	-3875.38	4.20E-11	1.23E-09
OTA001047		-1979.02	-2000.69	4.64E-11	1.36E-09
OTA008265	PLSCR1	-1320.46	-1342.01	5.17E-11	1.50E-09
OTA008705		-1866.1	-1887.58	5.54E-11	1.60E-09
OTA001863	NUDC	-1697.06	-1718.26	7.42E-11	2.14E-09
OTA004961	ERGIC3	-1730.74	-1751.89	7.78E-11	2.23E-09
OTA014504	HEXDC	-2965.16	-2986.06	1.01E-10	2.88E-09
OTA011248	TEC	-3519.78	-3540.64	1.05E-10	2.98E-09
OTA003044	TENM4	-8732.83	-8753.67	1.08E-10	3.05E-09
OTA014651	NVL	-2757.35	-2777.98	1.32E-10	3.72E-09
OTA006505	C8G	-1010.71	-1031.21	1.52E-10	4.25E-09
OTA007382	GRIA2	-3787.44	-3807.92	1.55E-10	4.32E-09
OTA006111	LUC7L3	-2151.96	-2172.31	1.77E-10	4.92E-09
OTA001319	ABI1	-2348.08	-2368.39	1.84E-10	5.08E-09
OTA008227	PLCG1	-6165.24	-6185.46	2.02E-10	5.56E-09
OTA005528	VIPAS39	-2734.27	-2754.28	2.53E-10	6.91E-09
OTA006603	TSC1	-5723.14	-5742.75	3.80E-10	1.04E-08
OTA013808	EFEMP1	-1555.13	-1574.5	4.82E-10	1.31E-08
OTA009326	MAP4K5	-2810.7	-2830.05	4.92E-10	1.33E-08
OTA012716	TTF2	-5646.61	-5665.71	6.41E-10	1.72E-08
OTA008266		-2150.31	-2169.18	8.14E-10	2.18E-08
OTA010703	APBA2	-3570.58	-3589.09	1.17E-09	3.12E-08
OTA014247	IVNS1ABP	-3545.41	-3563.79	1.33E-09	3.54E-08
OTA001177	SPAG6	-1782.62	-1800.77	1.71E-09	4.51E-08
OTA013243	PSMG2	-1672.72	-1690.83	1.75E-09	4.60E-08
OTA002047	ZPR1	-2652.89	-2670.9	1.95E-09	5.10E-08
OTA013809	SMEK2	-2820.11	-2838.05	2.10E-09	5.46E-08
OTA013571	IL1R1	-2446.73	-2464.65	2.16E-09	5.60E-08
OTA015362		-2302.09	-2319.92	2.34E-09	6.05E-08
OTA001317	PRTFDC1	-857.46	-875.149	2.72E-09	6.99E-08
OTA012574	DESI1	-913.314	-930.522	4.45E-09	1.14E-07

