

FIG S1 Validation of identified shRNAs. (A) Validation of identified genes. Suppression of targets by individual shRNAs. shRNAs available from each gene identified in the screen were used to infect BJ cells and the degree of suppression determined. For each gene depicted in the graph, the first bar is a control shRNA normalized to 1, and subsequent bars represent knockdown from shRNAs targeting that gene. Bars colored red indicate the shRNAs isolated from the original screen. Error bars indicate the standard deviation of triplicate measurements. (B-F) Proliferation of cells with suppression of identified genes. Cells described in part A which demonstrated successful knockdown were allowed to proliferate toward replicative senescence. The number of PDs achieved was measured at the time points indicated and reported as the average number in singleton experiments of cumulative PDs for each line.

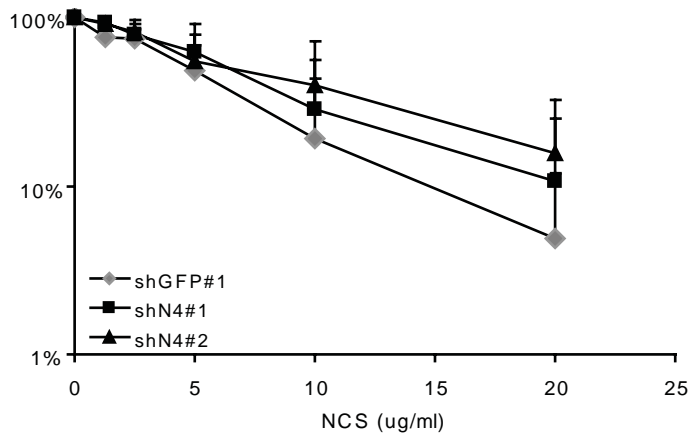
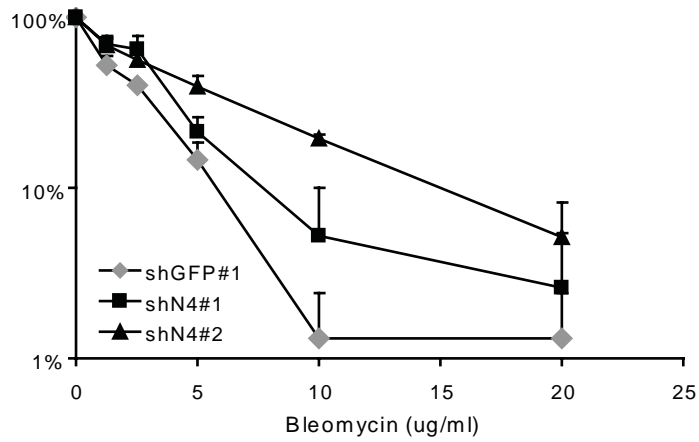


FIG S2 *NEK4* suppressed cells are less sensitive to double-stranded DNA damaging drugs neocarzinostatin and bleomycin. Colony formation assays to examine sensitivity of control (shGFP #1) or *NEK4* suppressed (shN4 #1 and #2) BJ fibroblasts to treatment with neocarzinostatin (NCS) (top) or bleomycin (bottom). Survival is expressed as a percentage of colonies formed compared to mock-treated cells after treatment with the indicated amounts of drug. Error bars indicate the standard deviation of triplicate experiments.

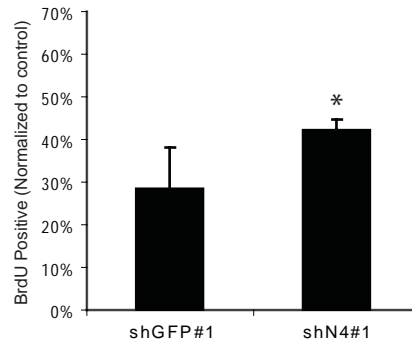


FIG S3 Suppression of *NEK4* in IMR-90 cells impairs cell cycle arrest. BrdU incorporation assays to assess cell cycle arrest of control (shGFP #1) or *NEK4* suppressed (shN4 #1) IMR-90 fibroblasts in response to treatment with etoposide. Bars indicate the percentage of cells that were BrdU positive following treatment with etoposide, normalized to percentage of BrdU-positive mock-treated cells. Error bars represent the standard deviation of triplicate experiments. *= $p < 0.035$, compared to shGFP #1 control.

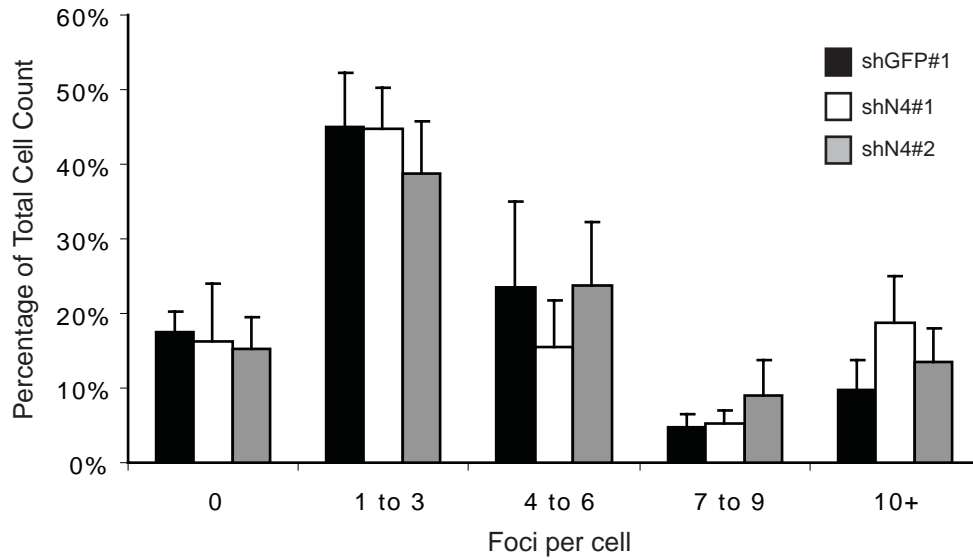


FIG S4 γ -H2AX foci in BJ shGFP and BJ shN4 cells. The number of γ -H2AX foci were scored in asynchronous BJ cells expressing either a control shRNA (shGFP #1) or one of two shRNAs targeting *NEK4* (shN4 #1 and #2). The bars indicate the percentage of cells that contained the indicated number of foci. At least 150 cells were counted per cell line per replicate. Error bars represent the standard deviation of triplicate experiments.

Supplemental Table 1

Identity of genes targeted in each shRNA pool

POOL 1

Symbol	NCBI Gene ID	Description	Number of shRNAs
AASDHPPT	60496	Aminoadipate-semialdehyde dehydrogenase-phosphopantetheinyl transferase	5
ACAD11	84129	Acyl-Coenzyme A dehydrogenase family, member 11	5
ACAD9	28976	Acyl-Coenzyme A dehydrogenase family, member 9	5
ACTB	60	Actin, beta	4
ACTG1	71	Actin, gamma 1	5
ACTR3	10096	ARP3 actin-related protein 3 homolog (yeast)	5
ADH4	127	Alcohol dehydrogenase 4 (class II), pi polypeptide	5
ADH5	128	Alcohol dehydrogenase 5 (class III), chi polypeptide	5
ADH5P4	285802	alcohol dehydrogenase 5B	5
ADH6	130	Alcohol dehydrogenase 6 (class V)	5
ADH7	131	Alcohol dehydrogenase 7 (class IV), mu or sigma polypeptide	5
AKR1C3	8644	Aldo-keto reductase family 1, member C3 (3-alpha hydroxysteroid dehydrogenase, type II)	5
ALDH1A1	216	Aldehyde dehydrogenase 1 family, member A1	5
ALDH1A3	220	Aldehyde dehydrogenase 1 family, member A3	5
ALDH1B1	219	Aldehyde dehydrogenase 1 family, member B1	4
ALDH2	217	Aldehyde dehydrogenase 2 family (mitochondrial)	5
ALDH3A1	218	Aldehyde dehydrogenase 3 family, member A1	5
ALDH3A2	224	Aldehyde dehydrogenase 3 family, member A2	5
ALDH3B1	221	Aldehyde dehydrogenase 3 family, member B1	4
ALDH3B2	222	Aldehyde dehydrogenase 3 family, member B2	4
ALDH7A1	501	Aldehyde dehydrogenase 7 family, member A1	5
ALDH8A1	64577	Aldehyde dehydrogenase 8 family, member A1	4
ALDH9A1	223	Aldehyde dehydrogenase 9 family, member A1	5
ANXA5	308	Annexin A5	5
APOD	347	Apolipoprotein D	5
ARHGAP26	23092	Rho GTPase activating protein 26	5
ARHGEF5	7984	Rho guanine nucleotide exchange factor (GEF) 5	5
ARSB	411	Arylsulfatase B	5
ASAH1	427	N-acylsphingosine amidohydrolase (acid ceramidase) 1	5
ATP5F1	515	ATP synthase, H+ transporting, mitochondrial F0 complex, subunit B1	5
ATP6V0C	527	ATPase, H+ transporting, lysosomal 16kDa, V0 subunit c	4
ATP6V1A	523	ATPase, H+ transporting, lysosomal 70kDa, V1 subunit A	5

ATP6V1B1	525	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B1 (Renal tubular acidosis with	4
ATP6V1B2	526	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B2	5
ATP6V1C1	528	ATPase, H+ transporting, lysosomal 42kDa, V1 subunit C1	4
ATP6V1E1	529	ATPase, H+ transporting, lysosomal 31kDa, V1 subunit E1	5
BCKDHA	593	Branched chain keto acid dehydrogenase E1, alpha polypeptide	5
BCKDHB	594	Branched chain keto acid dehydrogenase E1, beta polypeptide (maple syrup urine disease)	5
BDH1	622	3-hydroxybutyrate dehydrogenase, type 1	5
BMX	660	BMX non-receptor tyrosine kinase	5
C9orf53	51198	Chromosome 9 open reading frame 53	4
CABP1	9478	Calcium binding protein 1	5
CANX	821	Calnexin	5
CAP1	10487	CAP, adenylate cyclase-associated protein 1 (yeast)	5
CAPG	822	Capping protein (actin filament), gelsolin-like	5
CAPZB	832	Capping protein (actin filament) muscle Z-line, beta	5
CCT2	10576	Chaperonin containing TCP1, subunit 2 (beta)	5
CCT5	22948	Chaperonin containing TCP1, subunit 5 (epsilon)	5
CHDH	55349	Choline dehydrogenase	5
CIT	11113	Citron (rho-interacting, serine/threonine kinase 21)	5
CLEC4M	10332	C-type lectin domain family 4, member M	5
CORO1A	11151	Coronin, actin binding protein, 1A	5
CR1	1378	Complement component (3b/4b) receptor 1 (Knops blood group)	5
CRKL	1399	V-crk sarcoma virus CT10 oncogene homolog (avian)-like	5
CYP4A22	284541	cytochrome P450, family 4, subunit	5
DDEF2	8853	Development and differentiation enhancing factor 2	4
DHDH	27294	Dihydrodiol dehydrogenase (dimeric)	4
DHRS2	10202	Dehydrogenase/reductase (SDR family) member 2	5
DHRS4L2	317749	Dehydrogenase/reductase (SDR family) member 4 like 2	5
DHRS7	51635	Dehydrogenase/reductase (SDR family) member 7	5
DHRSX	207063	Dehydrogenase/reductase (SDR family) X-linked	5
DHTKD1	55526	Dehydrogenase E1 and transketolase domain containing 1	5
DKFZP761H1710	83459	hypothetical protein DKFZp761H	5
DOCK1	1793	Dedicator of cytokinesis 1	5
DUX3	26582	double homeobox, 3	4
DUX5	26581	double homeobox, 5	3
E2F7	144455	E2F transcription factor 7	5
E2F8	79733	E2F transcription factor 8	5
EEA1	8411	Early endosome antigen 1	5
EEF1A1	1915	Eukaryotic translation elongation factor 1 alpha 1	5

ELMO1	9844	Engulfment and cell motility 1	5
ELMO2	63916	Engulfment and cell motility 2	5
ELMO3	79767	Engulfment and cell motility 3	5
ENO1	2023	Enolase 1, (alpha)	5
ERP29	10961	Endoplasmic reticulum protein 29	5
EXOSC10	5394	Exosome component 10	5
FASTK	10922	Fas-activated serine/threonine kinase	5
FCAR	2204	Fc fragment of IgA, receptor for	5
FCER1A	2205	Fc fragment of IgE, high affinity I, receptor for; alpha polypeptide	5
FCER2	2208	Fc fragment of IgE, low affinity II, receptor for (CD23)	4
FCGR1A	2209	Fc fragment of IgG, high affinity Ia, receptor (CD64)	5
FCGR2A	2212	Fc fragment of IgG, low affinity IIa, receptor (CD32)	5
FCGR2B	2213	Fc fragment of IgG, low affinity IIb, receptor (CD32)	5
FCGR2C	9103	Fc fragment of IgG, low affinity IIc, receptor for (CD32)	4
FCGR3B	2215	Fc fragment of IgG, low affinity	5
FERD3L	222894	Fer3-like (Drosophila)	3
FLOT1	10211	Flotillin 1	5
FTH1	2495	Ferritin, heavy polypeptide 1	5
FTL	2512	Ferritin, light polypeptide	5
GAPDHS	26330	Glyceraldehyde-3-phosphate dehydrogenase, spermatogenic	4
GBA	2629	Glucosidase, beta; acid (includes glucosylceramidase)	4
GLMN	11146	Glomulin, FKBP associated protein	4
GNAI2	2771	Guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 2	5
GNB2	2783	Guanine nucleotide binding protein (G protein), beta polypeptide 2	5
GRB2	2885	Growth factor receptor-bound protein 2	5
GUSB	2990	Glucuronidase, beta	5
HADH	3033	Hydroxyacyl-Coenzyme A dehydrogenase	5
HADHB	3032	Hydroxyacyl-Coenzyme A dehydrogenase/3-ketoacyl-Coenzyme A thiolase/enoyl-Coenzy	5
HBA1	3039	Hemoglobin, alpha 1	3
HBA2	3040	Hemoglobin, alpha 2	5
HBB	3043	Hemoglobin, beta	5
HEXA	3073	Hexosaminidase A (alpha polypeptide)	5
HEXB	3074	Hexosaminidase B (beta polypeptide)	5
HNRPA1	3178	heterogeneous nuclear ribonucl	5
HSD11B1	3290	Hydroxysteroid (11-beta) dehydrogenase 1	4
HSD11B2	3291	Hydroxysteroid (11-beta) dehydrogenase 2	5
HSD17B1	3292	Hydroxysteroid (17-beta) dehydrogenase 1	4
HSD17B12	51144	Hydroxysteroid (17-beta) dehydrogenase 12	5

HSD17B13	345275	short-chain dehydrogenase/redu	5
HSD17B7	51478	Hydroxysteroid (17-beta) dehydrogenase 7	5
HSD17B8	7923	Hydroxysteroid (17-beta) dehydrogenase 8	5
HSD3B7	80270	Hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 7	4
HSDL1	83693	Hydroxysteroid dehydrogenase like 1	5
HSF2BP	11077	Heat shock transcription factor 2 binding protein	5
HSFY1	86614	Heat shock transcription factor, Y-linked 1	5
HSP90B1	7184	Heat shock protein 90kDa beta (Grp94), member 1	4
HSPA1L	3305	Heat shock 70kDa protein 1-like	5
HSPA2	3306	Heat shock 70kDa protein 2	5
HSPA9B	3313	heat shock 70kDa protein 9B (m	5
HSPC105	93517	NAD(P) dependent steroid dehydrogenase-like	4
HSPD1	3329	Heat shock 60kDa protein 1 (chaperonin)	5
HTATSF1	27336	HIV-1 Tat specific factor 1	5
HYOU1	10525	Hypoxia up-regulated 1	5
ICAM1	3383	Intercellular adhesion molecule 1 (CD54), human rhinovirus receptor	5
ICK	22858	Intestinal cell (MAK-like) kinase	5
IDUA	3425	Iduronidase, alpha-L-	5
IFI30	10437	Interferon, gamma-inducible protein 30	5
IFNA1	3439	Interferon, alpha 1	5
IFNA10	3446	Interferon, alpha 10	5
IFNA13	3447	Interferon, alpha 13	5
IFNA14	3448	Interferon, alpha 14	5
IFNA16	3449	Interferon, alpha 16	5
IFNA17	3451	Interferon, alpha 17	4
IFNA2	3440	Interferon, alpha 2	5
IFNA4	3441	Interferon, alpha 4	5
IFNA5	3442	Interferon, alpha 5	5
IFNA6	3443	Interferon, alpha 6	5
IFNA7	3444	Interferon, alpha 7	5
IFNA8	3445	Interferon, alpha 8	5
IFNE1	338376	Interferon epsilon 1	5
IGFBP2	3485	Insulin-like growth factor binding protein 2, 36kDa	4
IMPDH1	3614	IMP (inosine monophosphate) dehydrogenase 1	5
IMPDH2	3615	IMP (inosine monophosphate) dehydrogenase 2	5
ITGA5	3678	Integrin, alpha 5 (fibronectin receptor, alpha polypeptide)	4
ITGAL	3683	Integrin, alpha L (antigen CD11A (p180), lymphocyte function-associated antigen 1; alpha	5
ITGAM	3684	Integrin, alpha M (complement component 3 receptor 3 subunit)	5

ITGAX	3687	Integrin, alpha X (complement component 3 receptor 4 subunit)	5
ITGB1	3688	Integrin, beta 1 (fibronectin receptor, beta polypeptide, antigen CD29 includes MDF2, MSK)	5
ITGB2	3689	Integrin, beta 2 (complement component 3 receptor 3 and 4 subunit)	5
IVD	3712	Isovaleryl Coenzyme A dehydrogenase	5
KIAA2026	158358	KIAA2026	5
KLHL9	55958	Kelch-like 9 (Drosophila)	5
LAMP1	3916	Lysosomal-associated membrane protein 1	5
LAMP2	3920	Lysosomal-associated membrane protein 2	5
LCP2	3937	Lymphocyte cytosolic protein 2 (SH2 domain containing leukocyte protein of 76kDa)	5
LDHA	3939	Lactate dehydrogenase A	5
LDHAL6B	92483	Lactate dehydrogenase A-like 6B	5
LGALS3	3958	Lectin, galactoside-binding, soluble, 3	5
LGALS3BP	3959	Lectin, galactoside-binding, soluble, 3 binding protein	4
LGMN	5641	Legumain	5
LHX4	89884	LIM homeobox 4	5
LIPA	3988	Lipase A, lysosomal acid, cholesterol esterase (Wolman disease)	5
LMNB1	4001	Lamin B1	5
LOC128102	128102	3-beta-hydroxysteroid dehydrogenase, tissue-type heart	5
LOC220729	220729	Succinate dehydrogenase complex, subunit A, flavoprotein pseudogene	5
LOC346085	346085	Hypothetical LOC346085	5
LOC402530	402530	similar to RIKEN cDNA 2610034N	5
LONRF1	91694	LON peptidase N-terminal domain and ring finger 1	4
MAD1L1	8379	MAD1 mitotic arrest deficient-like 1 (yeast)	5
MAD2L1	4085	MAD2 mitotic arrest deficient-like 1 (yeast)	5
MAD2L2	10459	MAD2 mitotic arrest deficient-like 2 (yeast)	5
MAGOH	4116	Mago-nashi homolog, proliferation-associated (Drosophila)	4
MARCKS	4082	Myristoylated alanine-rich protein kinase C substrate	5
MARK1	4139	MAP/microtubule affinity-regulating kinase 1	5
MFGE8	4240	Milk fat globule-EGF factor 8 protein	5
MS4A2	2206	Membrane-spanning 4-domains, subfamily A, member 2 (Fc fragment of IgE, high affinity)	4
MTAP	4507	Methylthioadenosine phosphorylase	5
MYH9	4627	Myosin, heavy chain 9, non-muscle	5
NAPSA	9476	Napsin A aspartic peptidase	5
NDUFA1	4694	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 1, 7.5kDa	5
NDUFA10	4705	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 10, 42kDa	5
NDUFA2	4695	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 2, 8kDa	4
NDUFA3	4696	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 3, 9kDa	4
NDUFA4	4697	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 4, 9kDa	5

NDUFA5	4698	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 5, 13kDa	5
NDUFA6	4700	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 6, 14kDa	5
NDUFA7	4701	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 7, 14.5kDa	3
NDUFA8	4702	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 8, 19kDa	5
NDUFA9	4704	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 9, 39kDa	5
NDUFAB1	4706	NADH dehydrogenase (ubiquinone) 1, alpha/beta subcomplex, 1, 8kDa	5
NDUFAF1	51103	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, assembly factor 1	5
NDUFB1	4707	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 1, 7kDa	5
NDUFB3	4709	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 3, 12kDa	5
NDUFB4	4710	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 4, 15kDa	5
NDUFB5	4711	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 5, 16kDa	5
NDUFB6	4712	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 6, 17kDa	5
NDUFB7	4713	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 7, 18kDa	3
NDUFB8	4714	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 8, 19kDa	5
NDUFB9	4715	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 9, 22kDa	5
NPC2	10577	Niemann-Pick disease, type C2	5
NSDHL	50814	NAD(P) dependent steroid dehydrogenase-like	5
NSF	4905	N-ethylmaleimide-sensitive factor	5
PCTK3	5129	PCTAIRE protein kinase 3	5
PDCD6IP	10015	Programmed cell death 6 interacting protein	5
PGAM1	5223	Phosphoglycerate mutase 1 (brain)	5
PHB	5245	Prohibitin	5
PITPNM1	9600	Phosphatidylinositol transfer protein, membrane-associated 1	4
PITPNM2	57605	Phosphatidylinositol transfer protein, membrane-associated 2	5
PITPNM3	83394	PITPNM family member 3	5
PKLR	5313	Pyruvate kinase, liver and RBC	5
PPT1	5538	Palmitoyl-protein thioesterase 1 (ceroid-lipofuscinosis, neuronal 1, infantile)	4
PPT2	9374	Palmitoyl-protein thioesterase 2	5
PRDX1	5052	Peroxiredoxin 1	5
PRICKLE1	144165	Prickle homolog 1 (Drosophila)	5
PRKAG3	53632	Protein kinase, AMP-activated, gamma 3 non-catalytic subunit	4
PRKY	5616	Protein kinase, Y-linked	4
PRODH	5625	Proline dehydrogenase (oxidase) 1	5
PRPF19	27339	PRP19/PSO4 pre-mRNA processing factor 19 homolog (S. cerevisiae)	5
PTK9	5756	PTK9 protein tyrosine kinase 9	4
RAB7B	338382	RAB7B, member RAS oncogene family	4
RAI17	57178	retinoic acid induced 17	5
RAP1A	5906	RAP1A, member of RAS oncogene family	5

RAP1GDS1	5910	RAP1, GTP-GDP dissociation stimulator 1	5
RBJ	51277	Rab and DnaJ domain containing	5
RCN1	5954	Reticulocalbin 1, EF-hand calcium binding domain	5
RCN2	5955	Reticulocalbin 2, EF-hand calcium binding domain	5
RCN3	57333	Reticulocalbin 3, EF-hand calcium binding domain	4
RDH11	51109	Retinol dehydrogenase 11 (all-trans/9-cis/11-cis)	5
RDH14	57665	Retinol dehydrogenase 14 (all-trans/9-cis/11-cis)	4
RDH8	50700	Retinol dehydrogenase 8 (all-trans)	5
RFXDC1	222546	Regulatory factor X domain containing 1	5
RGS11	8786	Regulator of G-protein signaling 11	5
RGS12	6002	Regulator of G-protein signaling 12	3
RGS14	10636	Regulator of G-protein signaling 14	3
RGS16	6004	Regulator of G-protein signaling 16	4
RGS20	8601	Regulator of G-protein signaling 20	5
RGS4	5999	Regulator of G-protein signaling 4	4
RGS5	8490	Regulator of G-protein signaling 5	5
RGS6	9628	Regulator of G-protein signaling 6	4
RGS7	6000	Regulator of G-protein signaling 7	5
RGS9	8787	Regulator of G-protein signaling 9	5
RIPK2	8767	Receptor-interacting serine-threonine kinase 2	5
RNF135	84282	Ring finger protein 135	5
RNF146	81847	Ring finger protein 146	5
RNF170	81790	Ring finger protein 170	5
RNF185	91445	Ring finger protein 185	4
ROM1	6094	Retinal outer segment membrane protein 1	3
RP11-38O23.2	389852	PNPK6288	5
RPS6KA2	6196	Ribosomal protein S6 kinase, 90kDa, polypeptide 2	4
RPSA	3921	Ribosomal protein SA	5
RSPRY1	89970	Ring finger and SPRY domain containing 1	5
SCAP1	8631	src family associated phosphop	5
SCAP2	8935	src family associated phosphop	5
SCARB2	950	Scavenger receptor class B, member 2	5
SDHA	6389	Succinate dehydrogenase complex, subunit A, flavoprotein (Fp)	5
SDHACL	340026	succinate dehydrogenase comple	5
SDHB	6390	Succinate dehydrogenase complex, subunit B, iron sulfur (Ip)	5
SDHC	6391	Succinate dehydrogenase complex, subunit C, integral membrane protein, 15kDa	5
SERPINA1	5265	Serpin peptidase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 1	5
SF3A1	10291	Splicing factor 3a, subunit 1, 120kDa	5