OTA013087		-3784.78	-3801.88	4.98E-09	1.27E-07
OTA000552	*ITGA11*	-3897.14	-3914.19	5.23E-09	1.33E-07
OTA009301		-2140.58	-2157.53	5.83E-09	1.47E-07
OTA003577	*CDK7*	-1393.89	-1410.72	6.56E-09	1.65E-07
OTA012906	*DSCAM*	-3736.09	-3752.75	7.81E-09	1.96E-07
OTA003729	*AQP2*	-1095.93	-1112.56	8.07E-09	2.01E-07
OTA008185	*PPP1R16B*	-3031.4	-3047.86	9.55E-09	2.37E-07
OTA008045	*SOAT1*	-2696.37	-2712.82	9.76E-09	2.42E-07
OTA006935	*GLB1L*	-3077.06	-3093.46	1.02E-08	2.51E-07
OTA007281	*FUCA1*	-2474.24	-2490.05	1.87E-08	4.59E-07
OTA009783	*HDAC7*	-2694.49	-2710.23	2.00E-08	4.90E-07
OTA006478	*CACHD1*	-5399.06	-5414.79	2.04E-08	4.97E-07
OTA001021	*ZNF423*	-5909.87	-5925.59	2.05E-08	4.98E-07
OTA003858	*C8H1orf27*	-2560.51	-2576.05	2.46E-08	5.94E-07
OTA006787		-2153.65	-2168.78	3.76E-08	9.05E-07
OTA014947	*SPATA17*	-1911.86	-1926.82	4.51E-08	1.08E-06
OTA002227	*DENND2C*	-3643.01	-3657.92	4.76E-08	1.14E-06
OTA007139	*LEKR1*	-1625.27	-1640.12	5.06E-08	1.20E-06
OTA008644	*HOXA10*	-1436.71	-1451.34	6.35E-08	1.50E-06
OTA008718	*PLXNB2*	-9941.78	-9956.22	7.67E-08	1.81E-06
OTA007434	*PRIMPOL*	-2650.1	-2664.42	8.71E-08	2.05E-06
OTA007769	*MTG1*	-1539.51	-1553.77	9.31E-08	2.18E-06
OTA006926	*FAM171B*	-4066.52	-4080.71	9.91E-08	2.31E-06
OTA010987	*CACNA1H*	-7088.44	-7102.39	1.27E-07	2.96E-06
OTA006618	*ABCA2*	-12253.3	-12267.3	1.31E-07	3.02E-06
OTA011527	*GRPEL2*	-1068.42	-1082.27	1.42E-07	3.28E-06
OTA014720	*ZFAND5*	-1459.51	-1473.32	1.48E-07	3.39E-06
OTA014547	*DCT*	-3760.61	-3774.37	1.55E-07	3.56E-06
OTA001329	*DNAJB6*	-1409.8	-1423.48	1.69E-07	3.84E-06
OTA014072	*TAX1BP1*	-4168.89	-4182.48	1.86E-07	4.22E-06
OTA013214	*ADAD1*	-2671.01	-2684.58	1.89E-07	4.27E-06
OTA006485	*NSUN4*	-2089.94	-2103.45	2.02E-07	4.56E-06
OTA000222	*DHRS7*	-1624.55	-1638.02	2.12E-07	4.75E-06
OTA008425	*TBC1D22B*	-2572.93	-2586.34	2.24E-07	5.02E-06
OTA011649	*TCF7*	-1101.19	-1114.53	2.40E-07	5.36E-06
OTA013810	*MTIF2*	-3988.06	-4001.33	2.57E-07	5.70E-06
OTA003076	*GDPD4*	-2928.23	-2941.22	3.45E-07	7.62E-06
OTA010229		-1309.78	-1322.68	3.80E-07	8.37E-06
OTA013369	*TBC1D22A*	-2509.58	-2522.44	3.91E-07	8.59E-06
OTA002582	*MFSD8*	-1964.24	-1976.83	5.23E-07	1.14E-05
OTA009060	*SNAP91*	-3421.84	-3434.35	5.68E-07	1.24E-05
OTA000619	*HMCN2*	-10061.6	-10074.1	5.82E-07	1.26E-05
OTA010926	*RAC2*	-857.531	-869.907	6.52E-07	1.41E-05
OTA001609	*OSBPL6*	-2896.61	-2908.92	6.95E-07	1.50E-05
OTA011481	*PXK*	-2127.53	-2139.74	7.75E-07	1.67E-05
OTA013827	*MKKS*	-3661.11	-3673.3	7.91E-07	1.69E-05
OTA011256	*SMIM14*	-472.192	-484.261	8.97E-07	1.91E-05
OTA011380		-3683.26	-3695.29	9.35E-07	1.99E-05

OTA009450	*CHRNA5*	-1891.23	-1903.25	9.43E-07	2.00E-05
OTA004110	*EIF4B*	-2281.28	-2293.25	9.95E-07	2.10E-05
OTA010209	*FZD3*	-1807.89	-1819.76	1.11E-06	2.33E-05
OTA012062	*SEZ6L*	-2371.82	-2383.6	1.20E-06	2.51E-05
OTA006590	*C5*	-7937.9	-7949.52	1.43E-06	2.99E-05
OTA001612	*CSRNP3*	-2907.52	-2919.12	1.46E-06	3.03E-05
OTA012852	*BOC*	-2320.3	-2331.65	1.89E-06	3.93E-05
OTA004766	*SNCAIP*	-5061.28	-5072.38	2.47E-06	5.09E-05
OTA011887	*MFSD11*	-2368.58	-2379.63	2.59E-06	5.32E-05
OTA012037	*ANAPC7*	-2797.29	-2808.32	2.66E-06	5.46E-05
OTA003806	*MINA*	-2589.05	-2600.05	2.73E-06	5.58E-05
OTA011627	*TCOF1*	-3159.36	-3170.21	3.19E-06	6.50E-05
OTA010702	*SLC24A1*	-3508.34	-3519.05	3.70E-06	7.51E-05
OTA000850	*BTAF1*	-8751.04	-8761.66	4.06E-06	8.22E-05
OTA009687		-1580.52	-1591.06	4.40E-06	8.89E-05
OTA007737	*PLAU*	-1747.69	-1758.11	5.02E-06	0.000101
OTA008245	*TFDP2*	-2162.16	-2172.55	5.18E-06	0.000104
OTA002410	*TMEM26*	-2099.41	-2109.66	5.94E-06	0.000119
OTA002497	*CYTH4*	-2063.48	-2073.69	6.24E-06	0.000124
OTA007919	*NEK1*	-4807.08	-4817.23	6.63E-06	0.000131
OTA012718	*DCBLD2*	-2175.98	-2186.07	7.06E-06	0.00014
OTA013392	*FAM185A*	-1219.26	-1229.26	7.73E-06	0.000152
OTA000810		-799.672	-809.55	8.79E-06	0.000173
OTA011257	*UGDH*	-2879.06	-2888.81	1.00E-05	0.000197
OTA012747	*KIF26B*	-8833.28	-8843.02	1.02E-05	0.000198
OTA013328	*MFSD2B*	-2439.53	-2449.21	1.07E-05	0.000209
OTA008519	*PTPRJ*	-6823.6	-6832.71	1.96E-05	0.000381
OTA007917	*SH3D19*	-3726.68	-3735.7	2.16E-05	0.000417
OTA009835		-1841.94	-1850.8	2.56E-05	0.000493
OTA008250	*SPHKAP*	-8882.24	-8891.07	2.66E-05	0.000512
OTA015050	*USP40*	-6712.14	-6720.88	2.92E-05	0.000559
OTA008229	*ZNF335*	-6298.67	-6307.26	3.42E-05	0.000653
OTA005634	*PMS2*	-3698.55	-3707.1	3.56E-05	0.000677
OTA009395	*RBPMS*	-1226.4	-1234.94	3.57E-05	0.000678
OTA003587	*TRERF1*	-5646	-5654.2	5.17E-05	0.000977
OTA006564	*RAB14*	-788.115	-796.298	5.23E-05	0.000985
OTA012263		-2191.79	-2199.86	5.90E-05	0.001109
OTA012613	*RPL23A*	-830.626	-838.656	6.13E-05	0.001149
OTA014681	*DENND4C*	-10068.3	-10076.3	6.28E-05	0.001173
OTA006951	*ABCB11*	-7010.65	-7018.63	6.42E-05	0.001194
OTA015624	*GRIN3A*	-2366.21	-2374.19	6.44E-05	0.001194
OTA000221	*UBR7*	-2218.67	-2226.59	6.90E-05	0.001276
OTA009143	*NIT2*	-526.151	-533.994	7.47E-05	0.001378
OTA011119	*EXOC3L1*	-3770.19	-3777.89	8.73E-05	0.001605
OTA008901	*LANCL1*	-2219.95	-2227.61	9.10E-05	0.001667
OTA011290	*NELFA*	-1938.05	-1945.68	9.38E-05	0.001714
OTA014129	*CEP290*	-12769	-12776.5	0.000116	0.002111
OTA007048	*POP1*	-5869.34	-5876.76	0.000117	0.002124