SF3B2	10992	Splicing factor 3b, subunit 2, 145kDa	5
SFRS4	6429	Splicing factor, arginine/serine-rich 4	5
SFRS6	6431	Splicing factor, arginine/serine-rich 6	5
SFRS9	8683	Splicing factor, arginine/serine-rich 9	5
SFTPD	6441	Surfactant, pulmonary-associated protein D	5
SIRPB1	10326	Signal-regulatory protein beta 1	5
SIRPG	55423	Signal-regulatory protein gamma	5
SNRPA	6626	Small nuclear ribonucleoprotein polypeptide A	5
SORD	6652	Sorbitol dehydrogenase	5
SOX18	54345	SRY (sex determining region Y)-box 18	4
SOX30	11063	SRY (sex determining region Y)-box 30	5
SPRYD5	84767	SPRY domain containing 5	5
SRD5A1	6715	Steroid-5-alpha-reductase, alpha polypeptide 1 (3-oxo-5 alpha-steroid delta 4-dehydrogen	5
SRD5A2	6716	Steroid-5-alpha-reductase, alpha polypeptide 2 (3-oxo-5 alpha-steroid delta 4-dehydrogen	5
SYVN1	84447	Synovial apoptosis inhibitor 1, synoviolin	3
TCEA2	6919	Transcription elongation factor A (SII), 2	4
TCEA3	6920	Transcription elongation factor A (SII), 3	5
TGFA	7039	Transforming growth factor, alpha	5
THOC2	57187	THO complex 2	4
TK2	7084	Thymidine kinase 2, mitochondrial	2
TPM3	7170	Tropomyosin 3	5
TRIM15	89870	Tripartite motif-containing 15	4
TRIM34	53840	Tripartite motif-containing 34	4
TRIM4	89122	Tripartite motif-containing 4	5
TRIM41	90933	Tripartite motif-containing 41	5
TRIM47	91107	Tripartite motif-containing 47	5
TRIM5	85363	Tripartite motif-containing 5	3
TRIM52	84851	Tripartite motif-containing 52	5
TRIM55	84675	Tripartite motif-containing 55	5
TSLP	85480	Thymic stromal lymphopoietin	5
TTK	7272	TTK protein kinase	3
UGDH	7358	UDP-glucose dehydrogenase	5
UGT1A1	54658	UDP glycosyltransferase 1 fami	5
VAMP3	9341	Vesicle-associated membrane protein 3 (cellubrevin)	5
VN1R2	317701	Vomeronasal 1 receptor 2	5
VN1R3	317702	Vomeronasal 1 receptor 3	5
VN1R4	317703	Vomeronasal 1 receptor 4	5
VN1R5	317705	Vomeronasal 1 receptor 5	5

WAS	7454	Wiskott-Aldrich syndrome (eczema-thrombocytopenia)	5
WASPIP	7456	Wiskott-Aldrich syndrome prote	5
WIRE	147179	WIRE protein	5
XCR1	2829	Chemokine (C motif) receptor 1	4
XDH	7498	Xanthine dehydrogenase	4
XPR1	9213	Xenotropic and polytropic retrovirus receptor	5
YWHAZ	7534	Tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, zeta polypep	5
ZCCHC3	85364	Zinc finger, CCHC domain containing 3	5
ZCCHC7	84186	Zinc finger, CCHC domain containing 7	5
ZCCHC9	84240	Zinc finger, CCHC domain containing 9	4
ZNF248	57209	Zinc finger protein 248	5
ZNF419A	79744	zinc finger protein 419	5

POOL 2

Symbol	NCBI Gene ID	Description	Number of shRNAs
AAK1	22848	AP2 associated kinase 1	5
ABL1	25	V-abl Abelson murine leukemia viral oncogene homolog 1	4
ABL2	27	V-abl Abelson murine leukemia viral oncogene homolog 2 (arg, Abelson-related gene)	5
ACACB	32	Acetyl-Coenzyme A carboxylase beta	4
ACP1	52	Acid phosphatase 1, soluble	5
ACPP	55	Acid phosphatase, prostate	4
ACVR1B	91	Activin A receptor, type IB	5
ADCYAP1R1	117	Adenylate cyclase activating polypeptide 1 (pituitary) receptor type I	4
ADH5P4	285802	alcohol dehydrogenase 5B	5
ADMR	11318	adrenomedullin receptor	4
ADORA1	134	Adenosine A1 receptor	5
ADORA2A	135	Adenosine A2a receptor	5
ADORA3	140	Adenosine A3 receptor	5
ADRA1A	148	Adrenergic, alpha-1A-, receptor	5
ADRA1B	147	Adrenergic, alpha-1B-, receptor	5
ADRA1D	146	Adrenergic, alpha-1D-, receptor	4
ADRA2A	150	Adrenergic, alpha-2A-, receptor	4
ADRA2B	151	Adrenergic, alpha-2B-, receptor	5
ADRA2C	152	Adrenergic, alpha-2C-, receptor	4
ADRB1	153	Adrenergic, beta-1-, receptor	5
ADRB2	154	Adrenergic, beta-2-, receptor, surface	4
ADRB3	155	Adrenergic, beta-3-, receptor	5
ADRBK2	157	Adrenergic, beta, receptor kinase 2	4

AGTR1	185	Angiotensin II receptor, type 1	5
AGTR2	186	Angiotensin II receptor, type 2	4
AGTRL1	187	Angiotensin II receptor-like 1	5
AKAP11	11215	A kinase (PRKA) anchor protein 11	5
AKAP5	9495	A kinase (PRKA) anchor protein 5	4
AKT3	10000	V-akt murine thymoma viral oncogene homolog 3 (protein kinase B, gamma)	5
ALS2CR7	65061	amyotrophic lateral sclerosis	5
AMFR	267	Autocrine motility factor receptor	3
AMHR2	269	Anti-Mullerian hormone receptor, type II	5
AMPH	273	Amphiphysin	4
ANAPC10	10393	Anaphase promoting complex subunit 10	4
ANAPC2	29882	Anaphase promoting complex subunit 2	4
ANAPC4	29945	Anaphase promoting complex subunit 4	5
ANAPC5	51433	Anaphase promoting complex subunit 5	5
ANKK1	255239	Ankyrin repeat and kinase domain containing 1	3
ANUBL1	93550	AN1, ubiquitin-like, homolog (<i>Xenopus laevis</i>)	5
APOB	338	Apolipoprotein B (including Ag(x) antigen)	5
APOE	348	Apolipoprotein E	3
AR	367	Androgen receptor (dihydrotestosterone receptor; testicular feminization; spinal and bulba	5
ARHGAP29	9411	Rho GTPase activating protein 29	5
ARHGDI1A	396	Rho GDP dissociation inhibitor (GDI) alpha	4
ARHGEF2	9181	Rho/rac guanine nucleotide exchange factor (GEF) 2	4
ARNT	405	Aryl hydrocarbon receptor nuclear translocator	5
ATG7	10533	ATG7 autophagy related 7 homolog (<i>S. cerevisiae</i>)	5
ATXN1	6310	Ataxin 1	5
AUP1	550	Ancient ubiquitous protein 1	4
AURKC	6795	Aurora kinase C	4
AVPR1A	552	Arginine vasopressin receptor 1A	4
AVPR1B	553	Arginine vasopressin receptor 1B	3
AVPR2	554	Arginine vasopressin receptor 2 (nephrogenic diabetes insipidus)	4
AXL	558	AXL receptor tyrosine kinase	5
BAI1	575	Brain-specific angiogenesis inhibitor 1	4
BAI2	576	Brain-specific angiogenesis inhibitor 2	5
BAI3	577	Brain-specific angiogenesis inhibitor 3	5
BARD1	580	BRCA1 associated RING domain 1	5
BCL2L11	10018	BCL2-like 11 (apoptosis facilitator)	4
BDKRB1	623	Bradykinin receptor B1	5
BDKRB2	624	Bradykinin receptor B2	5

BIRC2	329	Baculoviral IAP repeat-containing 2	5
BIRC3	330	Baculoviral IAP repeat-containing 3	5
BIRC4	331	Baculoviral IAP repeat-containing 4	4
BIRC6	57448	Baculoviral IAP repeat-containing 6 (apollon)	5
BLM	641	Bloom syndrome	5
BLR1	643	Burkitt lymphoma receptor 1, GTP binding protein (chemokine (C-X-C motif) receptor 5)	5
BMP1	649	Bone morphogenetic protein 1	5
BNIP3	664	BCL2/adenovirus E1B 19kDa interacting protein 3	5
BNIP3L	665	BCL2/adenovirus E1B 19kDa interacting protein 3-like	5
BRAP	8315	BRCA1 associated protein	5
BRS3	680	Bombesin-like receptor 3	5
BRSK1	84446	BR serine/threonine kinase 1	5
BTG1	694	B-cell translocation gene 1, anti-proliferative	5
BTG2	7832	BTG family, member 2	5
C1R	715	Complement component 1, r subcomponent	5
C1S	716	Complement component 1, s subcomponent	5
C2	717	Complement component 2	5
C21orf6	10069	chromosome 21 open reading fra	5
C3AR1	719	Complement component 3a receptor 1	4
C3orf29	64419	hypothetical protein FLJ22405	4
C3orf48	151649	Chromosome 3 open reading frame 48	5
C6orf218	221718	Chromosome 6 open reading frame 218	5
CAMK1D	57118	Calcium/calmodulin-dependent protein kinase ID	5
CAMK1G	57172	Calcium/calmodulin-dependent protein kinase IG	5
CAMKK1	84254	Calcium/calmodulin-dependent protein kinase kinase 1, alpha	5
CAMKK2	10645	Calcium/calmodulin-dependent protein kinase kinase 2, beta	5
CAND1	55832	Cullin-associated and neddylation-dissociated 1	5
CAPN1	823	Calpain 1, (mu/I) large subunit	5
CAPN2	824	Calpain 2, (m/II) large subunit	5
CAPN3	825	Calpain 3, (p94)	5
CAPN6	827	Calpain 6	5
CAPNS1	826	Calpain, small subunit 1	5
CARM1	10498	Coactivator-associated arginine methyltransferase 1	4
CASP1	834	Caspase 1, apoptosis-related cysteine peptidase (interleukin 1, beta, convertase)	3
CASP10	843	Caspase 10, apoptosis-related cysteine peptidase	5
CASP2	835	Caspase 2, apoptosis-related cysteine peptidase (neural precursor cell expressed, develo	5
CASP3	836	Caspase 3, apoptosis-related cysteine peptidase	4
CASP4	837	Caspase 4, apoptosis-related cysteine peptidase	5

CASP5	838	Caspase 5, apoptosis-related cysteine peptidase	5
CASP6	839	Caspase 6, apoptosis-related cysteine peptidase	4
CASP7	840	Caspase 7, apoptosis-related cysteine peptidase	5
CASP8	841	Caspase 8, apoptosis-related cysteine peptidase	5
CASP9	842	Caspase 9, apoptosis-related cysteine peptidase	5
CAV1	857	Caveolin 1, caveolae protein, 22kDa	4
CBLB	868	Cas-Br-M (murine) ecotropic retroviral transforming sequence b	4
CBLC	23624	Cas-Br-M (murine) ecotropic retroviral transforming sequence c	3
CBX4	8535	Chromobox homolog 4 (Pc class homolog, Drosophila)	3
CC2D1A	54862	Coiled-coil and C2 domain containing 1A	5
CCNB1IP1	57820	Cyclin B1 interacting protein 1	5
CCND3	896	Cyclin D3	5
CCNF	899	Cyclin F	5
CCR2	1231	Chemokine (C-C motif) receptor 2	5
CCRK	23552	Cell cycle related kinase	4
CCRN4L	25819	CCR4 carbon catabolite repression 4-like (<i>S. cerevisiae</i>)	5
CD47	961	CD47 molecule	5
CD63	967	CD63 molecule	5
CD86	942	CD86 molecule	4
CDC14A	8556	CDC14 cell division cycle 14 homolog A (<i>S. cerevisiae</i>)	5
CDC14C	168448	CDC14 cell division cycle 14 homolog C (<i>S. cerevisiae</i>)	5
CDC20	991	Cell division cycle 20 homolog (<i>S. cerevisiae</i>)	5
CDC25A	993	Cell division cycle 25 homolog A (<i>S. pombe</i>)	3
CDC25B	994	Cell division cycle 25 homolog B (<i>S. pombe</i>)	5
CDC25C	995	Cell division cycle 25 homolog C (<i>S. pombe</i>)	4
CDC2L6	23097	Cell division cycle 2-like 6 (CDK8-like)	5
CDC40	51362	Cell division cycle 40 homolog (<i>S. cerevisiae</i>)	5
CDC42BPA	8476	CDC42 binding protein kinase alpha (DMPK-like)	5
CDC7	8317	Cell division cycle 7 homolog (<i>S. cerevisiae</i>)	5
CDCA8	55143	Cell division cycle associated 8	5
CDKL3	51265	Cyclin-dependent kinase-like 3	5
CDKL5	6792	Cyclin-dependent kinase-like 5	5
CDKN3	1033	Cyclin-dependent kinase inhibitor 3 (CDK2-associated dual specificity phosphatase)	5
CEBPG	1054	CCAAT/enhancer binding protein (C/EBP), gamma	4
CFB	629	Complement factor B	5
CFLAR	8837	CASP8 and FADD-like apoptosis regulator	5
CHD1L	9557	Chromodomain helicase DNA binding protein 1-like	4
CHFR	55743	Checkpoint with forkhead and ring finger domains	5

CILP	8483	Cartilage intermediate layer protein, nucleotide pyrophosphohydrolase	5
CLK4	57396	CDC-like kinase 4	4
CMA1	1215	Chymase 1, mast cell	5
COL3A1	1281	Collagen, type III, alpha 1 (Ehlers-Danlos syndrome type IV, autosomal dominant)	5
COL6A3	1293	Collagen, type VI, alpha 3	5
COL7A1	1294	Collagen, type VII, alpha 1 (epidermolysis bullosa, dystrophic, dominant and recessive)	4
COPS8	10920	COP9 constitutive photomorphogenic homolog subunit 8 (Arabidopsis)	5
CPNE2	221184	Copine II	4
CPT2	1376	Carnitine palmitoyltransferase II	5
CREB5	9586	CAMP responsive element binding protein 5	4
CRKRS	51755	Cdc2-related kinase, arginine/serine-rich	5
CRYAB	1410	Crystallin, alpha B	3
CSF1R	1436	Colony stimulating factor 1 receptor, formerly McDonough feline sarcoma viral (v-fms) onc	3
CSNK1D	1453	Casein kinase 1, delta	4
CSNK2A1	1457	Casein kinase 2, alpha 1 polypeptide	3
CSNK2B	1460	Casein kinase 2, beta polypeptide	4
CST5	1473	Cystatin D	5
CST6	1474	Cystatin E/M	3
CTDP1	9150	CTD (carboxy-terminal domain, RNA polymerase II, polypeptide A) phosphatase, subunit	4
CTNNB1	1499	Catenin (cadherin-associated protein), beta 1, 88kDa	4
CTRL	1506	Chymotrypsin-like	5
CTSB	1508	Cathepsin B	5
CTSC	1075	Cathepsin C	5
CTSD	1509	Cathepsin D	5
CTSE	1510	Cathepsin E	4
CTSG	1511	Cathepsin G	5
CTSH	1512	Cathepsin H	4
CTSK	1513	Cathepsin K	5
CTSL	1514	cathepsin L	5
CTSL2	1515	Cathepsin L2	4
CTSS	1520	Cathepsin S	5
CTSW	1521	Cathepsin W	5
CTSZ	1522	Cathepsin Z	4
CUEDC1	404093	CUE domain containing 1	5
CUL1	8454	Cullin 1	4
CXCL12	6387	Chemokine (C-X-C motif) ligand 12 (stromal cell-derived factor 1)	5
CXCR4	7852	Chemokine (C-X-C motif) receptor 4	5
DAB2IP	153090	DAB2 interacting protein	5

DAPK2	23604	Death-associated protein kinase 2	5
DAPP1	27071	Dual adaptor of phosphotyrosine and 3-phosphoinositides	5
DARC	2532	Duffy blood group, chemokine receptor	5
DAXX	1616	Death-associated protein 6	5
DCAMKL1	9201	doublecortin and CaM kinase-li	5
DCAMKL2	166614	hypothetical protein MGC45428	5
DDR2	4921	Discoidin domain receptor family, member 2	5
DDX20	11218	DEAD (Asp-Glu-Ala-Asp) box polypeptide 20	5
DDX41	51428	DEAD (Asp-Glu-Ala-Asp) box polypeptide 41	5
DDX46	9879	DEAD (Asp-Glu-Ala-Asp) box polypeptide 46	5
DDX5	1655	DEAD (Asp-Glu-Ala-Asp) box polypeptide 5	5
DFFA	1676	DNA fragmentation factor, 45kDa, alpha polypeptide	4
DFFB	1677	DNA fragmentation factor, 40kDa, beta polypeptide (caspase-activated DNase)	4
DGKH	160851	Diacylglycerol kinase, eta	5
DHRS4L2	317749	Dehydrogenase/reductase (SDR family) member 4 like 2	5
DHRSX	207063	Dehydrogenase/reductase (SDR family) X-linked	5
DHX16	8449	DEAH (Asp-Glu-Ala-His) box polypeptide 16	5
DHX35	60625	DEAH (Asp-Glu-Ala-His) box polypeptide 35	5
DHX38	9785	DEAH (Asp-Glu-Ala-His) box polypeptide 38	5
DHX9	1660	DEAH (Asp-Glu-Ala-His) box polypeptide 9	5
DIABLO	56616	Diablo homolog (Drosophila)	5
DNAJC6	9829	DnaJ (Hsp40) homolog, subfamily C, member 6	4
DNM1L	10059	Dynamin 1-like	3
DTX2	113878	Deltex homolog 2 (Drosophila)	4
DUSP1	1843	Dual specificity phosphatase 1	5
DUSP11	8446	Dual specificity phosphatase 11 (RNA/RNP complex 1-interacting)	5
DUSP13	51207	Dual specificity phosphatase 13	5
DUSP15	128853	Dual specificity phosphatase 15	5
DUSP18	150290	Dual specificity phosphatase 18	5
DUSP19	142679	Dual specificity phosphatase 19	5
DUSP26	78986	Dual specificity phosphatase 26 (putative)	5
DUSP5	1847	Dual specificity phosphatase 5	4
DUSP6	1848	Dual specificity phosphatase 6	3
DUSP7	1849	Dual specificity phosphatase 7	3
DUSP9	1852	Dual specificity phosphatase 9	3
DYRK1B	9149	Dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 1B	5
EDD1	51366	E3 identified by differential	5
EDN1	1906	Endothelin 1	5

EGLN1	54583	Egl nine homolog 1 (<i>C. elegans</i>)	4
EGLN3	112399	Egl nine homolog 3 (<i>C. elegans</i>)	5
EIF2AK2	5610	Eukaryotic translation initiation factor 2-alpha kinase 2	5
EIF2AK3	9451	Eukaryotic translation initiation factor 2-alpha kinase 3	5
EIF2C1	26523	Eukaryotic translation initiation factor 2C, 1	5
EIF2C2	27161	Eukaryotic translation initiation factor 2C, 2	4
EIF2C3	192669	Eukaryotic translation initiation factor 2C, 3	4
EIF2C4	192670	Eukaryotic translation initiation factor 2C, 4	4
ELA1	1990	Elastase 1, pancreatic	4
ELA2	1991	Elastase 2, neutrophil	4
ELOVL2	54898	Elongation of very long chain fatty acids (FEN1/Elo2, SUR4/Elo3, yeast)-like 2	5
ELP3	55140	Elongation protein 3 homolog (<i>S. cerevisiae</i>)	5
ELP4	26610	Elongation protein 4 homolog (<i>S. cerevisiae</i>)	5
ELTD1	64123	EGF, latrophilin and seven transmembrane domain containing 1	5
EMR3	84658	Egf-like module containing, mucin-like, hormone receptor-like 3	5
ENPP1	5167	Ectonucleotide pyrophosphatase/phosphodiesterase 1	5
ENPP7	339221	Ectonucleotide pyrophosphatase/phosphodiesterase 7	4
EPAS1	2034	Endothelial PAS domain protein 1	5
EPHA6	285220	EPH receptor A6	5
EPHA8	2046	EPH receptor A8	5
EPHB4	2050	EPH receptor B4	4
EPHB6	2051	EPH receptor B6	3
EPM2A	7957	Epilepsy, progressive myoclonus type 2A, Lafora disease (laforin)	5
ERBB4	2066	V-erb-a erythroblastic leukemia viral oncogene homolog 4 (avian)	5
ERCC8	1161	Excision repair cross-complementing rodent repair deficiency, complementation group 8	5
ESR1	2099	Estrogen receptor 1	4
ESR2	2100	Estrogen receptor 2 (ER beta)	4
ETV6	2120	Ets variant gene 6 (TEL oncogene)	5
EVI1	2122	Ecotropic viral integration site 1	5
EZH1	2145	Enhancer of zeste homolog 1 (<i>Drosophila</i>)	4
F2	2147	Coagulation factor II (thrombin)	5
F2R	2149	Coagulation factor II (thrombin) receptor	5
F2RL3	9002	Coagulation factor II (thrombin) receptor-like 3	3
FAF1	11124	Fas (TNFRSF6) associated factor 1	5
FAM62A	23344	Family with sequence similarity 62 (C2 domain containing), member A	5
FASN	2194	Fatty acid synthase	5
FAU	2197	Finkel-Biskis-Reilly murine sarcoma virus (FBR-MuSV) ubiquitously expressed	3
FBXL2	25827	F-box and leucine-rich repeat protein 2	5

FBXL21	26223	F-box and leucine-rich repeat protein 21	4
FBXL3	26224	F-box and leucine-rich repeat protein 3	5
FBXL5	26234	F-box and leucine-rich repeat protein 5	5
FBXL6	26233	F-box and leucine-rich repeat protein 6	5
FBXO11	80204	F-box protein 11	5
FBXO2	26232	F-box protein 2	3
FBXO22	26263	F-box protein 22	4
FBXO24	26261	F-box protein 24	5
FBXO25	26260	F-box protein 25	5
FBXO27	126433	F-box protein 27	4
FBXO3	26273	F-box protein 3	5
FBXO5	26271	F-box protein 5	5
FBXO6	26270	F-box protein 6	4
FBXO7	25793	F-box protein 7	5
FBXW11	23291	F-box and WD repeat domain containing 11	5
FBXW4	6468	F-box and WD repeat domain containing 4	2
FBXW5	54461	F-box and WD repeat domain containing 5	3
FBXW8	26259	F-box and WD repeat domain containing 8	5
FER	2241	Fer (fps/fes related) tyrosine kinase (phosphoprotein NCP94)	5
FGF2	2247	Fibroblast growth factor 2 (basic)	5
FGR	2268	Gardner-Rasheed feline sarcoma viral (v-fgr) oncogene homolog	5
FKBP8	23770	FK506 binding protein 8, 38kDa	4
FLJ23356	84197	Hypothetical protein FLJ23356	5
FLJ25006	124923	Hypothetical protein FLJ25006	4
FLJ35834	154865	hypothetical protein FLJ35834	4
FLJ40125	147699	Hypothetical protein FLJ40125	3
FMNL1	752	Formin-like 1	5
FPR1	2357	Formyl peptide receptor 1	5
FPRL1	2358	Formyl peptide receptor-like 1	5
FPRL2	2359	Formyl peptide receptor-like 2	4
FSHR	2492	Follicle stimulating hormone receptor	5
FTS	64400	fused toes homolog (mouse)	5
FUS	2521	Fusion (involved in t(12;16) in malignant liposarcoma)	4
FXR2	9513	Fragile X mental retardation, autosomal homolog 2	5
FYN	2534	FYN oncogene related to SRC, FGR, YES	5
FZD1	8321	Frizzled homolog 1 (Drosophila)	5
FZD10	11211	Frizzled homolog 10 (Drosophila)	5
FZD2	2535	Frizzled homolog 2 (Drosophila)	4

FZD3	7976	Frizzled homolog 3 (Drosophila)	5
FZD4	8322	Frizzled homolog 4 (Drosophila)	5
FZD5	7855	Frizzled homolog 5 (Drosophila)	4
FZD6	8323	Frizzled homolog 6 (Drosophila)	5
FZD7	8324	Frizzled homolog 7 (Drosophila)	5
FZD8	8325	Frizzled homolog 8 (Drosophila)	5
FZD9	8326	Frizzled homolog 9 (Drosophila)	5
FZR1	51343	Fizzy/cell division cycle 20 related 1 (Drosophila)	2
GABBR1	2550	Gamma-aminobutyric acid (GABA) B receptor, 1	5
GAK	2580	Cyclin G associated kinase	5
GALR1	2587	Galanin receptor 1	5
GALR2	8811	Galanin receptor 2	5
GCGR	2642	Glucagon receptor	4
GCM2	9247	Glial cells missing homolog 2 (Drosophila)	5
GCNT2	2651	Glucosaminyl (N-acetyl) transferase 2, I-branching enzyme (I blood group)	5
GEMIN4	50628	Gem (nuclear organelle) associated protein 4	5
GHRHR	2692	Growth hormone releasing hormone receptor	5
GHSR	2693	Growth hormone secretagogue receptor	5
GIPR	2696	Gastric inhibitory polypeptide receptor	5
GIT1	28964	G protein-coupled receptor kinase interactor 1	4
GIT2	9815	G protein-coupled receptor kinase interactor 2	5
GMFB	2764	Glia maturation factor, beta	5
GMFG	9535	Glia maturation factor, gamma	4
GNLY	10578	Granulysin	5
GPR109A	338442	G protein-coupled receptor 109A	4
GPR132	29933	G protein-coupled receptor 132	4
GPR155	151556	G protein-coupled receptor 155	4
GPR156	165829	G protein-coupled receptor 156	5
GPR157	80045	G protein-coupled receptor 157	4
GPR172A	79581	G protein-coupled receptor 172A	4
GPR172B	55065	G protein-coupled receptor 172B	5
GPR174	84636	G protein-coupled receptor 174	5
GPR37L1	9283	G protein-coupled receptor 37 like 1	5
GRK1	6011	G protein-coupled receptor kinase 1	4
GRK6	2870	G protein-coupled receptor kinase 6	3
GRK7	131890	G protein-coupled receptor kinase 7	4
GSC	145258	Goosecoid homeobox	5
GTF2IRD1	9569	GTF2I repeat domain containing 1	4

GUCY2C	2984	Guanylate cyclase 2C (heat stable enterotoxin receptor)	5
HACE1	57531	HECT domain and ankyrin repeat containing, E3 ubiquitin protein ligase 1	5
HADH	3033	Hydroxyacyl-Coenzyme A dehydrogenase	5
HADHB	3032	Hydroxyacyl-Coenzyme A dehydrogenase/3-ketoacyl-Coenzyme A thiolase/enoyl-Coenzym	5
HECTD1	25831	HECT domain containing 1	5
HECTD2	143279	HECT domain containing 2	5
HECW1	23072	HECT, C2 and WW domain containing E3 ubiquitin protein ligase 1	2
HERC5	51191	Hect domain and RLD 5	4
HERPUD1	9709	Homocysteine-inducible, endoplasmic reticulum stress-inducible, ubiquitin-like domain me	4
HERPUD2	64224	HERPUD family member 2	5
HGF	3082	Hepatocyte growth factor (hepapoietin A; scatter factor)	10
HIF1A	3091	Hypoxia-inducible factor 1, alpha subunit (basic helix-loop-helix transcription factor)	4
HIF3A	64344	Hypoxia inducible factor 3, alpha subunit	4
HIPK1	204851	Homeodomain interacting protein kinase 1	5
HIPK2	28996	Homeodomain interacting protein kinase 2	4
HIPK3	10114	Homeodomain interacting protein kinase 3	5
HNRPA2B1	3181	heterogeneous nuclear ribonucleoprotein	4
HNRPA3P1	10151	Heterogeneous nuclear ribonucleoprotein A3 pseudogene 1	4
HNRPD	3184	Heterogeneous nuclear ribonucleoprotein D (AU-rich element RNA binding protein 1, 37kD	5
HNRPF	3185	Heterogeneous nuclear ribonucleoprotein F	5
HNRPM	4670	Heterogeneous nuclear ribonucleoprotein M	5
HNRPR	10236	heterogeneous nuclear ribonucleoprotein	5
HNRPU	3192	heterogeneous nuclear ribonucleoprotein	5
HRASLS	57110	HRAS-like suppressor	4
HSD11B1	3290	Hydroxysteroid (11-beta) dehydrogenase 1	4
HSD11B2	3291	Hydroxysteroid (11-beta) dehydrogenase 2	5
HSD17B1	3292	Hydroxysteroid (17-beta) dehydrogenase 1	4
HSD17B13	345275	short-chain dehydrogenase/redu	5
HSP90AA1	3320	Heat shock protein 90kDa alpha (cytosolic), class A member 1	4
HSPA5	3309	Heat shock 70kDa protein 5 (glucose-regulated protein, 78kDa)	3
HSPB2	3316	Heat shock 27kDa protein 2	4
HUNK	30811	Hormonally upregulated Neu-associated kinase	5
IHPK1	9807	Inositol hexaphosphate kinase 1	5
ILKAP	80895	Integrin-linked kinase-associated serine/threonine phosphatase 2C	5
ILVBL	10994	IlvB (bacterial acetolactate synthase)-like	4
IMPACT	55364	Impact homolog (mouse)	5
INPP4A	3631	Inositol polyphosphate-4-phosphatase, type I, 107kDa	5
INSRR	3645	Insulin receptor-related receptor	4

INTS6	26512	Integrator complex subunit 6	5
IRAK4	51135	Interleukin-1 receptor-associated kinase 4	4
ITCH	83737	Itchy homolog E3 ubiquitin protein ligase (mouse)	4
ITGAV	3685	Integrin, alpha V (vitronectin receptor, alpha polypeptide, antigen CD51)	3
ITGB3	3690	Integrin, beta 3 (platelet glycoprotein IIIa, antigen CD61)	5
ITSN1	6453	Intersectin 1 (SH3 domain protein)	4
ITSN2	50618	Intersectin 2	5
JAK1	3716	Janus kinase 1 (a protein tyrosine kinase)	4
JAK2	3717	Janus kinase 2 (a protein tyrosine kinase)	5
JMJD2A	9682	Jumonji domain containing 2A	5
KALRN	8997	Kalirin, RhoGEF kinase	5
KDR	3791	Kinase insert domain receptor (a type III receptor tyrosine kinase)	5
KIAA0317	9870	KIAA0317	4
KIAA1333	55632	KIAA1333	5
KIAA1706	80820	KIAA1706 protein	4
KIAA1804	84451	Mixed lineage kinase 4	5
Kua-UEV	387522	ubiquitin-conjugating enzyme E	5
LATS1	9113	LATS, large tumor suppressor, homolog 1 (Drosophila)	5
LCK	3932	Lymphocyte-specific protein tyrosine kinase	5
LITAF	9516	Lipopolysaccharide-induced TNF factor	3
LNX2	222484	Ligand of numb-protein X 2	4
LOC220729	220729	Succinate dehydrogenase complex, subunit A, flavoprotein pseudogene	5
LOC221711	221711	hypothetical protein LOC221711	5
LOC346085	346085	Hypothetical LOC346085	5
LOC51035	51035	SAPK substrate protein 1	4
LONRF2	164832	LON peptidase N-terminal domain and ring finger 2	5
LTK	4058	Leukocyte tyrosine kinase	4
LUC7L	55692	LUC7-like (S. cerevisiae)	5
LUC7L2	51631	LUC7-like 2 (S. cerevisiae)	5
MAGED1	9500	Melanoma antigen family D, 1	5
MAK	4117	Male germ cell-associated kinase	5
MAML1	9794	Mastermind-like 1 (Drosophila)	5
MAP2K1	5604	Mitogen-activated protein kinase kinase 1	5
MAP2K4	6416	Mitogen-activated protein kinase kinase 4	5
MAP2K5	5607	Mitogen-activated protein kinase kinase 5	5
MAP2K7	5609	Mitogen-activated protein kinase kinase 7	2
MAP3K10	4294	Mitogen-activated protein kinase kinase kinase 10	4
MAP3K2	10746	Mitogen-activated protein kinase kinase kinase 2	5

MAP3K3	4215	Mitogen-activated protein kinase kinase kinase 3	4
MAP3K6	9064	Mitogen-activated protein kinase kinase kinase 6	5
MAP3K7	6885	Mitogen-activated protein kinase kinase kinase 7	5
MAP3K7IP2	23118	Mitogen-activated protein kinase kinase kinase 7 interacting protein 2	5
MAP4K1	11184	Mitogen-activated protein kinase kinase kinase kinase 1	5
MAP4K2	5871	Mitogen-activated protein kinase kinase kinase kinase 2	5
MAP4K5	11183	Mitogen-activated protein kinase kinase kinase kinase 5	5
MAPK10	5602	Mitogen-activated protein kinase 10	5
MAPK15	225689	Mitogen-activated protein kinase 15	3
MAPK4	5596	Mitogen-activated protein kinase 4	5
MAPK6	5597	Mitogen-activated protein kinase 6	4
MAPK7	5598	Mitogen-activated protein kinase 7	3
MAPK8	5599	Mitogen-activated protein kinase 8	3
MAPK8IP1	9479	Mitogen-activated protein kinase 8 interacting protein 1	4
MAPK9	5601	Mitogen-activated protein kinase 9	5
MAPKAP1	79109	Mitogen-activated protein kinase associated protein 1	4
MAPKAPK2	9261	Mitogen-activated protein kinase-activated protein kinase 2	5
MARK2	2011	MAP/microtubule affinity-regulating kinase 2	5
MARK3	4140	MAP/microtubule affinity-regulating kinase 3	4
MARK4	57787	MAP/microtubule affinity-regulating kinase 4	5
MAST2	23139	Microtubule associated serine/threonine kinase 2	4
MASTL	84930	Microtubule associated serine/threonine kinase-like	5
MATK	4145	Megakaryocyte-associated tyrosine kinase	5
MBIP	51562	MAP3K12 binding inhibitory protein 1	5
MCTP1	79772	Multiple C2 domains, transmembrane 1	5
MDM2	4193	Mdm2, transformed 3T3 cell double minute 2, p53 binding protein (mouse)	5
MDM4	4194	Mdm4, transformed 3T3 cell double minute 4, p53 binding protein (mouse)	4
MELK	9833	Maternal embryonic leucine zipper kinase	5
MGC42638	340561	hypothetical protein MGC42638	4
MIB1	57534	Mindbomb homolog 1 (Drosophila)	5
MKRN2	23609	Makorin, ring finger protein, 2	5
MLKL	197259	Mixed lineage kinase domain-like	5
MMP1	4312	Matrix metalloproteinase 1 (interstitial collagenase)	5
MMP3	4314	Matrix metalloproteinase 3 (stromelysin 1, progelatinase)	4
MORC1	27136	MORC family CW-type zinc finger 1	5
MORC3	23515	MORC family CW-type zinc finger 3	5
MOS	4342	V-mos Moloney murine sarcoma viral oncogene homolog	3
MST1R	4486	Macrophage stimulating 1 receptor (c-met-related tyrosine kinase)	5

MTM1	4534	Myotubularin 1	4
MTMR1	8776	Myotubularin related protein 1	5
MTMR2	8898	Myotubularin related protein 2	5
MTMR3	8897	Myotubularin related protein 3	5
MTMR4	9110	Myotubularin related protein 4	5
MTMR8	55613	Myotubularin related protein 8	5
MUSK	4593	Muscle, skeletal, receptor tyrosine kinase	4
MYD88	4615	Myeloid differentiation primary response gene (88)	4
MYO3A	53904	Myosin IIIA	5
MYO3B	140469	Myosin IIIB	5
NANOG	79923	Nanog homeobox	5
NCOA1	8648	Nuclear receptor coactivator 1	5
NEIL3	55247	Nei endonuclease VIII-like 3 (E. coli)	5
NEK10	152110	NIMA (never in mitosis gene a)- related kinase 10	5
NEK11	79858	NIMA (never in mitosis gene a)- related kinase 11	5
NEK3	4752	NIMA (never in mitosis gene a)-related kinase 3	5
NEK4	6787	NIMA (never in mitosis gene a)-related kinase 4	5
NEK6	10783	NIMA (never in mitosis gene a)-related kinase 6	5
NEK7	140609	NIMA (never in mitosis gene a)-related kinase 7	4
NFE2L3	9603	Nuclear factor (erythroid-derived 2)-like 3	5
NFKBIA	4792	Nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, alpha	4
NLK	51701	Nemo-like kinase	5
NOS2A	4843	Nitric oxide synthase 2A (inducible, hepatocytes)	5
NOTCH1	4851	Notch homolog 1, translocation-associated (Drosophila)	5
NOTCH2	4853	Notch homolog 2 (Drosophila)	5
NOVA1	4857	Neuro-oncological ventral antigen 1	4
NPR2	4882	Natriuretic peptide receptor B/guanylate cyclase B (atrionatriuretic peptide receptor B)	4
NQO1	1728	NAD(P)H dehydrogenase, quinone 1	5
NRBP1	29959	Nuclear receptor binding protein 1	5
NTRK1	4914	Neurotrophic tyrosine kinase, receptor, type 1	5
NTRK2	4915	Neurotrophic tyrosine kinase, receptor, type 2	5
NTRK3	4916	Neurotrophic tyrosine kinase, receptor, type 3	5
NUAK2	81788	NUAK family, SNF1-like kinase, 2	4
NUB1	51667	Negative regulator of ubiquitin-like proteins 1	4
NUMB	8650	Numb homolog (Drosophila)	5
NUPL1	9818	Nucleoporin like 1	5
NXF1	10482	Nuclear RNA export factor 1	4
OASL	8638	2'-5'-oligoadenylate synthetase-like	5

OGG1	4968	8-oxoguanine DNA glycosylase	5
ONECUT2	9480	One cut homeobox 2	4
OR7E5P	219445	Olfactory receptor, family 7, subfamily E, member 5 pseudogene	3
OTUB1	55611	OTU domain, ubiquitin aldehyde binding 1	5
OTUD7B	56957	OTU domain containing 7B	5
OCSR1	9943	Oxidative-stress responsive 1	4
P15RS	55197	Hypothetical protein FLJ10656	5
PAK1	5058	P21/Cdc42/Rac1-activated kinase 1 (STE20 homolog, yeast)	4
PAK1IP1	55003	PAK1 interacting protein 1	5
PAK2	5062	P21 (CDKN1A)-activated kinase 2	5
PAK3	5063	P21 (CDKN1A)-activated kinase 3	5
PAK6	56924	P21(CDKN1A)-activated kinase 6	5
PARC	23113	P53-associated parkin-like cytoplasmic protein	5
PARK7	11315	Parkinson disease (autosomal recessive, early onset) 7	5
PARP11	57097	Poly (ADP-ribose) polymerase family, member 11	4
PARP12	64761	Poly (ADP-ribose) polymerase family, member 12	5
PBK	55872	PDZ binding kinase	5
PCNA	5111	Proliferating cell nuclear antigen	4
PDGFRA	5156	Platelet-derived growth factor receptor, alpha polypeptide	5
PDGFRB	5159	Platelet-derived growth factor receptor, beta polypeptide	5
PDIK1L	149420	PDLIM1 interacting kinase 1 like	5
PDK2	5164	Pyruvate dehydrogenase kinase, isozyme 2	5
PDPK1	5170	3-phosphoinositide dependent protein kinase-1	5
PFTK1	5218	PFTAIRE protein kinase 1	5
PGR	5241	Progesterone receptor	4
PHGDHL1	337867	phosphoglycerate dehydrogenase	5
PIAS1	8554	Protein inhibitor of activated STAT, 1	4
PIAS4	51588	Protein inhibitor of activated STAT, 4	5
PIK3C2A	5286	Phosphoinositide-3-kinase, class 2, alpha polypeptide	5
PIK3C2B	5287	Phosphoinositide-3-kinase, class 2, beta polypeptide	5
PIK3C2G	5288	Phosphoinositide-3-kinase, class 2, gamma polypeptide	5
PIM2	11040	Pim-2 oncogene	5
PIN1	5300	Protein (peptidylprolyl cis/trans isomerase) NIMA-interacting 1	4
PIWIL1	9271	Piwi-like 1 (Drosophila)	5
PIWIL2	55124	Piwi-like 2 (Drosophila)	5
PJA1	64219	Praja 1	4
PJA2	9867	Praja 2, RING-H2 motif containing	5
PKIA	5569	Protein kinase (cAMP-dependent, catalytic) inhibitor alpha	5

PKIB	5570	Protein kinase (cAMP-dependent, catalytic) inhibitor beta	5
PKN1	5585	Protein kinase N1	5
PKN3	29941	Protein kinase N3	4
PLCB2	5330	Phospholipase C, beta 2	5
PLCD1	5333	Phospholipase C, delta 1	4
PLCG2	5336	Phospholipase C, gamma 2 (phosphatidylinositol-specific)	5
PLCL1	5334	Phospholipase C-like 1	4
PLCL2	23228	Phospholipase C-like 2	5
PLCZ1	89869	Phospholipase C, zeta 1	5
PLD1	5337	Phospholipase D1, phosphatidylcholine-specific	3
PLK4	10733	Polo-like kinase 4 (Drosophila)	5
PML	5371	Promyelocytic leukemia	5
POU5F1	5460	POU class 5 homeobox 1	5
PPAP2A	8611	Phosphatidic acid phosphatase type 2A	4
PPAP2C	8612	Phosphatidic acid phosphatase type 2C	5
PPARA	5465	Peroxisome proliferator-activated receptor alpha	5
PPARD	5467	Peroxisome proliferator-activated receptor delta	4
PPARG	5468	Peroxisome proliferator-activated receptor gamma	5
PPARGC1A	10891	Peroxisome proliferator-activated receptor gamma, coactivator 1 alpha	5
PPEF1	5475	Protein phosphatase, EF-hand calcium binding domain 1	5
PPEF2	5470	Protein phosphatase, EF-hand calcium binding domain 2	5
PPFIA1	8500	Protein tyrosine phosphatase, receptor type, f polypeptide (PTPRF), interacting protein (liprin beta 1)	5
PPFIA2	8499	Protein tyrosine phosphatase, receptor type, f polypeptide (PTPRF), interacting protein (liprin beta 1)	5
PPFIA3	8541	Protein tyrosine phosphatase, receptor type, f polypeptide (PTPRF), interacting protein (liprin beta 1)	5
PPFIBP1	8496	PTPRF interacting protein, binding protein 1 (liprin beta 1)	5
PPM1A	5494	Protein phosphatase 1A (formerly 2C), magnesium-dependent, alpha isoform	5
PPM1B	5495	Protein phosphatase 1B (formerly 2C), magnesium-dependent, beta isoform	4
PPM1D	8493	Protein phosphatase 1D magnesium-dependent, delta isoform	5
PPM1E	22843	Protein phosphatase 1E (PP2C domain containing)	5
PPM1F	9647	Protein phosphatase 1F (PP2C domain containing)	3
PPM1G	5496	Protein phosphatase 1G (formerly 2C), magnesium-dependent, gamma isoform	5
PPM1K	152926	Protein phosphatase 1K (PP2C domain containing)	5
PPM1L	151742	Protein phosphatase 1 (formerly 2C)-like	5
PPM1M	132160	Protein phosphatase 1M (PP2C domain containing)	4
PPM2C	54704	Protein phosphatase 2C, magnesium-dependent, catalytic subunit	5
PPME1	51400	Protein phosphatase methylesterase 1	4
PPP1CA	5499	Protein phosphatase 1, catalytic subunit, alpha isoform	5
PPP1CB	5500	Protein phosphatase 1, catalytic subunit, beta isoform	5

PPP1CC	5501	Protein phosphatase 1, catalytic subunit, gamma isoform	5
PPP1R10	5514	Protein phosphatase 1, regulatory (inhibitor) subunit 10	5
PPP1R11	6992	Protein phosphatase 1, regulatory (inhibitor) subunit 11	4
PPP1R12A	4659	Protein phosphatase 1, regulatory (inhibitor) subunit 12A	5
PPP1R12C	54776	Protein phosphatase 1, regulatory (inhibitor) subunit 12C	3
PPP1R13B	23368	Protein phosphatase 1, regulatory (inhibitor) subunit 13B	5
PPP1R14C	81706	Protein phosphatase 1, regulatory (inhibitor) subunit 14C	5
PPP1R14D	54866	Protein phosphatase 1, regulatory (inhibitor) subunit 14D	4
PPP1R15A	23645	Protein phosphatase 1, regulatory (inhibitor) subunit 15A	5
PPP1R15B	84919	Protein phosphatase 1, regulatory (inhibitor) subunit 15B	5
PPP1R16A	84988	Protein phosphatase 1, regulatory (inhibitor) subunit 16A	4
PPP1R1A	5502	Protein phosphatase 1, regulatory (inhibitor) subunit 1A	5
PPP1R2P9	80316	Protein phosphatase 1, regulatory (inhibitor) subunit 2 pseudogene 9	5
PPP1R3B	79660	Protein phosphatase 1, regulatory (inhibitor) subunit 3B	5
PPP1R3C	5507	Protein phosphatase 1, regulatory (inhibitor) subunit 3C	4
PPP1R7	5510	Protein phosphatase 1, regulatory (inhibitor) subunit 7	5
PPP1R8	5511	Protein phosphatase 1, regulatory (inhibitor) subunit 8	5
PPP1R9B	84687	Protein phosphatase 1, regulatory (inhibitor) subunit 9B	3
PPP2CA	5515	Protein phosphatase 2 (formerly 2A), catalytic subunit, alpha isoform	5
PPP2CB	5516	Protein phosphatase 2 (formerly 2A), catalytic subunit, beta isoform	5
PPP2R1A	5518	Protein phosphatase 2 (formerly 2A), regulatory subunit A , alpha isoform	2
PPP2R1B	5519	Protein phosphatase 2 (formerly 2A), regulatory subunit A, beta isoform	2
PPP2R2A	5520	Protein phosphatase 2 (formerly 2A), regulatory subunit B, alpha isoform	5
PPP2R4	5524	Protein phosphatase 2A activator, regulatory subunit 4	4
PPP2R5C	5527	Protein phosphatase 2, regulatory subunit B', gamma isoform	5
PPP2R5D	5528	Protein phosphatase 2, regulatory subunit B', delta isoform	4
PPP2R5E	5529	Protein phosphatase 2, regulatory subunit B', epsilon isoform	5
PPP3CA	5530	Protein phosphatase 3 (formerly 2B), catalytic subunit, alpha isoform	5
PPP3CB	5532	Protein phosphatase 3 (formerly 2B), catalytic subunit, beta isoform	5
PPP3R1	5534	Protein phosphatase 3 (formerly 2B), regulatory subunit B, alpha isoform	5
PPP4C	5531	Protein phosphatase 4 (formerly X), catalytic subunit	4
PPP5C	5536	Protein phosphatase 5, catalytic subunit	5
PPP6C	5537	Protein phosphatase 6, catalytic subunit	5
PPTC7	160760	PTC7 protein phosphatase homolog (S. cerevisiae)	5
PRKAA2	5563	Protein kinase, AMP-activated, alpha 2 catalytic subunit	5
PRKAB2	5565	Protein kinase, AMP-activated, beta 2 non-catalytic subunit	5
PRKACA	5566	Protein kinase, cAMP-dependent, catalytic, alpha	4
PRKACB	5567	Protein kinase, cAMP-dependent, catalytic, beta	5

PRKAG1	5571	Protein kinase, AMP-activated, gamma 1 non-catalytic subunit	5
PRKAG2	51422	Protein kinase, AMP-activated, gamma 2 non-catalytic subunit	5
PRKCA	5578	Protein kinase C, alpha	5
PRKCB1	5579	Protein kinase C, beta 1	4
PRKCG	5582	Protein kinase C, gamma	4
PRKCQ	5588	Protein kinase C, theta	5
PRKCZ	5590	Protein kinase C, zeta	5
PRKD1	5587	Protein kinase D1	5
PRKD2	25865	Protein kinase D2	4
PRKD3	23683	Protein kinase D3	5
PRKG2	5593	Protein kinase, cGMP-dependent, type II	5
PRKX	5613	Protein kinase, X-linked	4
PRPF31	26121	PRP31 pre-mRNA processing factor 31 homolog (<i>S. cerevisiae</i>)	5
PRSS7	5651	Protease, serine, 7 (enterokinase)	5
PSKH1	5681	Protein serine kinase H1	5
PSKH2	85481	Protein serine kinase H2	5
PSMA1	5682	Proteasome (prosome, macropain) subunit, alpha type, 1	5
PSMA2	5683	Proteasome (prosome, macropain) subunit, alpha type, 2	5
PSMA3	5684	Proteasome (prosome, macropain) subunit, alpha type, 3	4
PSMA4	5685	Proteasome (prosome, macropain) subunit, alpha type, 4	5
PSMA5	5686	Proteasome (prosome, macropain) subunit, alpha type, 5	5
PSMA7	5688	Proteasome (prosome, macropain) subunit, alpha type, 7	4
PSMB1	5689	Proteasome (prosome, macropain) subunit, beta type, 1	5
PSMB10	5699	Proteasome (prosome, macropain) subunit, beta type, 10	3
PSMB2	5690	Proteasome (prosome, macropain) subunit, beta type, 2	5
PSMB3	5691	Proteasome (prosome, macropain) subunit, beta type, 3	4
PSMB4	5692	Proteasome (prosome, macropain) subunit, beta type, 4	4
PSMB5	5693	Proteasome (prosome, macropain) subunit, beta type, 5	5
PSMB6	5694	Proteasome (prosome, macropain) subunit, beta type, 6	5
PSMB7	5695	Proteasome (prosome, macropain) subunit, beta type, 7	4
PSMB9	5698	Proteasome (prosome, macropain) subunit, beta type, 9 (large multifunctional peptidase 2)	5
PSMC2	5701	Proteasome (prosome, macropain) 26S subunit, ATPase, 2	5
PSMD11	5717	Proteasome (prosome, macropain) 26S subunit, non-ATPase, 11	5
PSMD4	5710	Proteasome (prosome, macropain) 26S subunit, non-ATPase, 4	3
PSMD9	5715	proteasome (prosome, macropain)	5
PSPH	5723	Phosphoserine phosphatase	5
PSTPIP1	9051	Proline-serine-threonine phosphatase interacting protein 1	4
PSTPIP2	9050	Proline-serine-threonine phosphatase interacting protein 2	5

PTBP1	5725	Polypyrimidine tract binding protein 1	2
PTBP2	58155	Polypyrimidine tract binding protein 2	5
PTEN	5728	Phosphatase and tensin homolog (mutated in multiple advanced cancers 1)	5
PTHHR1	5745	Parathyroid hormone receptor 1	4
PTK2	5747	PTK2 protein tyrosine kinase 2	5
PTN	5764	Pleiotrophin (heparin binding growth factor 8, neurite growth-promoting factor 1)	3
PTP4A1	7803	Protein tyrosine phosphatase type IVA, member 1	5
PTP4A2	8073	Protein tyrosine phosphatase type IVA, member 2	4
PTPDC1	138639	Protein tyrosine phosphatase domain containing 1	5
PTPLA	9200	Protein tyrosine phosphatase-like (proline instead of catalytic arginine), member A	5
PTPN1	5770	Protein tyrosine phosphatase, non-receptor type 1	4
PTPN12	5782	Protein tyrosine phosphatase, non-receptor type 12	5
PTPN13	5783	Protein tyrosine phosphatase, non-receptor type 13 (APO-1/CD95 (Fas)-associated phosphatase)	5
PTPN18	26469	Protein tyrosine phosphatase, non-receptor type 18 (brain-derived)	3
PTPN2	5771	Protein tyrosine phosphatase, non-receptor type 2	5
PTPN22	26191	Protein tyrosine phosphatase, non-receptor type 22 (lymphoid)	5
PTPN23	25930	Protein tyrosine phosphatase, non-receptor type 23	5
PTPN3	5774	Protein tyrosine phosphatase, non-receptor type 3	4
PTPN4	5775	Protein tyrosine phosphatase, non-receptor type 4 (megakaryocyte)	5
PTPN5	84867	Protein tyrosine phosphatase, non-receptor type 5 (striatum-enriched)	4
PTPN7	5778	Protein tyrosine phosphatase, non-receptor type 7	5
PTPN9	5780	Protein tyrosine phosphatase, non-receptor type 9	5
PTPRA	5786	Protein tyrosine phosphatase, receptor type, A	5
PTPRB	5787	Protein tyrosine phosphatase, receptor type, B	5
PTPRC	5788	Protein tyrosine phosphatase, receptor type, C	5
PTPRD	5789	Protein tyrosine phosphatase, receptor type, D	5
PTPRE	5791	Protein tyrosine phosphatase, receptor type, E	4
PTPRF	5792	Protein tyrosine phosphatase, receptor type, F	5
PTPRG	5793	Protein tyrosine phosphatase, receptor type, G	5
PTPRH	5794	Protein tyrosine phosphatase, receptor type, H	4
PTPRJ	5795	Protein tyrosine phosphatase, receptor type, J	4
PTPRK	5796	Protein tyrosine phosphatase, receptor type, K	5
PTPRM	5797	Protein tyrosine phosphatase, receptor type, M	5
PTPRN	5798	Protein tyrosine phosphatase, receptor type, N	5
PTPRN2	5799	Protein tyrosine phosphatase, receptor type, N polypeptide 2	5
PTPRO	5800	Protein tyrosine phosphatase, receptor type, O	5
PTPRR	5801	Protein tyrosine phosphatase, receptor type, R	4
PTPRS	5802	Protein tyrosine phosphatase, receptor type, S	5