OTA014918	*GALNT2*	-2580.07	-2587.43	0.000124	0.002253
OTA011445	*GLT8D1*	-1790.4	-1797.49	0.000166	0.002994
OTA013896	*MEF2D*	-1242.77	-1249.86	0.000167	0.002998
OTA002617	*SLC7A11*	-2243.11	-2250.17	0.000172	0.003087
OTA004797	*ATP2A3*	-4718.1	-4725.13	0.000177	0.003168
OTA005475	*MTHFD1*	-4832.76	-4839.75	0.000186	0.003314
OTA006213	*SSBP3*	-650.196	-657.161	0.00019	0.003376
OTA002316	*RBM19*	-4279.6	-4286.53	0.000197	0.00349
OTA005402	*CDAN1*	-3590.31	-3597.24	0.000198	0.003495
OTA006861	*METTL8*	-1398.68	-1405.49	0.000224	0.003949
OTA001833	*PLEKHN1*	-1140.55	-1147.31	0.000236	0.00415
OTA010764	*NOLC1*	-3615.73	-3622.47	0.000241	0.004216
OTA014664	*WDR26*	-2722.88	-2729.56	0.000257	0.004488
OTA011504	*CELSR3*	-19442.3	-19448.9	0.000258	0.004492
OTA014570	*PPAP2A*	-1427.36	-1433.97	0.000276	0.0048
OTA005097	*TRPV5*	-3377.99	-3384.59	0.000279	0.004829
OTA014665	*TP53BP2*	-4988.96	-4995.42	0.000323	0.00558
OTA009242	*CEP57L1*	-2178.85	-2185.31	0.000326	0.005609
OTA004492	*ERICH3*	-1322.61	-1329.06	0.00033	0.005668
OTA014546	*GGACT*	-793.297	-799.638	0.000369	0.006318
OTA009741	*CHRNB3*	-2345.23	-2351.41	0.000436	0.00744
OTA007413	*EGF*	-5960.06	-5966.05	0.00054	0.009185
OTA010577	*AP3B2*	-5070.61	-5076.54	0.000574	0.009748
OTA013692		-1264.87	-1270.69	0.000645	0.010927
OTA001103	*GABARAPL2*	-483.323	-489.14	0.000648	0.010943
OTA007396	*CDKN2AIP*	-2367.27	-2373.06	0.000667	0.011228
OTA002126	*RFX6*	-4881.74	-4887.5	0.000688	0.011545
OTA003231	*SGSM2*	-5693.46	-5699.17	0.000728	0.012192
OTA015245	*RIOK2*	-3058.56	-3064.16	0.000824	0.01375
OTA008459	*CHAF1A*	-5147.37	-5152.94	0.000848	0.014115
OTA004943	*HABP4*	-1627.11	-1632.59	0.000936	0.015545
OTA002298	*GNAT2*	-902.224	-907.635	0.001003	0.0166
OTA000205	*WDR25*	-1297.06	-1302.46	0.001017	0.01679
OTA006533	*WDR34*	-1337.58	-1342.96	0.001035	0.017037
OTA006473	*VCAM1*	-3059.97	-3065.17	0.001264	0.020749
OTA000041	*ZFYVE1*	-3502.99	-3508.17	0.001288	0.021097
OTA005112	*RFESD*	-983.014	-988.127	0.001384	0.022604
OTA013961	*CDC123*	-1593.84	-1598.86	0.001537	0.02503
OTA005822	*IMMT*	-4093.4	-4098.4	0.001579	0.025643
OTA006517	*PRPF4*	-2371.83	-2376.64	0.001934	0.031327
OTA007762	*ADAM8*	-2312.51	-2317.21	0.002186	0.035314
OTA000103	*ZC3H14*	-3127.65	-3132.31	0.002273	0.036618
OTA000715	*OLFM1*	-1769.16	-1773.77	0.002409	0.03871
OTA006810	*ITGB1BP2*	-1757.44	-1762.01	0.002497	0.040009
OTA013666	*BRPF3*	-5295.75	-5300.28	0.002617	0.041826
OTA001275	*MALRD1*	-764.921	-769.434	0.002662	0.042424
OTA011313		-1864.01	-1868.49	0.002774	0.04v4093

Table S13. Functional impacts of snowfinch-specific *DTL* nonsynonymous substitutions as compared to those of *montan*. The nonsynonymous substitutions caused potential functional changes are shown in bold.