PTPRZ1	5803	Protein tyrosine phosphatase, receptor-type, Z polypeptide 1	4
PXK	54899	PX domain containing serine/threonine kinase	5
PXMP3	5828	Peroxisomal membrane protein 3, 35kDa (Zellweger syndrome)	5
RAB11FIP5	26056	RAB11 family interacting protein 5 (class I)	4
RAB7	7879	RAB7, member RAS oncogene fami	5
RAD18	56852	RAD18 homolog (S. cerevisiae)	4
RAD23B	5887	RAD23 homolog B (S. cerevisiae)	5
RAF1	5894	V-raf-1 murine leukemia viral oncogene homolog 1	5
RAG1	5896	Recombination activating gene 1	4
RAGE	5891	Renal tumor antigen	5
RALY	22913	RNA binding protein, autoantigenic (hnRNP-associated with lethal yellow homolog (mouse	5
RANBP2	5903	RAN binding protein 2	5
RASA2	5922	RAS p21 protein activator 2	5
RASA3	22821	RAS p21 protein activator 3	5
RASAL2	9462	RAS protein activator like 2	3
RASSF5	83593	Ras association (RalGDS/AF-6) domain family 5	5
RB1CC1	9821	RB1-inducible coiled-coil 1	5
RBCK1	10616	RanBP-type and C3HC4-type zinc finger containing 1	5
RBM17	84991	RNA binding motif protein 17	4
RBM3	5935	RNA binding motif (RNP1, RRM) protein 3	5
RCHY1	25898	Ring finger and CHY zinc finger domain containing 1	4
RGS3	5998	Regulator of G-protein signaling 3	5
RHBDD3	25807	Rhomboid domain containing 3	4
RHO	6010	Rhodopsin (opsin 2, rod pigment) (retinitis pigmentosa 4, autosomal dominant)	5
RIMS1	22999	Regulating synaptic membrane exocytosis 1	5
RIMS2	9699	Regulating synaptic membrane exocytosis 2	5
RIPK3	11035	Receptor-interacting serine-threonine kinase 3	5
RKHD2	51320	ring finger and KH domain cont	5
RNF111	54778	Ring finger protein 111	5
RNF12	51132	Ring finger protein 12	5
RNF121	55298	Ring finger protein 121	5
RNF125	54941	Ring finger protein 125	5
RNF13	11342	Ring finger protein 13	5
RNF130	55819	Ring finger protein 130	5
RNF14	9604	Ring finger protein 14	3
RNF141	50862	Ring finger protein 141	5
RNF144	9781	ring finger protein 144	5
RNF152	220441	Ring finger protein 152	5

RNF166	115992	Ring finger protein 166	5
RNF167	26001	Ring finger protein 167	5
RNF175	285533	Ring finger protein 175	5
RNF186	54546	Ring finger protein 186	5
RNF24	11237	Ring finger protein 24	5
RNF25	64320	Ring finger protein 25	5
RNF38	152006	Ring finger protein 38	5
RNF43	54894	Ring finger protein 43	4
RNF44	22838	Ring finger protein 44	2
RNF8	9025	Ring finger protein 8	5
RNGTT	8732	RNA guanylyltransferase and 5'-phosphatase	5
ROCK1	6093	Rho-associated, coiled-coil containing protein kinase 1	5
ROR1	4919	Receptor tyrosine kinase-like orphan receptor 1	5
ROR2	4920	Receptor tyrosine kinase-like orphan receptor 2	4
RP6-213H19.1	51765	Serine/threonine protein kinase MST4	5
RPGRIP1	57096	Retinitis pigmentosa GTPase regulator interacting protein 1	5
RPS13	6207	Ribosomal protein S13	5
RPS27A	6233	Ribosomal protein S27a	5
RPS6KA1	6195	Ribosomal protein S6 kinase, 90kDa, polypeptide 1	5
RPS6KA3	6197	Ribosomal protein S6 kinase, 90kDa, polypeptide 3	5
RPS6KA5	9252	Ribosomal protein S6 kinase, 90kDa, polypeptide 5	5
RPS6KA6	27330	Ribosomal protein S6 kinase, 90kDa, polypeptide 6	5
RPS6KB1	6198	Ribosomal protein S6 kinase, 70kDa, polypeptide 1	5
RPS6KC1	26750	Ribosomal protein S6 kinase, 52kDa, polypeptide 1	5
RSC1A1	6248	Regulatory solute carrier protein, family 1, member 1	5
RWDD1	51389	RWD domain containing 1	5
RWDD3	25950	RWD domain containing 3	5
RYK	6259	RYK receptor-like tyrosine kinase	5
SAG	6295	S-antigen; retina and pineal gland (arrestin)	4
SALL1	6299	Sal-like 1 (Drosophila)	5
SART1	9092	Squamous cell carcinoma antigen recognized by T cells	4
SCRIB	23513	Scribbled homolog (Drosophila)	5
SCYL3	57147	SCY1-like 3 (S. cerevisiae)	5
SDHA	6389	Succinate dehydrogenase complex, subunit A, flavoprotein (Fp)	5
SDHACL	340026	succinate dehydrogenase comple	5
SDHB	6390	Succinate dehydrogenase complex, subunit B, iron sulfur (Ip)	5
SDHC	6391	Succinate dehydrogenase complex, subunit C, integral membrane protein, 15kDa	5
SENP1	29843	SUMO1/sentrin specific peptidase 1	5

SENP2	59343	SUMO1/sentrin/SMT3 specific peptidase 2	5
SENP3	26168	SUMO1/sentrin/SMT3 specific peptidase 3	5
SENP6	26054	SUMO1/sentrin specific peptidase 6	4
SENP7	57337	SUMO1/sentrin specific peptidase 7	5
SERPINA6	866	Serpin peptidase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 6	4
SERPINB1	1992	Serpin peptidase inhibitor, clade B (ovalbumin), member 1	5
SERPING1	710	Serpin peptidase inhibitor, clade G (C1 inhibitor), member 1, (angioedema, hereditary)	4
SERPINH1	871	Serpin peptidase inhibitor, clade H (heat shock protein 47), member 1, (collagen binding p	5
SETD2	29072	SET domain containing 2	5
SF1	7536	Splicing factor 1	5
SFPQ	6421	Splicing factor proline/glutamine-rich (polypyrimidine tract binding protein associated)	4
SFRS1	6426	Splicing factor, arginine/serine-rich 1 (splicing factor 2, alternate splicing factor)	4
SFRS12	140890	Splicing factor, arginine/serine-rich 12	5
SFRS3	6428	Splicing factor, arginine/serine-rich 3	5
SFRS7	6432	Splicing factor, arginine/serine-rich 7, 35kDa	5
SGK2	10110	Serum/glucocorticoid regulated kinase 2	4
SGK3	23678	Serum/glucocorticoid regulated kinase family, member 3	5
SGTA	6449	Small glutamine-rich tetratricopeptide repeat (TPR)-containing, alpha	5
SIAH1	6477	Seven in absentia homolog 1 (Drosophila)	5
SIRPA	140885	Signal-regulatory protein alpha	5
SIRPD	128646	protein tyrosine phosphatase,	4
SLC38A3	10991	Solute carrier family 38, member 3	5
SLU7	10569	SLU7 splicing factor homolog (S. cerevisiae)	5
SMARCA3	6596	SWI/SNF related, matrix associ	4
SMNDC1	10285	Survival motor neuron domain containing 1	4
SMURF1	57154	SMAD specific E3 ubiquitin protein ligase 1	4
SMURF2	64750	SMAD specific E3 ubiquitin protein ligase 2	4
SNCA	6622	Synuclein, alpha (non A4 component of amyloid precursor)	4
SNF1LK	150094	SNF1-like kinase	5
SNRK	54861	SNF related kinase	5
SNW1	22938	SNW domain containing 1	5
SNX1	6642	Sorting nexin 1	5
SORBS2	8470	Sorbin and SH3 domain containing 2	4
SORD	6652	Sorbitol dehydrogenase	5
SOX13	9580	SRY (sex determining region Y)-box 13	4
SOX2	6657	SRY (sex determining region Y)-box 2	2
SRF	6722	Serum response factor (c-fos serum response element-binding transcription factor)	3
SRPK1	6732	SFRS protein kinase 1	5

SSH1	54434	Slingshot homolog 1 (<i>Drosophila</i>)	4
SSH3	54961	Slingshot homolog 3 (<i>Drosophila</i>)	3
ST18	9705	Suppression of tumorigenicity 18 (breast carcinoma) (zinc finger protein)	5
STAC3	246329	SH3 and cysteine rich domain 3	4
STAM	8027	Signal transducing adaptor molecule (SH3 domain and ITAM motif) 1	5
STAT1	6772	Signal transducer and activator of transcription 1, 91kDa	5
STIL	6491	SCL/TAL1 interrupting locus	5
STK10	6793	Serine/threonine kinase 10	5
STK3	6788	Serine/threonine kinase 3 (STE20 homolog, yeast)	5
STK31	56164	Serine/threonine kinase 31	5
STK32B	55351	Serine/threonine kinase 32B	5
STK33	65975	Serine/threonine kinase 33	5
STK35	140901	Serine/threonine kinase 35	5
STK38L	23012	Serine/threonine kinase 38 like	5
STK4	6789	Serine/threonine kinase 4	5
STK40	83931	Serine/threonine kinase 40	5
STYK1	55359	Serine/threonine/tyrosine kinase 1	5
STYXL1	51657	Serine/threonine/tyrosine interacting-like 1	5
SUGT1	10910	SGT1, suppressor of G2 allele of SKP1 (<i>S. cerevisiae</i>)	5
SUMO2	6613	SMT3 suppressor of mif two 3 homolog 2 (<i>S. cerevisiae</i>)	5
SUMO3	6612	SMT3 suppressor of mif two 3 homolog 3 (<i>S. cerevisiae</i>)	4
SUPT16H	11198	Suppressor of Ty 16 homolog (<i>S. cerevisiae</i>)	5
SYK	6850	Spleen tyrosine kinase	5
SYT11	23208	Synaptotagmin XI	5
SYT14	255928	Synaptotagmin XIV	5
SYT16	83851	Synaptotagmin XVI	5
SYT17	51760	Synaptotagmin XVII	5
SYT4	6860	Synaptotagmin IV	5
SYTL5	94122	Synaptotagmin-like 5	4
TAOK2	9344	TAO kinase 2	5
TAOK3	51347	TAO kinase 3	5
TBK1	29110	TANK-binding kinase 1	5
TBPL1	9519	TBP-like 1	5
TBX4	9496	T-box 4	5
TCEA1	6917	Transcription elongation factor A (SII), 1	4
TCEB2	6923	Transcription elongation factor B (SIII), polypeptide 2 (18kDa, elongin B)	2
TDGF1	6997	Teratocarcinoma-derived growth factor 1	5
TENC1	23371	Tensin like C1 domain containing phosphatase (tensin 2)	5

TESK1	7016	Testis-specific kinase 1	5
TESK2	10420	Testis-specific kinase 2	5
TFAP2A	7020	Transcription factor AP-2 alpha (activating enhancer binding protein 2 alpha)	5
TGFB1	7040	Transforming growth factor, beta 1	5
THEX1	90459	Three prime histone mRNA exonuclease 1	5
THOC3	84321	THO complex 3	5
TIE1	7075	Tyrosine kinase with immunoglobulin-like and EGF-like domains 1	5
TIPARP	25976	TCDD-inducible poly(ADP-ribose) polymerase	5
TLK2	11011	Tousled-like kinase 2	5
TMEM11	8834	Transmembrane protein 11	5
TMEM14B	81853	Transmembrane protein 14B	5
TMEM14C	51522	Transmembrane protein 14C	5
TNF	7124	Tumor necrosis factor (TNF superfamily, member 2)	4
TNFRSF11A	8792	Tumor necrosis factor receptor superfamily, member 11a, NFKB activator	5
TNFRSF1B	7133	Tumor necrosis factor receptor superfamily, member 1B	4
TNFRSF7	939	tumor necrosis factor receptor	5
TNFSF11	8600	Tumor necrosis factor (ligand) superfamily, member 11	5
TNFSF7	970	tumor necrosis factor (ligand)	4
TNK2	10188	Tyrosine kinase, non-receptor, 2	5
TNNI3K	51086	TNNI3 interacting kinase	5
TNRC6C	57690	Trinucleotide repeat containing 6C	5
TNS1	7145	Tensin 1	5
TNS3	64759	Tensin 3	5
TOB2	10766	Transducer of ERBB2, 2	4
TOP1	7150	Topoisomerase (DNA) I	5
TP53	7157	Tumor protein p53 (Li-Fraumeni syndrome)	4
TPP1	1200	Tripeptidyl peptidase I	3
TPTE2	93492	Transmembrane phosphoinositide 3-phosphatase and tensin homolog 2	4
TRADD	8717	TNFRSF1A-associated via death domain	4
TRAF2	7186	TNF receptor-associated factor 2	4
TREX1	11277	Three prime repair exonuclease 1	2
TREX2	11219	Three prime repair exonuclease 2	4
TRIAD3	54476	TRIAD3 protein	3
TRIB1	10221	Tribbles homolog 1 (Drosophila)	5
TRIM10	10107	Tripartite motif-containing 10	5
TRIM21	6737	Tripartite motif-containing 21	4
TRIM25	7706	Tripartite motif-containing 25	5
TRIM26	7726	Tripartite motif-containing 26	5

TRIM32	22954	Tripartite motif-containing 32	4
TRIM50	135892	Tripartite motif-containing 50	5
TRPV5	56302	Transient receptor potential cation channel, subfamily V, member 5	4
TRPV6	55503	Transient receptor potential cation channel, subfamily V, member 6	3
TSC22D2	9819	TSC22 domain family, member 2	5
TSSK2	23617	Testis-specific serine kinase 2	5
TSSK3	81629	Testis-specific serine kinase 3	5
TSSK4	283629	Testis-specific serine kinase 4	4
TTBK2	146057	Tau tubulin kinase 2	5
TTC3	7267	Tetratricopeptide repeat domain 3	4
TTRAP	51567	TRAF and TNF receptor associated protein	5
TXK	7294	TXK tyrosine kinase	5
TYK2	7297	Tyrosine kinase 2	5
TYRO3	7301	TYRO3 protein tyrosine kinase	4
U2AF1	7307	U2 small nuclear RNA auxiliary factor 1	5
U2AF2	11338	U2 small nuclear RNA auxiliary factor 2	5
UBA52	7311	Ubiquitin A-52 residue ribosomal protein fusion product 1	4
UBAP1	51271	Ubiquitin associated protein 1	5
UBAP2	55833	Ubiquitin associated protein 2	4
UBAP2L	9898	Ubiquitin associated protein 2-like	5
UBASH3A	53347	Ubiquitin associated and SH3 domain containing, A	4
UBB	7314	Ubiquitin B	3
UBD	10537	Ubiquitin D	5
UBE1	7317	ubiquitin-activating enzyme E1	5
UBE1DC1	79876	ubiquitin-activating enzyme E1	4
UBE1L	7318	ubiquitin-activating enzyme E1	4
UBE1L2	55236	hypothetical protein FLJ10808	5
UBE2A	7319	Ubiquitin-conjugating enzyme E2A (RAD6 homolog)	4
UBE2B	7320	Ubiquitin-conjugating enzyme E2B (RAD6 homolog)	5
UBE2C	11065	Ubiquitin-conjugating enzyme E2C	4
UBE2D1	7321	Ubiquitin-conjugating enzyme E2D 1 (UBC4/5 homolog, yeast)	5
UBE2D2	7322	Ubiquitin-conjugating enzyme E2D 2 (UBC4/5 homolog, yeast)	5
UBE2D4	51619	Ubiquitin-conjugating enzyme E2D 4 (putative)	5
UBE2E1	7324	Ubiquitin-conjugating enzyme E2E 1 (UBC4/5 homolog, yeast)	5
UBE2G1	7326	Ubiquitin-conjugating enzyme E2G 1 (UBC7 homolog, yeast)	5
UBE2G2	7327	Ubiquitin-conjugating enzyme E2G 2 (UBC7 homolog, yeast)	5
UBE2H	7328	Ubiquitin-conjugating enzyme E2H (UBC8 homolog, yeast)	5
UBE2I	7329	Ubiquitin-conjugating enzyme E2I (UBC9 homolog, yeast)	3

UBE2J1	51465	Ubiquitin-conjugating enzyme E2, J1 (UBC6 homolog, yeast)	5
UBE2L3	7332	Ubiquitin-conjugating enzyme E2L 3	5
UBE2N	7334	Ubiquitin-conjugating enzyme E2N (UBC13 homolog, yeast)	5
UBE2O	63893	Ubiquitin-conjugating enzyme E2O	4
UBE2Q1	55585	Ubiquitin-conjugating enzyme E2Q (putative) 1	5
UBE2Q2	92912	Ubiquitin-conjugating enzyme E2Q (putative) 2	5
UBE2R2	54926	Ubiquitin-conjugating enzyme E2R 2	5
UBE2S	27338	Ubiquitin-conjugating enzyme E2S	5
UBE2T	29089	Ubiquitin-conjugating enzyme E2T (putative)	5
UBE2V2	7336	Ubiquitin-conjugating enzyme E2 variant 2	4
UBE2W	55284	Ubiquitin-conjugating enzyme E2W (putative)	5
UBE3A	7337	Ubiquitin protein ligase E3A (human papilloma virus E6-associated protein, Angelman syn	5
UBE3C	9690	Ubiquitin protein ligase E3C	4
UBL3	5412	Ubiquitin-like 3	4
UBL4A	8266	Ubiquitin-like 4A	5
UBOX5	22888	U-box domain containing 5	5
UBPH	56061	similar to ubiquitin binding p	4
UBQLN1	29979	Ubiquilin 1	5
UBQLN2	29978	Ubiquilin 2	5
UBQLN3	50613	Ubiquilin 3	5
UBQLN4	56893	Ubiquilin 4	4
UBR1	197131	Ubiquitin protein ligase E3 component n-recognin 1	5
UBR2	23304	Ubiquitin protein ligase E3 component n-recognin 2	5
UBXD2	23190	UBX domain containing 2	5
UBXD4	165324	UBX domain containing 4	5
UBXD8	23197	UBX domain containing 8	4
UCHL5	51377	Ubiquitin carboxyl-terminal hydrolase L5	5
UEVLD	55293	UEV and lactate/malate dehydrogenase domains	4
UFC1	51506	Ubiquitin-fold modifier conjugating enzyme 1	5
UGCGL1	56886	UDP-glucose ceramide glucosyltransferase-like 1	5
UGDH	7358	UDP-glucose dehydrogenase	5
UHMK1	127933	U2AF homology motif (UHM) kinase 1	5
UHRF1	29128	Ubiquitin-like, containing PHD and RING finger domains, 1	5
UHRF2	115426	Ubiquitin-like, containing PHD and RING finger domains, 2	4
ULK4	54986	Unc-51-like kinase 4 (C. elegans)	5
UNC13B	10497	Unc-13 homolog B (C. elegans)	5
USP1	7398	Ubiquitin specific peptidase 1	4
USP12	219333	Ubiquitin specific peptidase 12	5

USP16	10600	Ubiquitin specific peptidase 16	5
USP18	11274	Ubiquitin specific peptidase 18	4
USP20	10868	Ubiquitin specific peptidase 20	5
USP21	27005	Ubiquitin specific peptidase 21	5
USP25	29761	Ubiquitin specific peptidase 25	5
USP28	57646	Ubiquitin specific peptidase 28	3
USP29	57663	Ubiquitin specific peptidase 29	5
USP3	9960	Ubiquitin specific peptidase 3	5
USP31	57478	Ubiquitin specific peptidase 31	5
USP33	23032	Ubiquitin specific peptidase 33	5
USP37	57695	Ubiquitin specific peptidase 37	4
USP39	10713	Ubiquitin specific peptidase 39	5
USP4	7375	Ubiquitin specific peptidase 4 (proto-oncogene)	5
USP47	55031	Ubiquitin specific peptidase 47	5
USP49	25862	Ubiquitin specific peptidase 49	5
USP5	8078	Ubiquitin specific peptidase 5 (isopeptidase T)	5
USP52	9924	Ubiquitin specific peptidase 52	4
USP7	7874	Ubiquitin specific peptidase 7 (herpes virus-associated)	4
VCP	7415	Valosin-containing protein	5
VEGF	7422	vascular endothelial growth fa	5
VPS28	51160	Vacuolar protein sorting 28 homolog (S. cerevisiae)	4
VRK1	7443	Vaccinia related kinase 1	5
WEE1	7465	WEE1 homolog (S. pombe)	5
WNK2	65268	WNK lysine deficient protein kinase 2	5
WNK3	65267	WNK lysine deficient protein kinase 3	5
WRN	7486	Werner syndrome	5
WRNIP1	56897	Werner helicase interacting protein 1	5
WT1	7490	Wilms tumor 1	4
WTAP	9589	Wilms tumor 1 associated protein	5
WWP1	11059	WW domain containing E3 ubiquitin protein ligase 1	4
WWP2	11060	WW domain containing E3 ubiquitin protein ligase 2	5
XDH	7498	Xanthine dehydrogenase	4
YES1	7525	V-yes-1 Yamaguchi sarcoma viral oncogene homolog 1	5
YSK4	80122	Yeast Sps1/Ste20-related kinase 4 (S. cerevisiae)	5
ZAK	51776	Sterile alpha motif and leucine zipper containing kinase AZK	5
ZC3HAV1	56829	Zinc finger CCCH-type, antiviral 1	4
ZFAND3	60685	Zinc finger, AN1-type domain 3	5
ZFAND6	54469	Zinc finger, AN1-type domain 6	4

ZFHX1B	9839	zinc finger homeobox 1b	4
ZMAT2	153527	Zinc finger, matrin type 2	4
ZNF313	55905	Zinc finger protein 313	5
ZNF364	27246	Zinc finger protein 364	4
ZNF96	9753	zinc finger protein 305	4
ZNRF4	148066	Zinc and ring finger 4	5
ZSWIM2	151112	Zinc finger, SWIM-type containing 2	5

POOL 3

Symbol	NCBI Gene ID	Description	Number of shRNAs
A2M	2	Alpha-2-macroglobulin	5
ACR	49	Acrosin	5
ACVR1	90	Activin A receptor, type I	5
ACVR2A	92	Activin A receptor, type IIA	5
ACVR2B	93	Activin A receptor, type IIB	5
ACVRL1	94	Activin A receptor type II-like 1	4
ADAM10	102	ADAM metallopeptidase domain 10	5
ADAM8	101	ADAM metallopeptidase domain 8	5
ADRBK1	156	Adrenergic, beta, receptor kinase 1	5
AFF4	27125	AF4/FMR2 family, member 4	5
AFG3L1	172	AFG3 ATPase family gene 3-like 1 (<i>S. cerevisiae</i>)	5
AGT	183	Angiotensinogen (serpin peptidase inhibitor, clade A, member 8)	5
AHSG	197	Alpha-2-HS-glycoprotein	4
AKT2	208	V-akt murine thymoma viral oncogene homolog 2	5
ALK	238	Anaplastic lymphoma kinase (Ki-1)	5
ALX3	257	Aristaless-like homeobox 3	5
AMBP	259	Alpha-1-microglobulin/bikunin precursor	4
APAF1	317	Apoptotic peptidase activating factor 1	5
APLP2	334	Amyloid beta (A4) precursor-like protein 2	5
APP	351	Amyloid beta (A4) precursor protein (peptidase nexin-II, Alzheimer disease)	3
ARAF	369	V-raf murine sarcoma 3611 viral oncogene homolog	5
ARHGAP5	394	Rho GTPase activating protein 5	5
ASCL1	429	Achaete-scute complex homolog 1 (<i>Drosophila</i>)	4
ASCL2	430	Achaete-scute complex homolog 2 (<i>Drosophila</i>)	5
ATBF1	463	AT-binding transcription facto	3
ATF1	466	Activating transcription factor 1	5
ATF3	467	Activating transcription factor 3	5
ATF4	468	Activating transcription factor 4 (tax-responsive enhancer element B67)	4

ATF7IP2	80063	Activating transcription factor 7 interacting protein 2	5
ATOH1	474	Atonal homolog 1 (Drosophila)	4
ATRX	546	Alpha thalassemia/mental retardation syndrome X-linked (RAD54 homolog, <i>S. cerevisiae</i>)	4
AURKA	6790	Aurora kinase A	4
AURKB	9212	Aurora kinase B	4
AXL	558	AXL receptor tyrosine kinase	5
AZU1	566	Azurocidin 1 (cationic antimicrobial protein 37)	4
BACE1	23621	Beta-site APP-cleaving enzyme 1	5
BACH1	571	BTB and CNC homology 1, basic leucine zipper transcription factor 1	5
BAPX1	579	bagpipe homeobox homolog 1 (Dr	5
BAZ2A	11176	Bromodomain adjacent to zinc finger domain, 2A	5
BBS4	585	Bardet-Biedl syndrome 4	5
BCL6	604	B-cell CLL/lymphoma 6 (zinc finger protein 51)	5
BCR	613	Breakpoint cluster region	5
BMP2K	55589	BMP2 inducible kinase	5
BMPR1A	657	Bone morphogenetic protein receptor, type IA	5
BMPR1B	658	Bone morphogenetic protein receptor, type IB	5
BMPR2	659	Bone morphogenetic protein receptor, type II (serine/threonine kinase)	5
BRSK2	9024	BR serine/threonine kinase 2	5
BTK	695	Bruton agammaglobulinemia tyrosine kinase	5
BTRC	8945	Beta-transducin repeat containing	5
BUB1	699	BUB1 budding uninhibited by benzimidazoles 1 homolog (yeast)	4
BUB1B	701	BUB1 budding uninhibited by benzimidazoles 1 homolog beta (yeast)	5
C10orf1	11241	chromosome 10 open reading frame 1	4
C21orf66	94104	Chromosome 21 open reading frame 66	5
CAMK1	8536	Calcium/calmodulin-dependent protein kinase I	5
CAMK2B	816	Calcium/calmodulin-dependent protein kinase (CaM kinase) II beta	5
CAMK2D	817	Calcium/calmodulin-dependent protein kinase (CaM kinase) II delta	5
CAMK2G	818	Calcium/calmodulin-dependent protein kinase (CaM kinase) II gamma	5
CAMK4	814	Calcium/calmodulin-dependent protein kinase IV	5
CASK	8573	Calcium/calmodulin-dependent serine protein kinase (MAGUK family)	5
CDC2	983	Cell division cycle 2, G1 to S and G2 to M	5
CDC2L5	8621	Cell division cycle 2-like 5 (cholinesterase-related cell division controller)	5
CDC42BPA	8476	CDC42 binding protein kinase alpha (DMPK-like)	5
CDC42BPB	9578	CDC42 binding protein kinase beta (DMPK-like)	4
CDK10	8558	Cyclin-dependent kinase 10	5
CDK2	1017	Cyclin-dependent kinase 2	5
CDK3	1018	Cyclin-dependent kinase 3	4

CDK4	1019	Cyclin-dependent kinase 4	4
CDK6	1021	Cyclin-dependent kinase 6	5
CDK7	1022	Cyclin-dependent kinase 7	5
CDK8	1024	Cyclin-dependent kinase 8	5
CDK9	1025	Cyclin-dependent kinase 9	5
CDKL2	8999	Cyclin-dependent kinase-like 2 (CDC2-related kinase)	5
CENPN	55839	Centromere protein N	5
CHEK1	1111	CHK1 checkpoint homolog (S. pombe)	5
ChGn	55790	Chondroitin beta1,4 N-acetylgalactosaminyltransferase	5
CHUK	1147	Conserved helix-loop-helix ubiquitous kinase	5
CITED2	10370	Cbp/p300-interacting transactivator, with Glu/Asp-rich carboxy-terminal domain, 2	5
CLK1	1195	CDC-like kinase 1	5
CLK2	1196	CDC-like kinase 2	4
CLK3	1198	CDC-like kinase 3	5
CPNE3	8895	Copine III	5
CPSF1	29894	Cleavage and polyadenylation specific factor 1, 160kDa	5
CPSF6	11052	Cleavage and polyadenylation specific factor 6, 68kDa	5
CREB3L1	90993	CAMP responsive element binding protein 3-like 1	5
CREBBP	1387	CREB binding protein (Rubinstein-Taybi syndrome)	4
CSK	1445	C-src tyrosine kinase	5
CSNK1D	1453	Casein kinase 1, delta	5
CSNK1E	1454	Casein kinase 1, epsilon	5
CSNK1G3	1456	Casein kinase 1, gamma 3	4
CSNK2A1	1457	Casein kinase 2, alpha 1 polypeptide	5
CSNK2A2	1459	Casein kinase 2, alpha prime polypeptide	5
CUL2	8453	Cullin 2	5
CUL4A	8451	Cullin 4A	5
CUL4B	8450	Cullin 4B	5
CUL5	8065	Cullin 5	4
CUL7	9820	Cullin 7	5
DAPK1	1612	Death-associated protein kinase 1	4
DAPK3	1613	Death-associated protein kinase 3	5
DDR1	780	Discoidin domain receptor family, member 1	4
DDX3X	1654	DEAD (Asp-Glu-Ala-Asp) box polypeptide 3, X-linked	5
DDX3Y	8653	DEAD (Asp-Glu-Ala-Asp) box polypeptide 3, Y-linked	5
DGKB	1607	Diacylglycerol kinase, beta 90kDa	5
DGKD	8527	Diacylglycerol kinase, delta 130kDa	5
DGKG	1608	Diacylglycerol kinase, gamma 90kDa	5

DGKZ	8525	Diacylglycerol kinase, zeta 104kDa	3
DHX15	1665	DEAH (Asp-Glu-Ala-His) box polypeptide 15	5
DHX8	1659	DEAH (Asp-Glu-Ala-His) box polypeptide 8	4
DMPK	1760	Dystrophia myotonica-protein kinase	5
DNM2	1785	Dynamin 2	5
DYRK1A	1859	Dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 1A	5
DYRK2	8445	Dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 2	5
DYRK3	8444	Dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 3	4
DYRK4	8798	Dual-specificity tyrosine-(Y)-phosphorylation regulated kinase 4	4
DYSF	8291	Dysferlin, limb girdle muscular dystrophy 2B (autosomal recessive)	5
E2F1	1869	E2F transcription factor 1	5
ECD	11319	Ecdysoneless homolog (Drosophila)	5
EPHB1	2047	EPH receptor B1	5
ERBB3	2065	V-erb-b2 erythroblastic leukemia viral oncogene homolog 3 (avian)	5
ERN1	2081	Endoplasmic reticulum to nucleus signaling 1	5
EWSR1	2130	Ewing sarcoma breakpoint region 1	5
FBXW2	26190	F-box and WD repeat domain containing 2	5
FBXW7	55294	F-box and WD repeat domain containing 7	4
FES	2242	Feline sarcoma oncogene	4
FEZF2	55079	FEZ family zinc finger 2	5
FGFR1	2260	Fibroblast growth factor receptor 1 (fms-related tyrosine kinase 2, Pfeiffer syndrome)	5
FGFR2	2263	Fibroblast growth factor receptor 2 (bacteria-expressed kinase, keratinocyte growth factor)	5
FGFR3	2261	Fibroblast growth factor receptor 3 (achondroplasia, thanatophoric dwarfism)	4
FGFR4	2264	Fibroblast growth factor receptor 4	3
FKBP5	2289	FK506 binding protein 5	5
FKHL18	2307	Forkhead-like 18 (Drosophila)	5
FLT1	2321	Fms-related tyrosine kinase 1 (vascular endothelial growth factor/vascular permeability factor)	5
FLT3	2322	Fms-related tyrosine kinase 3	4
FLT4	2324	Fms-related tyrosine kinase 4	5
FOS	2353	V-fos FBJ murine osteosarcoma viral oncogene homolog	5
FOXB1	27023	Forkhead box B1	4
FOXC2	2303	Forkhead box C2 (MFH-1, mesenchyme forkhead 1)	5
FOXD2	2306	Forkhead box D2	4
FOXD3	27022	Forkhead box D3	4
FOXE1	2304	Forkhead box E1 (thyroid transcription factor 2)	4
FOXL2	668	Forkhead box L2	5
FOXM1	2305	Forkhead box M1	5
FOXP1	27086	Forkhead box P1	5

FOXR1	283150	Forkhead box R1	5
GATAD1	57798	GATA zinc finger domain containing 1	5
GATAD2A	54815	GATA zinc finger domain containing 2A	4
GNMT	27232	Glycine N-methyltransferase	5
GREB1	9687	GREB1 protein	5
GRHL2	79977	Grainyhead-like 2 (Drosophila)	5
GRK4	2868	G protein-coupled receptor kinase 4	5
GRK5	2869	G protein-coupled receptor kinase 5	4
GSK3B	2932	Glycogen synthase kinase 3 beta	3
GUCY2D	3000	Guanylate cyclase 2D, membrane (retina-specific)	4
GUCY2F	2986	Guanylate cyclase 2F, retinal	5
H2BFM	286436	H2B histone family, member M	5
HELLS	3070	Helicase, lymphoid-specific	5
HERC3	8916	Hect domain and RLD 3	5
HGD	3081	Homogentisate 1,2-dioxygenase (homogentisate oxidase)	5
HMG20A	10363	High-mobility group 20A	5
HMG20B	10362	High-mobility group 20B	5
HMX3	340784	H6 family homeobox 3	4
HNRPC	3183	heterogeneous nuclear ribonucl	4
HOXA13	3209	Homeobox A13	5
HOXB1	3211	Homeobox B1	4
HOXB2	3212	Homeobox B2	4
HOXB3	3213	Homeobox B3	5
HOXB4	3214	Homeobox B4	5
HOXB5	3215	Homeobox B5	5
HOXB6	3216	Homeobox B6	4
HOXB7	3217	Homeobox B7	4
HOXB8	3218	Homeobox B8	5
HPGD	3248	Hydroxyprostaglandin dehydrogenase 15-(NAD)	5
IDE	3416	Insulin-degrading enzyme	5
IGF1R	3480	Insulin-like growth factor 1 receptor	5
ILK	3611	Integrin-linked kinase	5
INPP4A	3631	Inositol polyphosphate-4-phosphatase, type I, 107kDa	5
INSR	3643	Insulin receptor	4
IRAK1	3654	Interleukin-1 receptor-associated kinase 1	5
IRAK2	3656	Interleukin-1 receptor-associated kinase 2	4
IRAK3	11213	Interleukin-1 receptor-associated kinase 3	5
JAK3	3718	Janus kinase 3 (a protein tyrosine kinase, leukocyte)	5

KCNMA1	3778	Potassium large conductance calcium-activated channel, subfamily M, alpha member 1	5
KHDRBS1	10657	KH domain containing, RNA binding, signal transduction associated 1	5
KIAA1627	57721	KIAA1627 protein	5
KIFC1	3833	Kinesin family member C1	5
KIN	22944	KIN, antigenic determinant of recA protein homolog (mouse)	5
KIT	3815	V-kit Hardy-Zuckerman 4 feline sarcoma viral oncogene homolog	5
KLF12	11278	Kruppel-like factor 12	5
KLF8	11279	Kruppel-like factor 8	5
KLK3	354	Kallikrein-related peptidase 3	5
L3MBTL4	91133	L(3)mbt-like 4 (Drosophila)	5
LATS2	26524	LATS, large tumor suppressor, homolog 2 (Drosophila)	5
LIMK1	3984	LIM domain kinase 1	2
LMO7	4008	LIM domain 7	5
LOC285563	285563	similar to Transcription initi	5
LOC285697	285697	similar to Transcription initi	5
LOC339799	339799	similar to eukaryotic translat	5
LOC340260	340260	similar to Unc4.1 homeobox	5
LOC340501	340501	Similar to Transcription elongation factor A protein 1 (Transcription elongation factor S-II p	5
LOC340765	340765	similar to double homeobox, 4;	5
LOC341098	341098	similar to ENSANGP00000020885	4
LZTS1	11178	Leucine zipper, putative tumor suppressor 1	4
MAF	4094	V-maf musculoaponeurotic fibrosarcoma oncogene homolog (avian)	5
MAP3K12	7786	Mitogen-activated protein kinase kinase kinase 12	5
MAP3K14	9020	Mitogen-activated protein kinase kinase kinase 14	4
MAP3K4	4216	Mitogen-activated protein kinase kinase kinase 4	4
MAP3K5	4217	Mitogen-activated protein kinase kinase kinase 5	5
MAP4K3	8491	Mitogen-activated protein kinase kinase kinase kinase 3	4
MAPK13	5603	Mitogen-activated protein kinase 13	4
MAPK14	1432	Mitogen-activated protein kinase 14	5
MAPK9	5601	Mitogen-activated protein kinase 9	5
MAPKAPK5	8550	Mitogen-activated protein kinase-activated protein kinase 5	5
MAZ	4150	MYC-associated zinc finger protein (purine-binding transcription factor)	5
MBD1	4152	Methyl-CpG binding domain protein 1	5
MCM5	4174	Minichromosome maintenance complex component 5	4
MDF1	4188	MyoD family inhibitor	4
MDS1	4197	Myelodysplasia syndrome 1	5
MEF2B	4207	MADS box transcription enhance	5
MEF2C	4208	Myocyte enhancer factor 2C	5

MEF2D	4209	Myocyte enhancer factor 2D	5
MEIS1	4211	Meis homeobox 1	5
MEIS2	4212	Meis homeobox 2	5
MERTK	10461	C-mer proto-oncogene tyrosine kinase	5
MET	4233	Met proto-oncogene (hepatocyte growth factor receptor)	5
MKL2	57496	MKL/myocardin-like 2	5
MKX	283078	Mohawk homeobox	5
MLX	6945	MAX-like protein X	5
MPP6	51678	Membrane protein, palmitoylated 6 (MAGUK p55 subfamily member 6)	5
MYLK	4638	Myosin, light chain kinase	3
MYLK2	85366	Myosin light chain kinase 2, skeletal muscle	3
NEDD4L	23327	Neural precursor cell expressed, developmentally down-regulated 4-like	5
NEDD8	4738	Neural precursor cell expressed, developmentally down-regulated 8	5
NEK2	4751	NIMA (never in mitosis gene a)-related kinase 2	5
NEK9	91754	NIMA (never in mitosis gene a)- related kinase 9	4
NFKB1	4790	Nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 (p105)	5
NFKB2	4791	Nuclear factor of kappa light polypeptide gene enhancer in B-cells 2 (p49/p100)	5
NPR2	4882	Natriuretic peptide receptor B/guanylate cyclase B (atrionatriuretic peptide receptor B)	4
NRL	4901	Neural retina leucine zipper	5
NUAK1	9891	NUAK family, SNF1-like kinase, 1	5
NUDT21	11051	Nudix (nucleoside diphosphate linked moiety X)-type motif 21	5
OTX1	5013	Orthodenticle homeobox 1	5
OTX2	5015	Orthodenticle homeobox 2	4
OVOL1	5017	Ovo-like 1(Drosophila)	5
PABPN1	8106	Poly(A) binding protein, nuclear 1	5
PARK2	5071	Parkinson disease (autosomal recessive, juvenile) 2, parkin	5
PAX1	5075	Paired box 1	5
PAX2	5076	Paired box 2	5
PAX3	5077	Paired box 3	5
PAX4	5078	Paired box 4	5
PB1	55193	polybromo 1	5
PDIA2	64714	Protein disulfide isomerase family A, member 2	5
PDK3	5165	Pyruvate dehydrogenase kinase, isozyme 3	4
PHF12	57649	PHD finger protein 12	4
PHKG2	5261	Phosphorylase kinase, gamma 2 (testis)	5
PHOX2A	401	Paired-like homeobox 2a	5
PIK3R4	30849	Phosphoinositide-3-kinase, regulatory subunit 4, p150	4
PLCB3	5331	Phospholipase C, beta 3 (phosphatidylinositol-specific)	5

PLK2	10769	Polo-like kinase 2 (<i>Drosophila</i>)	4
PLK3	1263	Polo-like kinase 3 (<i>Drosophila</i>)	5
POU6F2	11281	POU class 6 homeobox 2	5
PPIL1	51645	Peptidylprolyl isomerase (cyclophilin)-like 1	5
PPIL2	23759	Peptidylprolyl isomerase (cyclophilin)-like 2	5
PPIL3	53938	Peptidylprolyl isomerase (cyclophilin)-like 3	5
PPWD1	23398	Peptidylprolyl isomerase domain and WD repeat containing 1	5
PRDM1	639	PR domain containing 1, with ZNF domain	5
PRDM4	11108	PR domain containing 4	5
PRIM2A	5558	primase, polypeptide 2A, 58kDa	5
PRKAA1	5562	Protein kinase, AMP-activated, alpha 1 catalytic subunit	5
PRKCE	5581	Protein kinase C, epsilon	5
PRKG1	5592	Protein kinase, cGMP-dependent, type I	4
PRPF18	8559	PRP18 pre-mRNA processing factor 18 homolog (<i>S. cerevisiae</i>)	4
PRPF4B	8899	PRP4 pre-mRNA processing factor 4 homolog B (yeast)	5
PTF1A	256297	Pancreas specific transcription factor, 1a	5
PTGER4	5734	Prostaglandin E receptor 4 (subtype EP4)	5
PTK2B	2185	PTK2B protein tyrosine kinase 2 beta	3
PYCRL	65263	Pyrroline-5-carboxylate reductase-like	13
RAB3B	5865	RAB3B, member RAS oncogene family	5
RAD54L	8438	RAD54-like (<i>S. cerevisiae</i>)	5
RERE	473	Arginine-glutamic acid dipeptide (RE) repeats	5
RET	5979	Ret proto-oncogene	5
RGS2	5997	Regulator of G-protein signaling 2, 24kDa	5
RIPK1	8737	Receptor (TNFRSF)-interacting serine-threonine kinase 1	5
RNASEL	6041	Ribonuclease L (2',5'-oligoadenylate synthetase-dependent)	5
RNPS1	10921	RNA binding protein S1, serine-rich domain	5
ROCK2	9475	Rho-associated, coiled-coil containing protein kinase 2	5
ROS1	6098	V-ros UR2 sarcoma virus oncogene homolog 1 (avian)	5
RPS6KB2	6199	Ribosomal protein S6 kinase, 70kDa, polypeptide 2	2
SDCCAG10	10283	Serologically defined colon cancer antigen 10	5
SERPINA3	12	Serpin peptidase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 3	4
SERPINC1	462	Serpin peptidase inhibitor, clade C (antithrombin), member 1	5
SF3A2	8175	Splicing factor 3a, subunit 2, 66kDa	5
SF3A3	10946	Splicing factor 3a, subunit 3, 60kDa	5
SF3B1	23451	Splicing factor 3b, subunit 1, 155kDa	5
SF3B3	23450	Splicing factor 3b, subunit 3, 130kDa	5
SF3B4	10262	Splicing factor 3b, subunit 4, 49kDa	5

SFRS10	6434	Splicing factor, arginine/serine-rich 10 (transformer 2 homolog, Drosophila)	5
SFRS11	9295	Splicing factor, arginine/serine-rich 11	5
SFRS2	6427	Splicing factor, arginine/serine-rich 2	31
SFRS5	6430	Splicing factor, arginine/serine-rich 5	5
SHFM3P1	26226	split hand/foot malformation (4
SHPRH	257218	SNF2 histone linker PHD RING helicase	5
SIX5	147912	SIX homeobox 5	3
SIX6	4990	SIX homeobox 6	5
SKP1A	6500	S-phase kinase-associated prot	3
SLK	9748	STE20-like kinase (yeast)	5
SMARCA4	6597	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a,	5
SMARCC1	6599	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily c,	5
SMARCC2	6601	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily c,	4
SMARCE1	6605	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily e,	5
SNAI2	6591	Snail homolog 2 (Drosophila)	5
SNAPC5	10302	Small nuclear RNA activating complex, polypeptide 5, 19kDa	5
SNF8	11267	SNF8, ESCRT-II complex subunit, homolog (S. cerevisiae)	5
SNRP70	6625	Small nuclear ribonucleoprotein 70kDa polypeptide (RNP antigen)	5
SOHLH2	54937	Spermatogenesis and oogenesis specific basic helix-loop-helix 2	4
SOLH	6650	Small optic lobes homolog (Drosophila)	5
SOX1	6656	SRY (sex determining region Y)-box 1	4
SOX21	11166	SRY (sex determining region Y)-box 21	5
SP140	11262	SP140 nuclear body protein	5
SPOCD1	90853	SPOC domain containing 1	5
SRMS	6725	Src-related kinase lacking C-terminal regulatory tyrosine and N-terminal myristylation sites	5
SRRM1	10250	Serine/arginine repetitive matrix 1	5
SRRM2	23524	Serine/arginine repetitive matrix 2	2
STK11	6794	Serine/threonine kinase 11	5
STK16	8576	Serine/threonine kinase 16	5
STK17A	9263	Serine/threonine kinase 17a	4
STK17B	9262	Serine/threonine kinase 17b	4
STK24	8428	Serine/threonine kinase 24 (STE20 homolog, yeast)	5
STK39	27347	Serine threonine kinase 39 (STE20/SPS1 homolog, yeast)	5
SYT5	6861	Synaptotagmin V	5
TADA3L	10474	Transcriptional adaptor 3 (NGG1 homolog, yeast)-like	5
TAF5L	27097	TAF5-like RNA polymerase II, p300/CBP-associated factor (PCAF)-associated factor, 65k	5
TARDBP	23435	TAR DNA binding protein	5
TCERG1L	256536	Transcription elongation regulator 1-like	5

TCF19	6941	Transcription factor 19 (SC1)	5
TCF20	6942	Transcription factor 20 (AR1)	5
TCF21	6943	Transcription factor 21	5
TEAD1	7003	TEA domain family member 1 (SV40 transcriptional enhancer factor)	5
TEAD3	7005	TEA domain family member 3	5
TEAD4	7004	TEA domain family member 4	5
TEF	7008	Thyrotrophic embryonic factor	5
TEK	7010	TEK tyrosine kinase, endothelial (venous malformations, multiple cutaneous and mucosal)	5
TGFBR2	7048	Transforming growth factor, beta receptor II (70/80kDa)	5
TGIF2LY	90655	TGFB-induced factor homeobox 2-like, Y-linked	5
TGM2	7052	Transglutaminase 2 (C polypeptide, protein-glutamine-gamma-glutamyltransferase)	5
THBS1	7057	Thrombospondin 1	5
THOC1	9984	THO complex 1	5
THOC4	10189	THO complex 4	4
THOC5	8563	THO complex 5	5
TM4SF1	4071	Transmembrane 4 L six family member 1	5
TMEPAI	56937	Transmembrane, prostate androgen induced RNA	5
TMPRSS2	7113	Transmembrane protease, serine 2	4
TNK1	8711	Tyrosine kinase, non-receptor, 1	5
TP73	7161	Tumor protein p73	5
TP73L	8626	tumor protein p73-like	5
TPRX1	284355	Tetra-peptide repeat homeobox 1	4
TRIO	7204	Triple functional domain (PTPRF interacting)	4
TSHZ3	57616	Teashirt zinc finger homeobox 3	5
ULK1	8408	Unc-51-like kinase 1 (C. elegans)	5
ULK2	9706	Unc-51-like kinase 2 (C. elegans)	5
VENTX	27287	VENT homeobox homolog (Xenopus laevis)	5
VRK3	51231	Vaccinia related kinase 3	4
WDR79	55135	WD repeat domain 79	5
WHSC1L1	54904	Wolf-Hirschhorn syndrome candidate 1-like 1	5
WNK1	65125	WNK lysine deficient protein kinase 1	5
ZAP70	7535	Zeta-chain (TCR) associated protein kinase 70kDa	5
ZBTB3	79842	Zinc finger and BTB domain containing 3	5
ZBTB32	27033	Zinc finger and BTB domain containing 32	5
ZBTB4	57659	Zinc finger and BTB domain containing 4	5
ZBTB40	9923	Zinc finger and BTB domain containing 40	5
ZFP36L1	677	Zinc finger protein 36, C3H type-like 1	5
ZMYM1	79830	Zinc finger, MYM-type 1	5

ZNF117	7670	Zinc finger protein 117	5
ZNF132	7691	Zinc finger protein 132	5
ZNF133	7692	Zinc finger protein 133	5
ZNF134	7693	Zinc finger protein 134	5
ZNF160	90338	Zinc finger protein 160	5
ZNF222	7673	zinc finger protein 222	5
ZNF285	26974	zinc finger protein 285	5
ZNF420	147923	Zinc finger protein 420	5
ZNF434	54925	Zinc finger protein 434	5
ZNF439	90594	Zinc finger protein 439	5
ZNF442	79973	Zinc finger protein 442	5
ZNF471	57573	Zinc finger protein 471	4
ZNF502	91392	Zinc finger protein 502	4
ZNF524	147807	Zinc finger protein 524	5
ZNF529	57711	Zinc finger protein 529	5
ZNF547	284306	zinc finger protein 547	5
ZNF548	147694	zinc finger protein 548	5
ZNF552	79818	Zinc finger protein 552	5
ZNF556	80032	Zinc finger protein 556	5
ZNF560	147741	Zinc finger protein 560	5
ZNF562	54811	Zinc finger protein 562	5
ZNF563	147837	Zinc finger protein 563	5
ZNF565	147929	Zinc finger protein 565	5
ZNF569	148266	Zinc finger protein 569	5
ZNF586	54807	zinc finger protein 586	5
ZNF605	90462	Zinc finger protein 605	5
ZNF625	90589	zinc finger protein 625	3
ZNF672	79894	Zinc finger protein 672	5
ZNF682	91120	Zinc finger protein 682	5
ZNF702	79986	Zinc finger protein 702	5
ZNF776	284309	Zinc finger protein 776	5
ZNF777	27153	Zinc finger protein 777	5
ZNF784	147808	Zinc finger protein 784	2
ZNF85	7639	Zinc finger protein 85	5
ZNF91	7644	Zinc finger protein 91	5
ZSCAN1	284312	Zinc finger and SCAN domain containing 1	4
ZSCAN2	54993	Zinc finger and SCAN domain containing 2	4

POOL 4

Symbol	NCBI Gene ID	Description	Number of shRNAs
ABLIM3	22885	Actin binding LIM protein family, member 3	5
ADCK4	79934	AarF domain containing kinase 4	5
AKAP1	8165	A kinase (PRKA) anchor protein 1	4
ANKFN1	162282	Ankyrin-repeat and fibronectin type III domain containing 1	5
ANXA6	309	Annexin A6	3
ARID3A	1820	AT rich interactive domain 3A (BRIGHT-like)	4
ARID4A	5926	AT rich interactive domain 4A (RBP1-like)	5
ARIH1	25820	Ariadne homolog, ubiquitin-conjugating enzyme E2 binding protein, 1 (Drosophila)	5
ATF2	1386	Activating transcription factor 2	5
ATG12	9140	ATG12 autophagy related 12 homolog (S. cerevisiae)	5
ATOX1	475	ATX1 antioxidant protein 1 homolog (yeast)	5
BAP1	8314	BRCA1 associated protein-1 (ubiquitin carboxy-terminal hydrolase)	5
BARX2	8538	BARX homeobox 2	5
BAT3	7917	HLA-B associated transcript 3	5
BAZ1B	9031	Bromodomain adjacent to zinc finger domain, 1B	5
BCL6B	255877	B-cell CLL/lymphoma 6, member B (zinc finger protein)	5
BCS1L	617	BCS1-like (yeast)	5
BHLHB2	8553	Basic helix-loop-helix domain containing, class B, 2	5
BLZF1	8548	Basic leucine zipper nuclear factor 1 (JEM-1)	5
BPY2	9083	basic charge, Y-linked, 2	5
BSG	682	Basigin (Ok blood group)	5
BTAF1	9044	BTAF1 RNA polymerase II, B-TFIID transcription factor-associated, 170kDa (Mot1 homolog)	5
BTF3	689	Basic transcription factor 3	5
BTF3L1	690	Basic transcription factor 3, like 1	5
BUD31	8896	BUD31 homolog (S. cerevisiae)	5
C20orf86	140731	chromosome 20 open reading fra	4
C2orf3	6936	Chromosome 2 open reading frame 3	5
C5AR1	728	Complement component 5a receptor 1	5
C7orf9	64111	chromosome 7 open reading fram	4
CACNA1A	773	Calcium channel, voltage-dependent, P/Q type, alpha 1A subunit	4
CALCR	799	Calcitonin receptor	5
CALCRL	10203	Calcitonin receptor-like	5
CART1	8092	cartilage paired-class homeopr	5
CASR	846	Calcium-sensing receptor (hypocalciuric hypercalcemia 1, severe neonatal hyperparathyroidism)	5
CBFA2T2	9139	Core-binding factor, runt domain, alpha subunit 2; translocated to, 2	5
CCBP2	1238	Chemokine binding protein 2	5