Species	Variant	*Montan*	Snowfinch	Provean	Sift
adamsi	T83S	T	S	0.605 (Neutral)	0.88 (Tolerated)
	V437M	V	M	-0.193 (Neutral)	0.11 (Tolerated)
	S599P	S	P	-1.484 (Neutral)	0.28 (Tolerated)
	P639T	P	T	-0.225 (Neutral)	**0 (Affect protein function)**
	R646H	R	H	-0.852 (Neutral)	0.22 (Tolerated)
rufico	T53A	T	A	-0.569 (Neutral)	0.53 (Tolerated)
	P480R	P	R	1.007 (Neutral)	0.78 (Tolerated)
	P544L	P	L	-2.085 (Neutral)	0.12 (Tolerated)
	E561D	E	D	-0.486 (Neutral)	0.49 (Tolerated)
taczan	N59D	N	D	-1.664 (Neutral)	0.5 (Tolerated)
	I132V	I	V	0.296 (Neutral)	1 (Tolerated)
	D190N	D	N	-1.227 (Neutral)	0.16 (Tolerated)
	R389C	R	C	-2.275 (Neutral)	**0 (Affect protein function)**
	E394G	E	G	**-2.67 (Deleterious)**	0.23 (Tolerated)
	G417A	G	A	0.479 (Neutral)	0.93 (Tolerated)
	A418T	A	T	-0.201 (Neutral)	0.3 (Tolerated)
	P506L	P	L	**-3.105 (Deleterious)**	**0 (Affect protein function)**
	E549G	E	G	-1.822 (Neutral)	**0.05 (Affect protein function)**
	K553R	K	R	-1.494 (Neutral)	**0 (Affect protein function)**
	S585P	S	P	-0.601 (Neutral)	0.26 (Tolerated)
	K586S	K	S	-0.897 (Neutral)	**0.04 (Affect protein function)**
	H591N	H	N	0.4 (Neutral)	0.77 (Tolerated)
	L606R	L	R	-1.791 (Neutral)	0.06 (Tolerated)
	R662N	R	N	-0.175 (Neutral)	0.84 (Tolerated)
	R686N	R	N	0.5 (Neutral)	0.11 (Tolerated)
ancestor	K45T	K	T	0.68 (Neutral)	0.34 (Tolerated)
	M163L	M	L	-1.56 (Neutral)	0.81 (Tolerated)
	V188M	V	M	-0.979 (Neutral)	0.08 (Tolerated)
	Q312R	Q	R	-1.909 (Neutral)	0.31 (Tolerated)
	V330L	V	L	-0.166 (Neutral)	0.42 (Tolerated)
	T338V	T	V	-0.602 (Neutral)	1 (Tolerated)
	V397G	V	G	-0.318 (Neutral)	0.5 (Tolerated)
	E413K	E	K	-0.631 (Neutral)	0.24 (Tolerated)
	G414Q	G	Q	1.307 (Neutral)	0.57 (Tolerated)
	P428L	P	L	**-3.107 (Deleterious)**	0.58 (Tolerated)
	C438R	C	R	0.107 (Neutral)	0.26 (Tolerated)
	T450I	T	I	-1.496 (Neutral)	**0.01 (Affect protein**

				function)
P462A	P	A	-1.542 (Neutral)	**0 (Affect protein function)**
S471T	S	T	-0.125 (Neutral)	0.12 (Tolerated)
H500Y	H	Y	-1.405 (Neutral)	0.06 (Tolerated)
G533D	G	D	0.216 (Neutral)	0.73 (Tolerated)
K550T	K	T	-0.243 (Neutral)	0.06 (Tolerated)
H580N	H	N	0.434 (Neutral)	1 (Tolerated)
A582D	A	D	-1.092 (Neutral)	**0.03 (Affect protein function)**
D640R	D	R	0.943 (Neutral)	0.27 (Tolerated)
F642C	F	C	0.104 (Neutral)	**0.01 (Affect protein function)**
K648Q	K	Q	-0.022 (Neutral)	0.25 (Tolerated)
E671A	E	A	0.001 (Neutral)	0.35 (Tolerated)
A710L	A	L	0.037 (Neutral)	0.16 (Tolerated)
A711L	A	L	-0.27 (Neutral)	0.32 (Tolerated)
M717V	M	V	-1.381 (Neutral)	**0 (Affect protein function)**

Table S14. Statistical results of pairwise comparisons of snowfinch *DTL*s. T-tests combined with FDR correction. *, $P<0.05$; **, $P<0.01$; ***, $P<0.001$.

6-4PP	1.5 h/6 h	$DTL_{ancestor}$	DTL_{adamsi}	DTL_{rufico}
	DTL_{adamsi}	**/**		
	DTL_{rufico}	**/**	**/*	
	DTL_{taczan}	*/0.26	**/***	**/0.25
CPD	6 h/24 h	$DTL_{ancestor}$	DTL_{adamsi}	DTL_{rufico}
	DTL_{adamsi}	*/0.92		
	DTL_{rufico}	*/0.92	0.61/0.92	
	DTL_{taczan}	*/0.92	0.59/0.92	0.2/0.56

Table S15. Phylogenetic signal test for adaptive characteristics in the three descendant species.

Adaptive characteristics	Blomberg's K	P value
Semantic similarity values (RCMAX)	1.039	0.343
Semantic similarity values (BMA)	1.041	0.325
DTL nonsynonymous substitution in Non-WD40 region	1.048	0.344
DTL nonsynonymous substitution in WD40 region	1.049	0.318
DNA repair capacity at 1.5 h (6-4PP)	0.952	1.000
DNA repair capacity at 6 h (6-4PP)	0.985	0.657
DNA repair capacity at 6 h (CPD)	0.997	0.661
DNA repair capacity at 24 h (CPD)	0.989	0.638

Table S16. Functional impacts of four alternative variants of inferred ancestral *DTL* sequences.