CCDC69	26112	Coiled-coil domain containing 69	5
CCKAR	886	Cholecystokinin A receptor	3
CCNT1	904	Cyclin T1	5
CCNT2	905	Cyclin T2	5
CCR1	1230	Chemokine (C-C motif) receptor 1	5
CCR3	1232	Chemokine (C-C motif) receptor 3	5
CCR4	1233	Chemokine (C-C motif) receptor 4	5
CCR5	1234	Chemokine (C-C motif) receptor 5	5
CCR6	1235	Chemokine (C-C motif) receptor 6	5
CCR7	1236	Chemokine (C-C motif) receptor 7	5
CCR8	1237	Chemokine (C-C motif) receptor 8	5
CCR9	10803	Chemokine (C-C motif) receptor 9	5
CCRL1	51554	Chemokine (C-C motif) receptor-like 1	5
CCRL2	9034	Chemokine (C-C motif) receptor-like 2	5
CD74	972	CD74 molecule, major histocompatibility complex, class II invariant chain	5
CD97	976	CD97 molecule	5
CDC23	8697	Cell division cycle 23 homolog (<i>S. cerevisiae</i>)	5
CDC73	79577	Cell division cycle 73, Paf1/RNA polymerase II complex component, homolog (<i>S. cerevisiae</i>)	4
CDX1	1044	Caudal type homeobox 1	5
CDX2	1045	Caudal type homeobox 2	3
CDX4	1046	Caudal type homeobox 4	5
CEBPD	1052	CCAAT/enhancer binding protein (C/EBP), delta	4
CEBPE	1053	CCAAT/enhancer binding protein (C/EBP), epsilon	4
CELSR1	9620	Cadherin, EGF LAG seven-pass G-type receptor 1 (flamingo homolog, <i>Drosophila</i>)	4
CELSR2	1952	Cadherin, EGF LAG seven-pass G-type receptor 2 (flamingo homolog, <i>Drosophila</i>)	5
CELSR3	1951	Cadherin, EGF LAG seven-pass G-type receptor 3 (flamingo homolog, <i>Drosophila</i>)	3
CHES1	1112	checkpoint suppressor 1	5
CHRM1	1128	Cholinergic receptor, muscarinic 1	5
CHRM2	1129	Cholinergic receptor, muscarinic 2	3
CHRM3	1131	Cholinergic receptor, muscarinic 3	4
CHRM4	1132	Cholinergic receptor, muscarinic 4	5
CHRM5	1133	Cholinergic receptor, muscarinic 5	5
CMKLR1	1240	Chemokine-like receptor 1	5
CNBP	7555	CCHC-type zinc finger, nucleic acid binding protein	5
CNOT2	4848	CCR4-NOT transcription complex, subunit 2	5
CNOT3	4849	CCR4-NOT transcription complex, subunit 3	5
CNOT4	4850	CCR4-NOT transcription complex, subunit 4	5
CNOT8	9337	CCR4-NOT transcription complex, subunit 8	5

CNR1	1268	Cannabinoid receptor 1 (brain)	5
CNR2	1269	Cannabinoid receptor 2 (macrophage)	4
CREBL1	1388	cAMP responsive element bindin	5
CREG1	8804	Cellular repressor of E1A-stimulated genes 1	5
CREM	1390	CAMP responsive element modulator	4
CRH	1392	Corticotropin releasing hormone	3
CRHR1	1394	Corticotropin releasing hormone receptor 1	5
CRHR2	1395	Corticotropin releasing hormone receptor 2	5
CRX	1406	Cone-rod homeobox	5
CRY1	1407	Cryptochrome 1 (photolyase-like)	5
CSDA	8531	Cold shock domain protein A	5
CST1	1469	Cystatin SN	4
CST2	1470	Cystatin SA	4
CST3	1471	Cystatin C (amyloid angiopathy and cerebral hemorrhage)	5
CST4	1472	Cystatin S	4
CSTA	1475	Cystatin A (stefin A)	4
CSTB	1476	Cystatin B (stefin B)	5
CTBP1	1487	C-terminal binding protein 1	5
CTBP2	1488	C-terminal binding protein 2	5
CTCF	10664	CCCTC-binding factor (zinc finger protein)	5
CTRB1	1504	Chymotrypsinogen B1	5
CUTL1	1523	cut-like 1, CCAAT displacement	5
CX3CR1	1524	Chemokine (C-X3-C motif) receptor 1	5
CXCR3	2833	Chemokine (C-X-C motif) receptor 3	5
CXCR6	10663	Chemokine (C-X-C motif) receptor 6	5
CXCR7	57007	Chemokine (C-X-C motif) receptor 7	5
CYSLTR1	10800	Cysteinyl leukotriene receptor 1	5
CYSLTR2	57105	Cysteinyl leukotriene receptor 2	5
DBP	1628	D site of albumin promoter (albumin D-box) binding protein	4
DCTN4	51164	Dynactin 4 (p62)	5
DDI2	84301	DDI1, DNA-damage inducible 1, homolog 2 (S. cerevisiae)	5
DEK	7913	DEK oncogene (DNA binding)	5
DIDO1	11083	Death inducer-obliterator 1	5
DLX1	1745	Distal-less homeobox 1	4
DLX2	1746	Distal-less homeobox 2	4
DLX3	1747	Distal-less homeobox 3	5
DLX4	1748	Distal-less homeobox 4	4
DMRT1	1761	Doublesex and mab-3 related transcription factor 1	5

DPF1	8193	D4, zinc and double PHD fingers family 1	4
DPF2	5977	D4, zinc and double PHD fingers family 2	4
DPF3	8110	D4, zinc and double PHD fingers, family 3	5
DR1	1810	Down-regulator of transcription 1, TBP-binding (negative cofactor 2)	5
DRD1	1812	Dopamine receptor D1	5
DRD2	1813	Dopamine receptor D2	5
DRD3	1814	Dopamine receptor D3	4
DRD4	1815	Dopamine receptor D4	5
DRD5	1816	Dopamine receptor D5	3
DUX1	26584	Double homeobox, 1	5
DUX2	26583	double homeobox, 2	3
E2F2	1870	E2F transcription factor 2	4
E2F3	1871	E2F transcription factor 3	5
E2F4	1874	E2F transcription factor 4, p107/p130-binding	4
E2F5	1875	E2F transcription factor 5, p130-binding	5
E2F6	1876	E2F transcription factor 6	5
E4F1	1877	E4F transcription factor 1	5
EBF1	1879	Early B-cell factor 1	5
EBI2	1880	Epstein-Barr virus induced gene 2 (lymphocyte-specific G protein-coupled receptor)	5
EDF1	8721	Endothelial differentiation-related factor 1	5
EDG1	1901	Endothelial differentiation, sphingolipid G-protein-coupled receptor, 1	3
EDG2	1902	Endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 2	4
EDG3	1903	Endothelial differentiation, sphingolipid G-protein-coupled receptor, 3	5
EDG4	9170	Endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 4	5
EDG5	9294	Endothelial differentiation, sphingolipid G-protein-coupled receptor, 5	4
EDG6	8698	Endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 6	4
EDG7	23566	Endothelial differentiation, lysophosphatidic acid G-protein-coupled receptor, 7	4
EDNRA	1909	Endothelin receptor type A	5
EDNRB	1910	Endothelin receptor type B	4
EGR1	1958	Early growth response 1	5
EGR2	1959	Early growth response 2 (Krox-20 homolog, Drosophila)	5
EGR3	1960	Early growth response 3	5
EGR4	1961	Early growth response 4	4
ELF1	1997	E74-like factor 1 (ets domain transcription factor)	4
ELF2	1998	E74-like factor 2 (ets domain transcription factor)	5
ELF3	1999	E74-like factor 3 (ets domain transcription factor, epithelial-specific)	5
ELF4	2000	E74-like factor 4 (ets domain transcription factor)	5
ELF5	2001	E74-like factor 5 (ets domain transcription factor)	4

ELK3	2004	ELK3, ETS-domain protein (SRF accessory protein 2)	5
ELK4	2005	ELK4, ETS-domain protein (SRF accessory protein 1)	5
ELOVL4	6785	Elongation of very long chain fatty acids (FEN1/Elo2, SUR4/Elo3, yeast)-like 4	5
EMR1	2015	Egf-like module containing, mucin-like, hormone receptor-like 1	5
EMR2	30817	Egf-like module containing, mucin-like, hormone receptor-like 2	5
EMX1	2016	Empty spiracles homeobox 1	4
EMX2	2018	Empty spiracles homeobox 2	5
EN1	2019	Engrailed homeobox 1	5
EN2	2020	Engrailed homeobox 2	5
EOMES	8320	Eomesodermin homolog (<i>Xenopus laevis</i>)	4
ERF	2077	Ets2 repressor factor	5
ERG	2078	V-ets erythroblastosis virus E26 oncogene homolog (avian)	5
ETS2	2114	V-ets erythroblastosis virus E26 oncogene homolog 2 (avian)	5
ETV1	2115	Ets variant gene 1	5
ETV3	2117	Ets variant gene 3	5
ETV4	2118	Ets variant gene 4 (E1A enhancer binding protein, E1AF)	5
ETV5	2119	Ets variant gene 5 (ets-related molecule)	5
EVX1	2128	Even-skipped homeobox 1	5
F10	2159	Coagulation factor X	4
F11	2160	Coagulation factor XI (plasma thromboplastin antecedent)	5
F12	2161	Coagulation factor XII (Hageman factor)	5
F2RL1	2150	Coagulation factor II (thrombin) receptor-like 1	5
F2RL2	2151	Coagulation factor II (thrombin) receptor-like 2	5
F7	2155	Coagulation factor VII (serum prothrombin conversion accelerator)	5
F9	2158	Coagulation factor IX (plasma thromboplastic component, Christmas disease, hemophilia)	5
FAP	2191	Fibroblast activation protein, alpha	5
FAT2	2196	FAT tumor suppressor homolog 2 (<i>Drosophila</i>)	5
FBXO15	201456	F-box protein 15	4
FEV	54738	FEV (ETS oncogene family)	5
FFAR2	2867	Free fatty acid receptor 2	5
FFAR3	2865	Free fatty acid receptor 3	5
FJX1	24147	Four jointed box 1 (<i>Drosophila</i>)	4
FLJ36748	134265	hypothetical protein FLJ36748	3
FOLH1	2346	Folate hydrolase (prostate-specific membrane antigen) 1	5
FOXA1	3169	Forkhead box A1	5
FOXA2	3170	Forkhead box A2	4
FOXA3	3171	Forkhead box A3	5
FOXC1	2296	Forkhead box C1	5

FOXD1	2297	Forkhead box D1	4
FOXE3	2301	Forkhead box E3	3
FOXF1	2294	Forkhead box F1	5
FOXF2	2295	Forkhead box F2	4
FOXG1B	2290	forkhead box G1B	5
FOXH1	8928	Forkhead box H1	4
FOXI1	2299	Forkhead box I1	4
FOXJ1	2302	Forkhead box J1	5
FOXL1	2300	Forkhead box L1	5
FOXN1	8456	Forkhead box N1	5
FRZB	2487	Frizzled-related protein	5
FUBP1	8880	Far upstream element (FUSE) binding protein 1	5
G3BP	10146	Ras-GTPase-activating protein	5
GABBR2	9568	Gamma-aminobutyric acid (GABA) B receptor, 2	5
GALR3	8484	Galanin receptor 3	2
GAS7	8522	Growth arrest-specific 7	5
GATAD2B	57459	GATA zinc finger domain containing 2B	5
GCM1	8521	Glial cells missing homolog 1 (Drosophila)	5
GFI1B	8328	Growth factor independent 1B transcription repressor	5
GLIPR1L1	256710	GLI pathogenesis-related 1 like 1	5
GLRA1	2741	Glycine receptor, alpha 1 (startle disease/hyperekplexia)	4
GM2A	2760	GM2 ganglioside activator	5
GNRHR2	114814	Gonadotropin-releasing hormone (type 2) receptor 2	5
GPBAR1	151306	G protein-coupled bile acid receptor 1	5
GPR1	2825	G protein-coupled receptor 1	5
GPR101	83550	G protein-coupled receptor 101	5
GPR103	84109	G protein-coupled receptor 103	5
GPR109B	8843	G protein-coupled receptor 109B	5
GPR110	266977	G protein-coupled receptor 110	5
GPR111	222611	G protein-coupled receptor 111	5
GPR112	139378	G protein-coupled receptor 112	5
GPR113	165082	G protein-coupled receptor 113	5
GPR114	221188	G protein-coupled receptor 114	5
GPR115	221393	G protein-coupled receptor 115	5
GPR116	221395	G protein-coupled receptor 116	5
GPR120	338557	G protein-coupled receptor 120	4
GPR123	84435	G protein-coupled receptor 123	5
GPR124	25960	G protein-coupled receptor 124	5

GPR126	57211	G protein-coupled receptor 126	5
GPR133	283383	G protein-coupled receptor 133	4
GPR135	64582	G protein-coupled receptor 135	4
GPR141	353345	G protein-coupled receptor 141	5
GPR143	4935	G protein-coupled receptor 143	3
GPR144	347088	G protein-coupled receptor 144	5
GPR146	115330	G protein-coupled receptor 146	5
GPR150	285601	G protein-coupled receptor 150	5
GPR151	134391	G protein-coupled receptor 151	5
GPR160	26996	G protein-coupled receptor 160	5
GPR161	23432	G protein-coupled receptor 161	5
GPR162	27239	G protein-coupled receptor 162	4
GPR171	29909	G protein-coupled receptor 171	5
GPR173	54328	G protein-coupled receptor 173	5
GPR175	131601	G protein-coupled receptor 175	3
GPR176	11245	G protein-coupled receptor 176	5
GPR25	2848	G protein-coupled receptor 25	5
GPR4	2828	G protein-coupled receptor 4	5
GPR42	2866	G protein-coupled receptor 42	5
GPR44	11251	G protein-coupled receptor 44	5
GPR50	9248	G protein-coupled receptor 50	5
GPR52	9293	G protein-coupled receptor 52	5
GPR55	9290	G protein-coupled receptor 55	5
GPR56	9289	G protein-coupled receptor 56	5
GPR61	83873	G protein-coupled receptor 61	5
GPR62	118442	G protein-coupled receptor 62	5
GPR63	81491	G protein-coupled receptor 63	5
GPR64	10149	G protein-coupled receptor 64	5
GPR65	8477	G protein-coupled receptor 65	5
GPR68	8111	G protein-coupled receptor 68	5
GPR89A	51463	G protein-coupled receptor 89A	5
GPR98	84059	G protein-coupled receptor 98	5
GPRC5B	51704	G protein-coupled receptor, family C, group 5, member B	5
GPRC5C	55890	G protein-coupled receptor, family C, group 5, member C	5
GPRC6A	222545	G protein-coupled receptor, family C, group 6, member A	5
GPX3	2878	Glutathione peroxidase 3 (plasma)	5
GRM1	2911	Glutamate receptor, metabotropic 1	5
GRM2	2912	Glutamate receptor, metabotropic 2	4

GRM3	2913	Glutamate receptor, metabotropic 3	4
GRM4	2914	Glutamate receptor, metabotropic 4	4
GRM5	2915	Glutamate receptor, metabotropic 5	5
GRM6	2916	Glutamate receptor, metabotropic 6	5
GRM7	2917	Glutamate receptor, metabotropic 7	5
GRM8	2918	Glutamate receptor, metabotropic 8	5
GRPEL2	134266	GrpE-like 2, mitochondrial (E. coli)	5
GRPR	2925	Gastrin-releasing peptide receptor	5
GTF3C3	9330	General transcription factor III C, polypeptide 3, 102kDa	5
GTF3C4	9329	General transcription factor III C, polypeptide 4, 90kDa	5
GTF3C5	9328	General transcription factor III C, polypeptide 5, 63kDa	5
HAND1	9421	Heart and neural crest derivatives expressed 1	5
HAND2	9464	Heart and neural crest derivatives expressed 2	5
HBP1	26959	HMG-box transcription factor 1	5
HCLS1	3059	Hematopoietic cell-specific Lyn substrate 1	5
HCRTR2	3062	Hypocretin (orexin) receptor 2	4
HEAB	10978	ATP/GTP-binding protein	5
HERC2	8924	Hect domain and RLD 2	5
HESX1	8820	HESX homeobox 1	5
HHEX	3087	Hematopoietically expressed homeobox	5
HIC1	3090	Hypermethylated in cancer 1	5
HLF	3131	Hepatic leukemia factor	5
HLX1	3142	H2.0-like homeo box 1 (Drosoph	5
HLXB9	3110	homeo box HB9	4
HMBOX1	79618	Homeobox containing 1	5
HMX1	3166	H6 family homeobox 1	3
HOXA1	3198	Homeobox A1	4
HOXA10	3206	Homeobox A10	5
HOXA11	3207	Homeobox A11	3
HOXA2	3199	Homeobox A2	5
HOXA7	3204	Homeobox A7	5
HOXA9	3205	Homeobox A9	4
HRH1	3269	Histamine receptor H1	4
HRH2	3274	Histamine receptor H2	4
HRH3	11255	Histamine receptor H3	5
HRH4	59340	Histamine receptor H4	5
HTR1A	3350	5-hydroxytryptamine (serotonin) receptor 1A	5
HTR1B	3351	5-hydroxytryptamine (serotonin) receptor 1B	3

HTR1F	3355	5-hydroxytryptamine (serotonin) receptor 1F	5
HTR2A	3356	5-hydroxytryptamine (serotonin) receptor 2A	5
HTR2B	3357	5-hydroxytryptamine (serotonin) receptor 2B	5
HTR2C	3358	5-hydroxytryptamine (serotonin) receptor 2C	5
HTR3A	3359	5-hydroxytryptamine (serotonin) receptor 3A	5
HTR3B	9177	5-hydroxytryptamine (serotonin) receptor 3B	5
HTR4	3360	5-hydroxytryptamine (serotonin) receptor 4	5
HTR5A	3361	5-hydroxytryptamine (serotonin) receptor 5A	4
HTR7	3363	5-hydroxytryptamine (serotonin) receptor 7 (adenylate cyclase-coupled)	5
IL17B	27190	Interleukin 17B	4
IL8RA	3577	Interleukin 8 receptor, alpha	5
IL8RB	3579	Interleukin 8 receptor, beta	5
ILF2	3608	Interleukin enhancer binding factor 2, 45kDa	5
ILF3	3609	Interleukin enhancer binding factor 3, 90kDa	5
INSM1	3642	Insulinoma-associated 1	5
IPF1	3651	insulin promoter factor 1, hom	5
IRF1	3659	Interferon regulatory factor 1	5
IRF2	3660	Interferon regulatory factor 2	5
IRF4	3662	Interferon regulatory factor 4	5
IRF5	3663	Interferon regulatory factor 5	5
IRF6	3664	Interferon regulatory factor 6	5
IRF7	3665	Interferon regulatory factor 7	3
ISL1	3670	ISL LIM homeobox 1	5
JARID1A	5927	Jumonji, AT rich interactive domain 1A	5
JARID1B	10765	Jumonji, AT rich interactive domain 1B	4
JUNB	3726	Jun B proto-oncogene	5
JUND	3727	Jun D proto-oncogene	3
KHSRP	8570	KH-type splicing regulatory protein (FUSE binding protein 2)	5
KISS1R	84634	KISS1 receptor	4
KLF11	8462	Kruppel-like factor 11	4
KLF5	688	Kruppel-like factor 5 (intestinal)	5
KLF6	1316	Kruppel-like factor 6	4
KLF7	8609	Kruppel-like factor 7 (ubiquitous)	5
KLF9	687	Kruppel-like factor 9	4
LANCL1	10314	LanC lantibiotic synthetase component C-like 1 (bacterial)	5
LCORL	254251	Ligand dependent nuclear receptor corepressor-like	5
LEO1	123169	Leo1, Paf1/RNA polymerase II complex component, homolog (<i>S. cerevisiae</i>)	5
LGR5	8549	Leucine-rich repeat-containing G protein-coupled receptor 5	5

LHCGR	3973	Luteinizing hormone/choriogonadotropin receptor	3
LHX1	3975	LIM homeobox 1	5
LHX2	9355	LIM homeobox 2	4
LHX3	8022	LIM homeobox 3	4
LMO1	4004	LIM domain only 1 (rhombotin 1)	4
LMO4	8543	LIM domain only 4	5
LOC202201	202201	similar to Transcription initi	5
LOC220594	220594	TL132 protein	5
LPHN1	22859	Latrophilin 1	4
LPHN2	23266	Latrophilin 2	5
LPHN3	23284	Latrophilin 3	3
LRRFIP1	9208	Leucine rich repeat (in FLII) interacting protein 1	5
LTB4R	1241	Leukotriene B4 receptor	5
LTB4R2	56413	Leukotriene B4 receptor 2	2
LZTFL1	54585	Leucine zipper transcription factor-like 1	5
MAFG	4097	V-maf musculoaponeurotic fibrosarcoma oncogene homolog G (avian)	4
MAFK	7975	V-maf musculoaponeurotic fibrosarcoma oncogene homolog K (avian)	5
MAP3K7IP3	257397	Mitogen-activated protein kinase kinase kinase 7 interacting protein 3	5
MAS1	4142	MAS1 oncogene	5
MAS1L	116511	MAS1 oncogene-like	5
MBD2	8932	Methyl-CpG binding domain protein 2	5
MBD4	8930	Methyl-CpG binding domain protein 4	5
MBTPS1	8720	Membrane-bound transcription factor peptidase, site 1	5
MC1R	4157	Melanocortin 1 receptor (alpha melanocyte stimulating hormone receptor)	5
MC2R	4158	Melanocortin 2 receptor (adrenocorticotropic hormone)	5
MC3R	4159	Melanocortin 3 receptor	5
MC4R	4160	Melanocortin 4 receptor	5
MC5R	4161	Melanocortin 5 receptor	5
MCHR2	84539	Melanin-concentrating hormone receptor 2	5
MGC20470	143630	hypothetical protein MGC20470	5
MLL2	8085	Myeloid/lymphoid or mixed-lineage leukemia 2	5
MLLT10	8028	Myeloid/lymphoid or mixed-lineage leukemia (trithorax homolog, Drosophila); translocated	4
MORF4	10934	Mortality factor 4	3
MRGPRF	219928	MAS-related GPR, member F	5
MRGPRX1	259249	MAS-related GPR, member X1	4
MRGPRX2	117194	MAS-related GPR, member X2	5
MRGPRX4	117196	MAS-related GPR, member X4	4
MSC	9242	Musculin (activated B-cell factor-1)	4

MST150	85027	MSTP150	3
MTA1	9112	Metastasis associated 1	5
MTA2	9219	Metastasis associated 1 family, member 2	5
MTNR1A	4543	Melatonin receptor 1A	4
MTNR1B	4544	Melatonin receptor 1B	5
MYOZ3	91977	Myozenin 3	5
MYST3	7994	MYST histone acetyltransferase (monocytic leukemia) 3	4
NDST1	3340	N-deacetylase/N-sulfotransferase (heparan glucosaminyl) 1	4
NEDD4	4734	Neural precursor cell expressed, developmentally down-regulated 4	5
NES	10763	Nestin	5
NFATC3	4775	Nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 3	5
NFATC4	4776	Nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 4	5
NFE2	4778	Nuclear factor (erythroid-derived 2), 45kDa	5
NFE2L1	4779	Nuclear factor (erythroid-derived 2)-like 1	5
NFE2L2	4780	Nuclear factor (erythroid-derived 2)-like 2	5
NFIB	4781	Nuclear factor I/B	5
NFIC	4782	Nuclear factor I/C (CCAAT-binding transcription factor)	5
NFIL3	4783	Nuclear factor, interleukin 3 regulated	5
NFIX	4784	Nuclear factor I/X (CCAAT-binding transcription factor)	5
NFRKB	4798	Nuclear factor related to kappaB binding protein	4
NFX1	4799	Nuclear transcription factor, X-box binding 1	5
NFYA	4800	Nuclear transcription factor Y, alpha	5
NFYB	4801	Nuclear transcription factor Y, beta	5
NFYC	4802	Nuclear transcription factor Y, gamma	5
NHLH1	4807	Nescient helix loop helix 1	3
NHLH2	4808	Nescient helix loop helix 2	5
NKX2-5	1482	NK2 transcription factor related, locus 5 (Drosophila)	5
NMBR	4829	Neuromedin B receptor	5
NMUR2	56923	Neuromedin U receptor 2	4
NPAS1	4861	Neuronal PAS domain protein 1	5
NPBWR1	2831	Neuropeptides B/W receptor 1	4
NPFFR1	64106	Neuropeptide FF receptor 1	5
NPR1	4881	Natriuretic peptide receptor A/guanylate cyclase A (atriuretic peptide receptor A)	5
NPR3	4883	Natriuretic peptide receptor C/guanylate cyclase C (atriuretic peptide receptor C)	5
NPY	4852	Neuropeptide Y	3
NPY1R	4886	Neuropeptide Y receptor Y1	5
NPY2R	4887	Neuropeptide Y receptor Y2	4
NPY5R	4889	Neuropeptide Y receptor Y5	5

NTSR1	4923	Neurotensin receptor 1 (high affinity)	5
NTSR2	23620	Neurotensin receptor 2	5
ONECUT1	3175	One cut homeobox 1	5
OPN1LW	5956	Opsin 1 (cone pigments), long-wave-sensitive (color blindness, protan)	5
OPN1MW	2652	Opsin 1 (cone pigments), medium-wave-sensitive (color blindness, deutan)	5
OPN1SW	611	Opsin 1 (cone pigments), short-wave-sensitive (color blindness, tritan)	5
OPN3	23596	Opsin 3 (encephalopsin, panopsin)	4
OPN4	94233	Opsin 4 (melanopsin)	5
OPN5	221391	Opsin 5	5
OPRD1	4985	Opioid receptor, delta 1	5
OPRK1	4986	Opioid receptor, kappa 1	4
OPRL1	4987	Opiate receptor-like 1	5
OPRM1	4988	Opioid receptor, mu 1	2
OR10H1	26539	Olfactory receptor, family 10, subfamily H, member 1	4
OR10H2	26538	Olfactory receptor, family 10, subfamily H, member 2	5
OR10H3	26532	Olfactory receptor, family 10, subfamily H, member 3	5
OR10J1	26476	Olfactory receptor, family 10, subfamily J, member 1	5
OR11A1	26531	Olfactory receptor, family 11, subfamily A, member 1	5
OR12D2	26529	Olfactory receptor, family 12, subfamily D, member 2	5
OR12D3	81797	Olfactory receptor, family 12, subfamily D, member 3	5
OR1A1	8383	Olfactory receptor, family 1, subfamily A, member 1	5
OR1A2	26189	Olfactory receptor, family 1, subfamily A, member 2	5
OR1D2	4991	Olfactory receptor, family 1, subfamily D, member 2	5
OR1E1	8387	Olfactory receptor, family 1, subfamily E, member 1	5
OR1E2	8388	Olfactory receptor, family 1, subfamily E, member 2	5
OR1F1	4992	Olfactory receptor, family 1, subfamily F, member 1	5
OR1G1	8390	Olfactory receptor, family 1, subfamily G, member 1	5
OR2A4	79541	Olfactory receptor, family 2, subfamily A, member 4	5
OR2B2	81697	Olfactory receptor, family 2, subfamily B, member 2	5
OR2C1	4993	Olfactory receptor, family 2, subfamily C, member 1	5
OR2F1	26211	Olfactory receptor, family 2, subfamily F, member 1	4
OR2H1	26716	Olfactory receptor, family 2, subfamily H, member 1	5
OR2H2	7932	Olfactory receptor, family 2, subfamily H, member 2	3
OR2J2	26707	Olfactory receptor, family 2, subfamily J, member 2	5
OR2L13	284521	Olfactory receptor, family 2, subfamily L, member 13	5
OR2S2	56656	Olfactory receptor, family 2, subfamily S, member 2	5
OR2W1	26692	Olfactory receptor, family 2, subfamily W, member 1	5
OR3A1	4994	Olfactory receptor, family 3, subfamily A, member 1	5

OR3A2	4995	Olfactory receptor, family 3, subfamily A, member 2	5
OR3A3	8392	Olfactory receptor, family 3, subfamily A, member 3	4
OR51B2	79345	Olfactory receptor, family 51, subfamily B, member 2	5
OR51B4	79339	Olfactory receptor, family 51, subfamily B, member 4	5
OR51E1	143503	Olfactory receptor, family 51, subfamily E, member 1	5
OR51E2	81285	Olfactory receptor, family 51, subfamily E, member 2	5
OR52A1	23538	Olfactory receptor, family 52, subfamily A, member 1	5
OR5I1	10798	Olfactory receptor, family 5, subfamily I, member 1	5
OR5P2	120065	Olfactory receptor, family 5, subfamily P, member 2	5
OR5P3	120066	Olfactory receptor, family 5, subfamily P, member 3	4
OR5V1	81696	Olfactory receptor, family 5, subfamily V, member 1	5
OR6A2	8590	Olfactory receptor, family 6, subfamily A, member 2	4
OR6W1P	89883	Olfactory receptor, family 6, subfamily W, member 1 pseudogene	4
OR7A17	26333	Olfactory receptor, family 7, subfamily A, member 17	4
OR7A5	26659	Olfactory receptor, family 7, subfamily A, member 5	4
OR7C2	26658	Olfactory receptor, family 7, subfamily C, member 2	4
OR8B8	26493	Olfactory receptor, family 8, subfamily B, member 8	5
OXER1	165140	Oxoecosanoid (OXE) receptor 1	4
OXTR	5021	Oxytocin receptor	4
P2RY1	5028	Purinergic receptor P2Y, G-protein coupled, 1	5
P2RY10	27334	Purinergic receptor P2Y, G-protein coupled, 10	4
P2RY11	5032	Purinergic receptor P2Y, G-protein coupled, 11	5
P2RY12	64805	Purinergic receptor P2Y, G-protein coupled, 12	5
P2RY14	9934	Purinergic receptor P2Y, G-protein coupled, 14	3
P2RY2	5029	Purinergic receptor P2Y, G-protein coupled, 2	3
P2RY4	5030	Pyrimidinergic receptor P2Y, G-protein coupled, 4	4
P2RY5	10161	Purinergic receptor P2Y, G-protein coupled, 5	5
P2RY6	5031	Pyrimidinergic receptor P2Y, G-protein coupled, 6	5
P2RY8	286530	Purinergic receptor P2Y, G-protein coupled, 8	5
PBXIP1	57326	Pre-B-cell leukemia homeobox interacting protein 1	5
PCYOX1L	78991	Prenylcysteine oxidase 1 like	4
PDE6A	5145	Phosphodiesterase 6A, cGMP-specific, rod, alpha	3
PFKFB3	5209	6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 3	5
PHOX2B	8929	Paired-like homeobox 2b	5
PHTF1	10745	Putative homeodomain transcription factor 1	5
PIAS2	9063	Protein inhibitor of activated STAT, 2	5
PPARGC1B	133522	Peroxisome proliferator-activated receptor gamma, coactivator 1 beta	5
PPYR1	5540	Pancreatic polypeptide receptor 1	5

PRDM2	7799	PR domain containing 2, with ZNF domain	5
PRDM5	11107	PR domain containing 5	5
PRDM7	11105	PR domain containing 7	5
PRLHR	2834	Prolactin releasing hormone receptor	4
PROK2	60675	Prokineticin 2	5
PRRX2	51450	Paired related homeobox 2	3
PTAFR	5724	platelet-activating factor rec	5
PTGDR	5729	Prostaglandin D2 receptor (DP)	5
PTGER1	5731	Prostaglandin E receptor 1 (subtype EP1), 42kDa	5
PTGER2	5732	Prostaglandin E receptor 2 (subtype EP2), 53kDa	5
PTGER3	5733	Prostaglandin E receptor 3 (subtype EP3)	5
PTGFR	5737	Prostaglandin F receptor (FP)	5
PTGIR	5739	Prostaglandin I2 (prostacyclin) receptor (IP)	5
PTH2	5746	parathyroid hormone receptor 2	5
PTTG1	9232	Pituitary tumor-transforming 1	4
PURA	5813	Purine-rich element binding protein A	5
QKI	9444	Quaking homolog, KH domain RNA binding (mouse)	5
RAI1	10743	Retinoic acid induced 1	5
RAMP1	10267	Receptor (G protein-coupled) activity modifying protein 1	4
RBM22	55696	RNA binding motif protein 22	4
RDS	5961	retinal degeneration, slow	5
RELA	5970	V-rel reticuloendotheliosis viral oncogene homolog A, nuclear factor of kappa light polypep	5
RELB	5971	V-rel reticuloendotheliosis viral oncogene homolog B, nuclear factor of kappa light polypep	4
REST	5978	RE1-silencing transcription factor	5
RFX1	5989	Regulatory factor X, 1 (influences HLA class II expression)	5
RFX2	5990	Regulatory factor X, 2 (influences HLA class II expression)	5
RFX3	5991	Regulatory factor X, 3 (influences HLA class II expression)	4
RFX4	5992	Regulatory factor X, 4 (influences HLA class II expression)	5
RFXANK	8625	Regulatory factor X-associated ankyrin-containing protein	5
RFXAP	5994	Regulatory factor X-associated protein	3
RGR	5995	Retinal G protein coupled receptor	5
RLF	6018	Rearranged L-myc fusion	5
RNF103	7844	Ring finger protein 103	5
RNF133	168433	Ring finger protein 133	5
RPL7	6129	Ribosomal protein L7	5
RPS14	6208	Ribosomal protein S14	5
RRN3	54700	RRN3 RNA polymerase I transcription factor homolog (S. cerevisiae)	5
RUNX1	861	Runt-related transcription factor 1 (acute myeloid leukemia 1; aml1 oncogene)	5

RUNX1T1	862	Runt-related transcription factor 1; translocated to, 1 (cyclin D-related)	3
RUNX2	860	Runt-related transcription factor 2	5
RUNX3	864	Runt-related transcription factor 3	4
RWDD4A	201965	RWD domain containing 4A	5
RXFP1	59350	Relaxin/insulin-like family peptide receptor 1	5
RXFP2	122042	Relaxin/insulin-like family peptide receptor 2	5
RXFP3	51289	Relaxin/insulin-like family peptide receptor 3	5
RXFP4	339403	Relaxin/insulin-like family peptide receptor 4	5
SCTR	6344	Secretin receptor	5
SFRP4	6424	Secreted frizzled-related protein 4	5
SFRP5	6425	Secreted frizzled-related protein 5	5
SH3TC2	79628	SH3 domain and tetratricopeptide repeats 2	5
SIM1	6492	Single-minded homolog 1 (Drosophila)	5
SIM2	6493	Single-minded homolog 2 (Drosophila)	5
SIX1	6495	SIX homeobox 1	5
SIX2	10736	SIX homeobox 2	4
SIX3	6496	SIX homeobox 3	5
SKP2	6502	S-phase kinase-associated protein 2 (p45)	5
SLC26A2	1836	Solute carrier family 26 (sulfate transporter), member 2	5
SLC36A1	206358	Solute carrier family 36 (proton/amino acid symporter), member 1	5
SLC6A7	6534	Solute carrier family 6 (neurotransmitter transporter, L-proline), member 7	5
SMARCA5	8467	SWI/SNF related, matrix associated, actin dependent regulator of chromatin, subfamily a,	5
SMO	6608	Smoothened homolog (Drosophila)	5
SORT1	6272	Sortilin 1	5
SOX14	8403	SRY (sex determining region Y)-box 14	4
SPARC	6678	Secreted protein, acidic, cysteine-rich (osteonectin)	5
SPRY2	10253	Sprouty homolog 2 (Drosophila)	5
SSTR1	6751	Somatostatin receptor 1	5
SSTR2	6752	Somatostatin receptor 2	5
SSTR3	6753	Somatostatin receptor 3	4
SSTR4	6754	Somatostatin receptor 4	3
SSTR5	6755	Somatostatin receptor 5	3
STUB1	10273	STIP1 homology and U-box containing protein 1	5
SUB1	10923	SUB1 homolog (S. cerevisiae)	4
SUPT3H	8464	Suppressor of Ty 3 homolog (S. cerevisiae)	5
SURB7	9412	SRB7 suppressor of RNA polymer	5
SYNPO	11346	Synaptopodin	5
TAAR1	134864	Trace amine associated receptor 1	5

TAAR2	9287	Trace amine associated receptor 2	5
TAAR5	9038	Trace amine associated receptor 5	5
TAAR6	319100	Trace amine associated receptor 6	4
TAAR8	83551	Trace amine associated receptor 8	5
TAAR9	134860	Trace amine associated receptor 9	5
TACR1	6869	Tachykinin receptor 1	5
TACR2	6865	Tachykinin receptor 2	5
TACR3	6870	Tachykinin receptor 3	5
TAF10	6881	TAF10 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 30kDa	5
TAF11	6882	TAF11 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 28kDa	5
TAF12	6883	TAF12 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 20kDa	5
TAF1A	9015	TATA box binding protein (TBP)-associated factor, RNA polymerase I, A, 48kDa	5
TAF1B	9014	TATA box binding protein (TBP)-associated factor, RNA polymerase I, B, 63kDa	5
TAF1C	9013	TATA box binding protein (TBP)-associated factor, RNA polymerase I, C, 110kDa	5
TAF7	6879	TAF7 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 55kDa	5
TAF7L	54457	TAF7-like RNA polymerase II, TATA box binding protein (TBP)-associated factor, 50kDa	5
TAF9	6880	TAF9 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 32kDa	4
TAL1	6886	T-cell acute lymphocytic leuke	5
TAL2	6887	T-cell acute lymphocytic leukemia 2	4
TAS1R1	80835	Taste receptor, type 1, member 1	5
TAS1R2	80834	Taste receptor, type 1, member 2	5
TAS2R1	50834	Taste receptor, type 2, member 1	5
TAS2R10	50839	Taste receptor, type 2, member 10	5
TAS2R13	50838	Taste receptor, type 2, member 13	5
TAS2R14	50840	Taste receptor, type 2, member 14	5
TAS2R16	50833	Taste receptor, type 2, member 16	5
TAS2R3	50831	Taste receptor, type 2, member 3	5
TAS2R39	259285	Taste receptor, type 2, member 39	4
TAS2R4	50832	Taste receptor, type 2, member 4	5
TAS2R40	259286	Taste receptor, type 2, member 40	5
TAS2R41	259287	Taste receptor, type 2, member 41	5
TAS2R45	259291	Taste receptor, type 2, member 45	5
TAS2R46	259292	Taste receptor, type 2, member 46	5
TAS2R48	259294	Taste receptor, type 2, member 48	5
TAS2R5	54429	Taste receptor, type 2, member 5	5
TAS2R60	338398	Taste receptor, type 2, member 60	5
TAS2R7	50837	Taste receptor, type 2, member 7	5
TAS2R8	50836	Taste receptor, type 2, member 8	5

TAS2R9	50835	Taste receptor, type 2, member 9	5
TBP	6908	TATA box binding protein	4
TBR1	10716	T-box, brain, 1	4
TBX1	6899	T-box 1	4
TBX19	9095	T-box 19	5
TBX2	6909	T-box 2	5
TBX6	6911	T-box 6	4
TBXA2R	6915	Thromboxane A2 receptor	4
TCEAL1	9338	Transcription elongation factor A (SII)-like 1	5
TCEB3	6924	Transcription elongation factor B (SIII), polypeptide 3 (110kDa, elongin A)	5
TCERG1	10915	Transcription elongation regulator 1	5
TCF12	6938	Transcription factor 12 (HTF4, helix-loop-helix transcription factors 4)	5
TCF15	6939	Transcription factor 15 (basic helix-loop-helix)	2
TCF4	6925	Transcription factor 4	5
TCFL5	10732	Transcription factor-like 5 (basic helix-loop-helix)	5
TCOF1	6949	Treacher Collins-Franceschetti syndrome 1	5
TEAD2	8463	TEA domain family member 2	5
TFEB	7942	Transcription factor EB	5
TGIF2LX	90316	TGFB-induced factor homeobox 2-like, X-linked	5
TIGD6	81789	Tigger transposable element derived 6	5
TLX1	3195	T-cell leukemia homeobox 1	5
TMEM171	134285	Transmembrane protein 171	4
TMEM86B	255043	Transmembrane protein 86B	5
TNIP1	10318	TNFAIP3 interacting protein 1	5
TOB1	10140	Transducer of ERBB2, 1	5
TOPORS	10210	Topoisomerase I binding, arginine/serine-rich	5
TRAF5	7188	TNF receptor-associated factor 5	5
TRAF6	7189	TNF receptor-associated factor 6	5
TRHR	7201	Thyrotropin-releasing hormone receptor	5
TRIM38	10475	Tripartite motif-containing 38	5
TRIM40	135644	Tripartite motif-containing 40	4
TSC22D1	8848	TSC22 domain family, member 1	5
TSC22D3	1831	TSC22 domain family, member 3	5
TSG101	7251	Tumor susceptibility gene 101	5
TSHR	7253	Thyroid stimulating hormone receptor	5
TUBB3	10381	Tubulin, beta 3	5
TWISTNB	221830	TWIST neighbor	5
UBC	7316	Ubiquitin C	5

UBE2E2	7325	Ubiquitin-conjugating enzyme E2E 2 (UBC4/5 homolog, yeast)	3
UBE2E3	10477	Ubiquitin-conjugating enzyme E2E 3 (UBC4/5 homolog, yeast)	5
UBE2U	148581	Ubiquitin-conjugating enzyme E2U (putative)	5
UBE4A	9354	Ubiquitination factor E4A (UFD2 homolog, yeast)	5
UBE4B	10277	Ubiquitination factor E4B (UFD2 homolog, yeast)	5
UBL5	59286	Ubiquitin-like 5	5
UBL7	84993	Ubiquitin-like 7 (bone marrow stromal cell-derived)	4
UBXD3	127733	UBX domain containing 3	4
UBXD6	7993	UBX domain containing 6	5
UCHL3	7347	Ubiquitin carboxyl-terminal esterase L3 (ubiquitin thiolesterase)	5
USP11	8237	Ubiquitin specific peptidase 11	3
USP15	9958	Ubiquitin specific peptidase 15	5
USP26	83844	Ubiquitin specific peptidase 26	5
USP32	84669	Ubiquitin specific peptidase 32	5
USP6	9098	Ubiquitin specific peptidase 6 (Tre-2 oncogene)	3
USP9X	8239	Ubiquitin specific peptidase 9, X-linked	4
USP9Y	8287	Ubiquitin specific peptidase 9, Y-linked (fat facets-like, Drosophila)	5
USPL1	10208	Ubiquitin specific peptidase like 1	5
UTF1	8433	Undifferentiated embryonic cell transcription factor 1	2
UTS2R	2837	Urotensin 2 receptor	5
VEZF1	7716	Vascular endothelial zinc finger 1	5
VIPR1	7433	Vasoactive intestinal peptide receptor 1	5
VIPR2	7434	Vasoactive intestinal peptide receptor 2	5
VN1R1	57191	Vomeronasal 1 receptor 1	5
YEATS4	8089	YEATS domain containing 4	5
ZBTB16	7704	Zinc finger and BTB domain containing 16	5
ZBTB17	7709	Zinc finger and BTB domain containing 17	4
ZBTB22	9278	Zinc finger and BTB domain containing 22	5
ZBTB48	3104	Zinc finger and BTB domain containing 48	5
ZFAND5	7763	Zinc finger, AN1-type domain 5	5
ZFHX4	79776	Zinc finger homeobox 4	5
ZFP36L2	678	Zinc finger protein 36, C3H type-like 2	5
ZNF10	7556	Zinc finger protein 10	5
ZNF135	7694	Zinc finger protein 135	4
ZNF136	7695	Zinc finger protein 136	4
ZNF137	7696	Zinc finger protein 137	5
ZNF138	7697	Zinc finger protein 138	5
ZNF14	7561	Zinc finger protein 14	5

ZNF140	7699	Zinc finger protein 140	5
ZNF141	7700	Zinc finger protein 141	5
ZNF143	7702	Zinc finger protein 143	5
ZNF146	7705	Zinc finger protein 146	3
ZNF148	7707	Zinc finger protein 148	5
ZNF154	7710	Zinc finger protein 154	5
ZNF155	7711	Zinc finger protein 155	5
ZNF157	7712	Zinc finger protein 157	5
ZNF16	7564	Zinc finger protein 16	5
ZNF165	7718	Zinc finger protein 165	5
ZNF17	7565	Zinc finger protein 17	5
ZNF174	7727	Zinc finger protein 174	5
ZNF175	7728	Zinc finger protein 175	4
ZNF177	7730	Zinc finger protein 177	5
ZNF180	7733	Zinc finger protein 180	5
ZNF187	7741	Zinc finger protein 187	5
ZNF189	7743	Zinc finger protein 189	5
ZNF19	7567	zinc finger protein 19 (KOX 12	5
ZNF192	7745	Zinc finger protein 192	5
ZNF193	7746	Zinc finger protein 193	5
ZNF195	7748	Zinc finger protein 195	5
ZNF20	7568	Zinc finger protein 20	5
ZNF202	7753	Zinc finger protein 202	5
ZNF207	7756	Zinc finger protein 207	5
ZNF208	7757	Zinc finger protein 208	5
ZNF212	7988	Zinc finger protein 212	4
ZNF213	7760	Zinc finger protein 213	4
ZNF214	7761	Zinc finger protein 214	5
ZNF215	7762	Zinc finger protein 215	4
ZNF217	7764	Zinc finger protein 217	5
ZNF221	7638	Zinc finger protein 221	5
ZNF223	7766	Zinc finger protein 223	5
ZNF224	7767	Zinc finger protein 224	5
ZNF225	7768	Zinc finger protein 225	5
ZNF226	7769	Zinc finger protein 226	5
ZNF227	7770	Zinc finger protein 227	5
ZNF228	7771	Zinc finger protein 228	5
ZNF230	7773	Zinc finger protein 230	5

ZNF234	10780	Zinc finger protein 234	5
ZNF235	9310	Zinc finger protein 235	5
ZNF239	8187	Zinc finger protein 239	5
ZNF24	7572	Zinc finger protein 24	5
ZNF26	7574	Zinc finger protein 26	4
ZNF266	10781	Zinc finger protein 266	5
ZNF268	10795	Zinc finger protein 268	5
ZNF274	10782	Zinc finger protein 274	5
ZNF286	57335	zinc finger protein 286	5
ZNF287	57336	Zinc finger protein 287	5
ZNF30	90075	Zinc finger protein 30	5
ZNF300	91975	Zinc finger protein 300	5
ZNF31	7579	zinc finger protein 31 (KOX 29	5
ZNF32	7580	Zinc finger protein 32	5
ZNF33A	7581	Zinc finger protein 33A	3
ZNF33B	7582	Zinc finger protein 33B	5
ZNF35	7584	Zinc finger protein 35	5
ZNF354A	6940	Zinc finger protein 354A	5
ZNF38	7589	zinc finger protein 38	5
ZNF396	252884	Zinc finger protein 396	5
ZNF408	79797	Zinc finger protein 408	5
ZNF41	7592	Zinc finger protein 41	5
ZNF417	147687	Zinc finger protein 417	5
ZNF460	10794	Zinc finger protein 460	3
ZNF549	256051	Zinc finger protein 549	5
ZNF551	90233	Zinc finger protein 551	5
ZNF668	79759	Zinc finger protein 668	5
ZNF690	146050	hypothetical protein FLJ35867	5
ZNF7	7553	Zinc finger protein 7	5
ZNF785	146540	Zinc finger protein 785	5
ZNF80	7634	Zinc finger protein 80	3
ZNF84	7637	Zinc finger protein 84	5
ZNRF2	223082	Zinc and ring finger 2	5
ZRANB2	9406	Zinc finger, RAN-binding domain containing 2	5

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Symbol	NCBI Gene ID	Description	Number of shRNAs
A4GALT	53947	Alpha 1,4-galactosyltransferase (globotriaosylceramide synthase)	5

A4GNT	51146	Alpha-1,4-N-acetylglucosaminyltransferase	5
AADAT	51166	Amino adipate aminotransferase	5
ABAT	18	4-aminobutyrate aminotransferase	5
ABO	28	ABO blood group (transferase A, alpha 1-3-N-acetylgalactosaminyltransferase; transferase B, alpha 1-3-N-acetylglucosaminyltransferase)	5
ADAM2	2515	ADAM metalloproteinase domain 2 (fertilin beta)	5
ADCYAP1R1	117	Adenylate cyclase activating polypeptide 1 (pituitary) receptor type I	4
ADMR	11318	adrenomedullin receptor	4
ADORA1	134	Adenosine A1 receptor	5
ADORA2A	135	Adenosine A2a receptor	5
ADORA3	140	Adenosine A3 receptor	5
ADRA1A	148	Adrenergic, alpha-1A-, receptor	5
ADRA1B	147	Adrenergic, alpha-1B-, receptor	5
ADRA1D	146	Adrenergic, alpha-1D-, receptor	4
ADRA2A	150	Adrenergic, alpha-2A-, receptor	4
ADRA2B	151	Adrenergic, alpha-2B-, receptor	5
AGL	178	Amylo-1, 6-glucosidase, 4-alpha-glucanotransferase (glycogen debranching enzyme, glycogen phosphorylase-activating factor)	5
AGPAT1	10554	1-acylglycerol-3-phosphate O-acyltransferase 1 (lysophosphatidic acid acyltransferase, alpha)	5
AGPAT2	10555	1-acylglycerol-3-phosphate O-acyltransferase 2 (lysophosphatidic acid acyltransferase, beta)	5
AGPAT3	56894	1-acylglycerol-3-phosphate O-acyltransferase 3	4
AGPAT4	56895	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	4
AGPAT6	137964	1-acylglycerol-3-phosphate O-acyltransferase 6 (lysophosphatidic acid acyltransferase, zeta)	3
AGXT	189	Alanine-glyoxylate aminotransferase	5
AGXT2	64902	Alanine-glyoxylate aminotransferase 2	5
AGXT2L1	64850	Alanine-glyoxylate aminotransferase 2-like 1	5
ALDH1A2	8854	Aldehyde dehydrogenase 1 family, member A2	5
ALDH4A1	8659	Aldehyde dehydrogenase 4 family, member A1	5
ALDH5A1	7915	Aldehyde dehydrogenase 5 family, member A1 (succinate-semialdehyde dehydrogenase)	5
ALG10	84920	Asparagine-linked glycosylation 10 homolog (yeast, alpha-1,2-glucosyltransferase)	5
ALG9	79796	Asparagine-linked glycosylation 9 homolog (S. cerevisiae, alpha- 1,2-mannosyltransferase)	5
ALS2CR2	55437	Amyotrophic lateral sclerosis 2 (juvenile) chromosome region, candidate 2	5
AMPH	273	Amphiphysin	4
AMT	275	Aminomethyltransferase	3
ANP32A	8125	Acidic (leucine-rich) nuclear phosphoprotein 32 family, member A	5
APPL	26060	adaptor protein containing pH	4
APRT	353	Adenine phosphoribosyltransferase	5
ARHGDI1A	396	Rho GDP dissociation inhibitor (GDI) alpha	4
ARIH2	10425	Ariadne homolog 2 (Drosophila)	5
ART5	116969	ADP-ribosyltransferase 5	5

AS3MT	57412	Arsenic (+3 oxidation state) methyltransferase	5
ATIC	471	5-aminoimidazole-4-carboxamide ribonucleotide formyltransferase/IMP cyclohydrolase	5
ATP2B4	493	ATPase, Ca ⁺⁺ transporting, plasma membrane 4	5
B3GALT5	10317	UDP-Gal:betaGlcNAc beta 1,3-galactosyltransferase, polypeptide 5	5
B3GALTL	145173	Beta 1,3-galactosyltransferase-like	5
B3GNT5	84002	UDP-GlcNAc:betaGal beta-1,3-N-acetylglucosaminyltransferase 5	5
B4GALNT4	338707	Beta-1,4-N-acetyl-galactosaminyl transferase 4	5
B4GALT1	2683	UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 1	4
B4GALT2	8704	UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 2	5
B4GALT3	8703	UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 3	4
B4GALT6	9331	UDP-Gal:betaGlcNAc beta 1,4- galactosyltransferase, polypeptide 6	5
BAD	572	BCL2-antagonist of cell death	5
BAK1	578	BCL2-antagonist/killer 1	5
BAX	581	BCL2-associated X protein	5
BAZ1A	11177	Bromodomain adjacent to zinc finger domain, 1A	5
BCAT1	586	Branched chain aminotransferase 1, cytosolic	4
BCAT2	587	Branched chain aminotransferase 2, mitochondrial	5
BCL11A	53335	B-cell CLL/lymphoma 11A (zinc finger protein)	5
BCL11B	64919	B-cell CLL/lymphoma 11B (zinc finger protein)	5
BCL2A1	597	BCL2-related protein A1	5
BCL2L1	598	BCL2-like 1	5
BCL2L12	83596	BCL2-like 12 (proline rich)	5
BCL2L14	79370	BCL2-like 14 (apoptosis facilitator)	5
BCL2L2	599	BCL2-like 2	5
BCL7A	605	B-cell CLL/lymphoma 7A	5
BCL9L	283149	B-cell CLL/lymphoma 9-like	5
BCOR	54880	BCL6 co-repressor	5
BCORL1	63035	BCL6 co-repressor-like 1	5
BCORL2	286554	BCL6 co-repressor-like 2	5
BFAR	51283	Bifunctional apoptosis regulator	5
BIRC7	79444	Baculoviral IAP repeat-containing 7 (livin)	5
BRAF	673	V-raf murine sarcoma viral oncogene homolog B1	5
BRD2	6046	Bromodomain containing 2	5
BRDT	676	Bromodomain, testis-specific	5
C14orf4	64207	Chromosome 14 open reading frame 4	4
C16orf28	65259	chromosome 16 open reading fra	5
C1GALT1C1	29071	C1GALT1-specific chaperone 1	5
C1orf166	79594	Chromosome 1 open reading frame 166	5