Variants	$DTL_{ancestor\_1}$	$DTL_{ancestor\_2}$	$DTL_{ancestor}$	PolyPhen-2	Provean
T472R	T	R	T	0.40 (Benign)	-0.532 (Neutral)
L566P	L	P	P	0.01 (Benign)	-1.519 (Neutral)
H586N	H	H	N	0.03 (Benign)	0.076 (Neutral)
Y605C	Y	C	Y	0.00 (Benign)	0.585 (Neutral)

Table S17. Proportions of repeats in the genomes of the three species of snowfinches.

Type	White-rumped Snowfinch		Black-winged Snowfinch		Rufous-necked Snowfinch	
	Repeat Size(bp)	% of genome	Repeat Size(bp)	% of genome	Repeat Size(bp)	% of genome
TRF	32,808,224	3.16	29,493,038	2.80	29,559,512	2.81
RepeatMasker	63,386,645	6.11	69,799,001	6.63	68,872,029	6.55
RepeatProteinMask	26,239,030	2.53	31,021,768	2.95	30,732,968	2.92
De Novo	77,428,015	7.46	91,048,124	8.65	86,608,645	8.23
Total	113,021,890	10.89	122,922,653	11.67	119,950,493	11.40

Table S18. Comparison transposable elements of the genomes in the three species of snowfinches.

Type	White-rumped Snowfinch		Black-winged Snowfinch		Rufous-necked Snowfinch	
	Length (bp)	% in genome	Length (bp)	% in genome	Length (bp)	% in genome
DNA	4,048,441	0.39	4,215,590	0.4	3,748,454	0.36
LINE	49,927,044	4.81	49,797,281	4.73	49,288,476	4.69
SINE	24,333	0	90,735	0.01	51,452	0
LTR	20,227,074	1.95	36,065,547	3.42	31,318,798	2.98
Other	0	0	0	0	0	0
Satellite	2,501,301	0.24	2,774,732	0.26	2,005,983	0.19
Simple repeat	1,247,570	0.12	1,984,824	0.19	1,848,477	0.18
Unknown	3,302,048	0.32	3,311,783	0.31	3,631,406	0.35
Total	77,428,015	7.46	91,048,124	8.65	86,608,645	8.23

Table S19. Summary of predicted RNA genes and their characteristics.

Type		Copy (w)	Average length(bp)	Total length(bp)	% of genome
White-rumped Snowfinch					
	miRNA	194	83.08	16,118.00	0.001553
	tRNA	275	74.80	20,571.00	0.001982
rRNA	rRNA	41	184.07	7,547.00	0.000727
	18S	7	268.71	1,881.00	0.000181
	28S	29	180.76	5,242.00	0.000505
	5.8S	1	155.00	155.00	0.000015
	5S	4	67.25	269.00	0.000026
snRNA	snRNA	217	116.28	25,232.00	0.002432
	CD-box	105	87.71	9,210.00	0.000888
	HACA-box	68	141.07	9,593.00	0.000924
	Splicing	29	128.38	3,723.00	0.000359
Black-winged Snowfinch					
	miRNA	193	83.09	16,036	0.001523
	tRNA	279	74.74	20,853	0.00198
rRNA	rRNA	38	139.84	5,314	0.000505
	18S	6	328.33	1,970	0.000187
	28S	26	106.81	2,777	0.000264
	5.8S	1	155.00	155	0.000015
	5S	5	82.40	412	0.000039
snRNA	snRNA	202	117.21	23,676	0.002248
	CD-box	103	91.04	9,377	0.00089
	HACA-box	61	137.97	8,416	0.000799
	Splicing	26	135.65	3,527	0.000335
Rufous-necked Snowfinch					
	miRNA	200	82.64	16,527	0.001571
	tRNA	298	74.77	22,282	0.002119
rRNA	rRNA	105	158.35	16,627	0.001581
	18S	29	186.28	5,402	0.000514
	28S	70	154.39	10,807	0.001028
	5.8S	3	84.00	252	0.000024
	5S	3	55.33	166	0.000016
snRNA	snRNA	241	112.81	27,187	0.002585
	CD-box	123	85.94	10,571	0.001005
	HACA-box	72	140.26	10,099	0.00096
	Splicing	31	125.32	3,885	0.000369

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