C2orf49	79074	Chromosome 2 open reading frame 49	5
CARM1L	256280	coactivator associated arginin	5
CASC1	55259	Cancer susceptibility candidate 1	4
CAV1	857	Caveolin 1, caveolae protein, 22kDa	4
CBLL1	79872	Cas-Br-M (murine) ecotropic retroviral transforming sequence-like 1	5
CCKBR	887	Cholecystokinin B receptor	4
CCL2	6347	Chemokine (C-C motif) ligand 2	5
CCNB3	85417	Cyclin B3	5
CDC14B	8555	CDC14 cell division cycle 14 homolog B (S. cerevisiae)	3
CDC2L1	984	cell division cycle 2-like 1 (5
CDC2L2	985	Cell division cycle 2-like 2 (PITSLRE proteins)	5
CDK5R1	8851	Cyclin-dependent kinase 5, regulatory subunit 1 (p35)	5
CDKL1	8814	Cyclin-dependent kinase-like 1 (CDC2-related kinase)	5
CGRRF1	10668	Cell growth regulator with ring finger domain 1	4
CHAT	1103	Choline acetyltransferase	5
CHST10	9486	Carbohydrate sulfotransferase 10	5
CHST2	9435	Carbohydrate (N-acetylglucosamine-6-O) sulfotransferase 2	5
CHST4	10164	Carbohydrate (N-acetylglucosamine 6-O) sulfotransferase 4	5
CHST5	23563	carbohydrate (N-acetylglucosam	5
CHST7	56548	Carbohydrate (N-acetylglucosamine 6-O) sulfotransferase 7	5
CHST8	64377	Carbohydrate (N-acetylgalactosamine 4-O) sulfotransferase 8	5
CHST9	83539	Carbohydrate (N-acetylgalactosamine 4-O) sulfotransferase 9	5
CKMT2	1160	Creatine kinase, mitochondrial 2 (sarcomeric)	4
CMPK	51727	Cytidylate kinase	5
CNTN2	6900	Contactin 2 (axonal)	4
COL4A3BP	10087	Collagen, type IV, alpha 3 (Goodpasture antigen) binding protein	5
CPNE1	8904	Copine I	4
CSNK1A1L	122011	Casein kinase 1, alpha 1-like	5
CSPG2	1462	chondroitin sulfate proteoglyc	5
CYB561D2	11068	Cytochrome b-561 domain containing 2	4
DGKA	1606	Diacylglycerol kinase, alpha 80kDa	5
DGKE	8526	Diacylglycerol kinase, epsilon 64kDa	5
DGKI	9162	Diacylglycerol kinase, iota	4
DGKQ	1609	Diacylglycerol kinase, theta 110kDa	4
DGUOK	1716	Deoxyguanosine kinase	4
DHH	50846	Desert hedgehog homolog (Drosophila)	5
DHRS9	10170	Dehydrogenase/reductase (SDR family) member 9	5
DIMT1L	27292	DIM1 dimethyladenosine transferase 1-like (S. cerevisiae)	5

DKK1	22943	Dickkopf homolog 1 (<i>Xenopus laevis</i>)	5
DKK2	27123	Dickkopf homolog 2 (<i>Xenopus laevis</i>)	5
DKK3	27122	Dickkopf homolog 3 (<i>Xenopus laevis</i>)	5
DLG1	1739	Discs, large homolog 1 (<i>Drosophila</i>)	5
DLG2	1740	Discs, large homolog 2, chapsyn-110 (<i>Drosophila</i>)	5
DLG4	1742	Discs, large homolog 4 (<i>Drosophila</i>)	5
DLL1	28514	Delta-like 1 (<i>Drosophila</i>)	4
DLL3	10683	Delta-like 3 (<i>Drosophila</i>)	5
DLL4	54567	Delta-like 4 (<i>Drosophila</i>)	5
DPM3	54344	Dolichyl-phosphate mannosyltransferase polypeptide 3	3
DTYMK	1841	Deoxythymidylate kinase (thymidylate kinase)	4
DULLARD	23399	Dullard homolog (<i>Xenopus laevis</i>)	5
DUSP21	63904	Dual specificity phosphatase 21	5
DUSP22	56940	Dual specificity phosphatase 22	5
DUSP3	1845	Dual specificity phosphatase 3 (vaccinia virus phosphatase VH1-related)	5
DUSP4	1846	Dual specificity phosphatase 4	4
DVL1	1855	Dishevelled, dsh homolog 1 (<i>Drosophila</i>)	5
DVL2	1856	Dishevelled, dsh homolog 2 (<i>Drosophila</i>)	5
DVL3	1857	Dishevelled, dsh homolog 3 (<i>Drosophila</i>)	5
DZIP3	9666	DAZ interacting protein 3, zinc finger	5
EEF2K	29904	Eukaryotic elongation factor-2 kinase	5
EHBP1	23301	EH domain binding protein 1	5
ENPP6	133121	Ectonucleotide pyrophosphatase/phosphodiesterase 6	4
EPHA1	2041	EPH receptor A1	5
EPHA2	1969	EPH receptor A2	5
EPHA3	2042	EPH receptor A3	5
EPHA5	2044	EPH receptor A5	5
EPHA7	2045	EPH receptor A7	4
EPHB2	2048	EPH receptor B2	5
EPHB3	2049	EPH receptor B3	4
ESRRG	2104	Estrogen-related receptor gamma	5
FBXL12	54850	F-box and leucine-rich repeat protein 12	5
FBXO21	23014	F-box protein 21	5
FBXO4	26272	F-box protein 4	5
FBXO8	26269	F-box protein 8	5
FBXO9	26268	F-box protein 9	5
FGF18	8817	Fibroblast growth factor 18	5
FHL2	2274	Four and a half LIM domains 2	5

FKBP1A	2280	FK506 binding protein 1A, 12kDa	5
FLCN	201163	Folliculin	4
FLJ30294	130827	hypothetical protein FLJ30294	5
FTCD	10841	Formiminotransferase cyclodeaminase	5
FXN	2395	Frataxin	4
GAL3ST2	64090	Galactose-3-O-sulfotransferase 2	5
GALNT12	79695	UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglucosaminyltransferase 12 (5
GALNT14	79623	UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglucosaminyltransferase 14 (5
GALNTL1	57452	UDP-N-acetyl-alpha-D-galactosamine:polypeptide N-acetylglucosaminyltransferase-like	5
GART	2618	Phosphoribosylglycinamide formyltransferase, phosphoribosylglycinamide synthetase, pho	4
GATM	2628	Glycine amidinotransferase (L-arginine:glycine amidinotransferase)	5
GCNT1	2650	Glucosaminyl (N-acetyl) transferase 1, core 2 (beta-1,6-N-acetylglucosaminyltransferase)	5
GLI2	2736	GLI-Kruppel family member GLI2	5
GLT25D1	79709	Glycosyltransferase 25 domain containing 1	5
GLT25D2	23127	Glycosyltransferase 25 domain containing 2	4
GLT28D1	55849	glycosyltransferase 28 domain	5
GLT8D1	55830	Glycosyltransferase 8 domain containing 1	5
GLT8D2	83468	Glycosyltransferase 8 domain containing 2	5
GMIP	51291	GEM interacting protein	5
GNB2L1	10399	Guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1	4
GNE	10020	Glucosamine (UDP-N-acetyl)-2-epimerase/N-acetylmannosamine kinase	5
GNLY	10578	Granulysin	5
GOT1	2805	Glutamic-oxaloacetic transaminase 1, soluble (aspartate aminotransferase 1)	3
GOT2	2806	Glutamic-oxaloacetic transaminase 2, mitochondrial (aspartate aminotransferase 2)	5
GPR45	11250	G protein-coupled receptor 45	5
GPSM2	29899	G-protein signaling modulator 2 (AGS3-like, C. elegans)	4
GPT	2875	Glutamic-pyruvate transaminase (alanine aminotransferase)	5
GPT2	84706	Glutamic pyruvate transaminase (alanine aminotransferase) 2	5
GTF2H1	2965	General transcription factor IIH, polypeptide 1, 62kDa	5
GUK1	2987	Guanylate kinase 1	5
GYLTL1B	120071	Glycosyltransferase-like 1B	5
GZMA	3001	Granzyme A (granzyme 1, cytotoxic T-lymphocyte-associated serine esterase 3)	5
GZMB	3002	Granzyme B (granzyme 2, cytotoxic T-lymphocyte-associated serine esterase 1)	5
GZMH	2999	Granzyme H (cathepsin G-like 2, protein h-CCPX)	5
GZMK	3003	Granzyme K (granzyme 3; tryptase II)	5
GZMM	3004	Granzyme M (lymphocyte met-ase 1)	4
H6PD	9563	Hexose-6-phosphate dehydrogenase (glucose 1-dehydrogenase)	5
HABP2	3026	Hyaluronan binding protein 2	5

HAT1	8520	Histone acetyltransferase 1	5
HERC4	26091	Hect domain and RLD 4	5
HIP1	3092	Huntingtin interacting protein 1	4
HIPK4	147746	Homeodomain interacting protein kinase 4	5
HPRT1	3251	Hypoxanthine phosphoribosyltransferase 1 (Lesch-Nyhan syndrome)	5
HRAS	3265	V-Ha-ras Harvey rat sarcoma viral oncogene homolog	5
HS2ST1	9653	Heparan sulfate 2-O-sulfotransferase 1	5
HSD11B1L	374875	Hydroxysteroid (11-beta) dehydrogenase 1-like	4
HSD17B2	3294	Hydroxysteroid (17-beta) dehydrogenase 2	5
HSD17B3	3293	Hydroxysteroid (17-beta) dehydrogenase 3	4
HSD17B4	3295	Hydroxysteroid (17-beta) dehydrogenase 4	5
HSPA4	3308	Heat shock 70kDa protein 4	5
ICMT	23463	Isoprenylcysteine carboxyl methyltransferase	5
IDH1	3417	Isocitrate dehydrogenase 1 (NADP+), soluble	5
IDH2	3418	Isocitrate dehydrogenase 2 (NADP+), mitochondrial	5
IDH3A	3419	Isocitrate dehydrogenase 3 (NAD+) alpha	5
IDH3B	3420	Isocitrate dehydrogenase 3 (NAD+) beta	5
IDH3G	3421	Isocitrate dehydrogenase 3 (NAD+) gamma	5
IFNA21	3452	Interferon, alpha 21	5
IFNB1	3456	Interferon, beta 1, fibroblast	5
IFNW1	3467	Interferon, omega 1	4
IHH	3549	Indian hedgehog homolog (Drosophila)	5
IHPK2	51447	Inositol hexaphosphate kinase 2	5
IL18R1	8809	Interleukin 18 receptor 1	4
IL18RAP	8807	Interleukin 18 receptor accessory protein	4
IRF2BP1	26145	Interferon regulatory factor 2 binding protein 1	5
IRF3	3661	Interferon regulatory factor 3	5
JAG1	182	Jagged 1 (Alagille syndrome)	5
JAG2	3714	Jagged 2	5
KIAA1797	54914	KIAA1797	5
KLHL23	151230	Kelch-like 23 (Drosophila)	5
KRAS	3845	V-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog	5
KSR1	8844	Kinase suppressor of ras 1	5
KSR2	283455	Kinase suppressor of ras 2	5
LARGE	9215	Like-glycosyltransferase	5
LCAT	3931	Lecithin-cholesterol acyltransferase	5
LCMT1	51451	Leucine carboxyl methyltransferase 1	5
LOC339879	339879	Similar to beta-1,4-mannosyltransferase	5

LOC343705	343705	similar to beta-galactoside al	5
LOC390377	390377	similar to Alpha-N-acetyl-neur	4
LOC391491	391491	Similar to Guanidinoacetate N-methyltransferase	4
LOC391747	391747	similar to Transcription initi	4
LOC391761	391761	similar to Transcription initi	4
LOC391763	391763	similar to Transcription initi	5
LOC494115	494115	similar to RNA binding motif p	5
LOC51136	51136	PTD016 protein	5
LRMP	4033	Lymphoid-restricted membrane protein	5
LRP5	4041	Low density lipoprotein receptor-related protein 5	5
LRP6	4040	Low density lipoprotein receptor-related protein 6	5
LRRK1	79705	Leucine-rich repeat kinase 1	5
LRRN5	10446	leucine rich repeat neuronal 5	5
LYK5	92335	Protein kinase LYK5	5
MAMDC1	161357	MAM domain containing 1	5
MAMDC2	256691	MAM domain containing 2	5
MAP2K2	5605	Mitogen-activated protein kinase kinase 2	4
MAP3K1	4214	Mitogen-activated protein kinase kinase kinase 1	5
MAP3K13	9175	Mitogen-activated protein kinase kinase kinase 13	5
MAPK12	6300	Mitogen-activated protein kinase 12	5
MAPK3	5595	Mitogen-activated protein kinase 3	3
MAPKAPK3	7867	Mitogen-activated protein kinase-activated protein kinase 3	5
MBOAT1	154141	Membrane bound O-acyltransferase domain containing 1	5
MBOAT2	129642	Membrane bound O-acyltransferase domain containing 2	3
MCTP2	55784	Multiple C2 domains, transmembrane 2	5
MEFV	4210	Mediterranean fever	5
METTL3	56339	Methyltransferase like 3	5
METTL4	64863	Methyltransferase like 4	5
MGAT1	4245	Mannosyl (alpha-1,3-)-glycoprotein beta-1,2-N-acetylglucosaminyltransferase	5
MGC11332	84804	hypothetical protein MGC11332	4
MGC16169	93627	Hypothetical protein MGC16169	5
MGC42105	167359	Hypothetical protein MGC42105	3
MGRN1	23295	Mahogunin, ring finger 1	5
MID2	11043	Midline 2	4
MINK1	50488	Misshapen-like kinase 1 (zebrafish)	3
MKNK1	8569	MAP kinase interacting serine/threonine kinase 1	4
MKNK2	2872	MAP kinase interacting serine/threonine kinase 2	5
MKRN1	23608	Makorin, ring finger protein, 1	5

MKRN3	7681	Makorin, ring finger protein, 3	5
MKRN4	7682	makorin, ring finger protein,	4
MLL	4297	Myeloid/lymphoid or mixed-lineage leukemia (trithorax homolog, Drosophila)	4
MLL4	9757	Myeloid/lymphoid or mixed-lineage leukemia 4	5
MLLT3	4300	Myeloid/lymphoid or mixed-lineage leukemia (trithorax homolog, Drosophila); translocated	5
MOGAT1	116255	Monoacylglycerol O-acyltransferase 1	5
MPP1	4354	Membrane protein, palmitoylated 1, 55kDa	5
MPP2	4355	Membrane protein, palmitoylated 2 (MAGUK p55 subfamily member 2)	5
MPP3	4356	Membrane protein, palmitoylated 3 (MAGUK p55 subfamily member 3)	5
MTFMT	123263	Mitochondrial methionyl-tRNA formyltransferase	5
MTMR6	9107	Myotubularin related protein 6	4
MYCBP2	23077	MYC binding protein 2	4
MYD88	4615	Myeloid differentiation primary response gene (88)	4
MYLIP	29116	Myosin regulatory light chain interacting protein	5
MYO9B	4650	Myosin IXB	5
MYST1	84148	MYST histone acetyltransferase 1	4
NAT1	9	N-acetyltransferase 1 (arylamine N-acetyltransferase)	5
NAT2	10	N-acetyltransferase 2 (arylamine N-acetyltransferase)	4
NDUFS7	374291	NADH dehydrogenase (ubiquinone) Fe-S protein 7, 20kDa (NADH-coenzyme Q reductase)	5
NEK8	284086	NIMA (never in mitosis gene a)- related kinase 8	5
NME5	8382	Non-metastatic cells 5, protein expressed in (nucleoside-diphosphate kinase)	5
NNMT	4837	Nicotinamide N-methyltransferase	5
NR0B2	8431	Nuclear receptor subfamily 0, group B, member 2	5
NR2F6	2063	Nuclear receptor subfamily 2, group F, member 6	5
NRAS	4893	Neuroblastoma RAS viral (v-ras) oncogene homolog	5
OAT	4942	Ornithine aminotransferase (gyrate atrophy)	5
OATL1	4943	ornithine aminotransferase-lik	5
OGT	8473	O-linked N-acetylglucosamine (GlcNAc) transferase (UDP-N-acetylglucosamine:polypeptide)	5
OTC	5009	Ornithine carbamoyltransferase	5
OTOF	9381	Otoferlin	5
PAK7	57144	P21(CDKN1A)-activated kinase 7	5
PASK	23178	PAS domain containing serine/threonine kinase	4
PCGF3	10336	Polycomb group ring finger 3	5
PCTK2	5128	PCTAIRE protein kinase 2	5
PDHX	8050	Pyruvate dehydrogenase complex, component X	5
PDK1	5163	Pyruvate dehydrogenase kinase, isozyme 1	4
PDK4	5166	Pyruvate dehydrogenase kinase, isozyme 4	5
PEX12	5193	Peroxisomal biogenesis factor 12	5

PGK1	5230	Phosphoglycerate kinase 1	5
PHKA1	5255	Phosphorylase kinase, alpha 1 (muscle)	5
PHKA2	5256	Phosphorylase kinase, alpha 2 (liver)	4
PHKB	5257	Phosphorylase kinase, beta	5
PHKG1	5260	Phosphorylase kinase, gamma 1 (muscle)	5
PHOSPHO1	162466	Phosphatase, orphan 1	4
PIGZ	80235	Phosphatidylinositol glycan anchor biosynthesis, class Z	4
PIK3AP1	118788	Phosphoinositide-3-kinase adaptor protein 1	5
PIK3CD	5293	Phosphoinositide-3-kinase, catalytic, delta polypeptide	5
PIK3CG	5294	Phosphoinositide-3-kinase, catalytic, gamma polypeptide	5
PIK3R1	5295	Phosphoinositide-3-kinase, regulatory subunit 1 (p85 alpha)	5
PIK3R3	8503	Phosphoinositide-3-kinase, regulatory subunit 3 (p55, gamma)	5
PIK3R5	23533	Phosphoinositide-3-kinase, regulatory subunit 5, p101	5
PINK1	65018	PTEN induced putative kinase 1	5
PKMYT1	9088	Protein kinase, membrane associated tyrosine/threonine 1	3
PKN2	5586	Protein kinase N2	5
PLA2G4B	8681	Phospholipase A2, group IVB (cytosolic)	5
PLCB1	23236	Phospholipase C, beta 1 (phosphoinositide-specific)	4
PLCB4	5332	Phospholipase C, beta 4	5
PLCD4	84812	Phospholipase C, delta 4	5
PLCG1	5335	Phospholipase C, gamma 1	4
PLEKHA5	54477	Pleckstrin homology domain containing, family A member 5	5
PLK1	5347	Polo-like kinase 1 (Drosophila)	4
PMVK	10654	Phosphomevalonate kinase	4
POFUT1	23509	Protein O-fucosyltransferase 1	5
POMGNT1	55624	Protein O-linked mannose beta1,2-N-acetylglucosaminyltransferase	5
POU3F3	5455	POU class 3 homeobox 3	3
PPP1R12B	4660	Protein phosphatase 1, regulatory (inhibitor) subunit 12B	5
PPP1R14A	94274	Protein phosphatase 1, regulatory (inhibitor) subunit 14A	5
PPP1R16B	26051	Protein phosphatase 1, regulatory (inhibitor) subunit 16B	5
PPP1R2	5504	Protein phosphatase 1, regulatory (inhibitor) subunit 2	5
PPP1R3A	5506	Protein phosphatase 1, regulatory (inhibitor) subunit 3A (glycogen and sarcoplasmic reticu	5
PPP1R3D	5509	Protein phosphatase 1, regulatory (inhibitor) subunit 3D	5
PPP2R2C	5522	Protein phosphatase 2 (formerly 2A), regulatory subunit B, gamma isoform	5
PPP2R3A	5523	Protein phosphatase 2 (formerly 2A), regulatory subunit B", alpha	5
PPP2R3B	28227	Protein phosphatase 2 (formerly 2A), regulatory subunit B", beta	4
PPP3CC	5533	Protein phosphatase 3 (formerly 2B), catalytic subunit, gamma isoform	5
PPP3R2	5535	Protein phosphatase 3 (formerly 2B), regulatory subunit B, beta isoform	5

PPP4R2	151987	Protein phosphatase 4, regulatory subunit 2	5
PRKCH	5583	Protein kinase C, eta	5
PRKDC	5591	Protein kinase, DNA-activated, catalytic polypeptide	5
PRMT7	54496	protein arginine N-methyltrans	5
PRMT8	56341	Protein arginine methyltransferase 8	5
PRTFDC1	56952	Phosphoribosyl transferase domain containing 1	5
PSAT1	29968	Phosphoserine aminotransferase 1	5
PSMD14	10213	Proteasome (prosome, macropain) 26S subunit, non-ATPase, 14	3
PTCH2	8643	Patched homolog 2 (Drosophila)	5
PTK7	5754	PTK7 protein tyrosine kinase 7	5
PTPN14	5784	Protein tyrosine phosphatase, non-receptor type 14	5
PTPN6	5777	Protein tyrosine phosphatase, non-receptor type 6	4
QPRT	23475	Quinolate phosphoribosyltransferase (nicotinate-nucleotide pyrophosphorylase (carboxy	5
QTRT1	81890	Queuine tRNA-ribosyltransferase 1 (tRNA-guanine transglycosylase)	4
QTRTD1	79691	Queuine tRNA-ribosyltransferase domain containing 1	5
RAB7	7879	RAB7, member RAS oncogene fami	5
RAD23A	5886	RAD23 homolog A (S. cerevisiae)	5
RDH16	8608	Retinol dehydrogenase 16 (all-trans)	4
RFPL1	5988	Ret finger protein-like 1	5
RFPL2	10739	Ret finger protein-like 2	5
RFPL3	10738	Ret finger protein-like 3	5
RFWD3	55159	Ring finger and WD repeat domain 3	5
RG9MTD2	93587	RNA (guanine-9-) methyltransferase domain containing 2	4
RG9MTD3	158234	RNA (guanine-9-) methyltransferase domain containing 3	4
RIC8B	55188	Resistance to inhibitors of cholinesterase 8 homolog B (C. elegans)	4
RIMS4	140730	Regulating synaptic membrane exocytosis 4	5
RIPK4	54101	Receptor-interacting serine-threonine kinase 4	5
RMND5A	64795	Required for meiotic nuclear division 5 homolog A (S. cerevisiae)	5
RMND5B	64777	Required for meiotic nuclear division 5 homolog B (S. cerevisiae)	4
RNF10	9921	Ring finger protein 10	5
RNF113A	7737	Ring finger protein 113A	5
RNF123	63891	Ring finger protein 123	5
RNF138	51444	Ring finger protein 138	5
RNF139	11236	Ring finger protein 139	5
RNF2	6045	Ring finger protein 2	5
RNF20	56254	Ring finger protein 20	5
RNF26	79102	Ring finger protein 26	4
RNF34	80196	Ring finger protein 34	5

RNF41	10193	Ring finger protein 41	5
RNF6	6049	Ring finger protein (C3H2C3 type) 6	5
RNMTL1	55178	RNA methyltransferase like 1	5
RORC	6097	RAR-related orphan receptor C	5
RPS6KL1	83694	Ribosomal protein S6 kinase-like 1	5
RSAD1	55316	Radical S-adenosyl methionine domain containing 1	5
SAT1	6303	Spermidine/spermine N1-acetyltransferase 1	5
SAT2	112483	Spermidine/spermine N1-acetyltransferase 2	5
SBF1	6305	SET binding factor 1	3
SCYL1	57410	SCY1-like 1 (S. cerevisiae)	5
SCYL2	55681	SCY1-like 2 (S. cerevisiae)	5
SERGEF	26297	Secretion regulating guanine nucleotide exchange factor	5
SHH	6469	Sonic hedgehog homolog (Drosophila)	5
SHMT1	6470	Serine hydroxymethyltransferase 1 (soluble)	5
SHMT2	6472	Serine hydroxymethyltransferase 2 (mitochondrial)	4
SIP1	8487	Survival of motor neuron protein interacting protein 1	5
SLC9A2	6549	Solute carrier family 9 (sodium/hydrogen exchanger), member 2	5
SNAI3	333929	Snail homolog 3 (Drosophila)	5
SOD2	6648	Superoxide dismutase 2, mitochondrial	5
SPTLC1	10558	Serine palmitoyltransferase, long chain base subunit 1	5
SPTLC2	9517	Serine palmitoyltransferase, long chain base subunit 2	5
SRPK2	6733	SFRS protein kinase 2	5
SRPK3	26576	SFRS protein kinase 3	3
SSH2	85464	Slingshot homolog 2 (Drosophila)	5
ST6GAL2	84620	ST6 beta-galactosamide alpha-2,6-sialyltransferase 2	5
ST6GALNAC5	81849	ST6 (alpha-N-acetyl-neuraminyl-2,3-beta-galactosyl-1,3)-N-acetylgalactosaminide alpha-2	5
ST8SIA2	8128	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 2	5
ST8SIA4	7903	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 4	5
ST8SIA5	29906	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 5	5
ST8SIA6	338596	ST8 alpha-N-acetyl-neuraminide alpha-2,8-sialyltransferase 6	5
STK25	10494	Serine/threonine kinase 25 (STE20 homolog, yeast)	5
STK32A	202374	Serine/threonine kinase 32A	5
STK32C	282974	Serine/threonine kinase 32C	4
STK36	27148	Serine/threonine kinase 36, fused homolog (Drosophila)	5
STYX	6815	Serine/threonine/tyrosine interacting protein	5
SULT1A1	6817	Sulfotransferase family, cytosolic, 1A, phenol-preferring, member 1	5
SULT1A2	6799	Sulfotransferase family, cytosolic, 1A, phenol-preferring, member 2	4
SULT1A3	6818	Sulfotransferase family, cytosolic, 1A, phenol-preferring, member 3	4

SULT1B1	27284	Sulfotransferase family, cytosolic, 1B, member 1	5
SULT1C1	6819	sulfotransferase family, cytos	5
SULT1C2	27233	Sulfotransferase family, cytosolic, 1C, member 2	5
SULT4A1	25830	Sulfotransferase family 4A, member 1	5
SUV39H2	79723	Suppressor of variegation 3-9 homolog 2 (Drosophila)	4
TAF1	6872	TAF1 RNA polymerase II, TATA box binding protein (TBP)-associated factor, 250kDa	5
TASP1	55617	Taspase, threonine aspartase, 1	5
TAT	6898	Tyrosine aminotransferase	5
TFF1	7031	Trefoil factor 1	2
TFF2	7032	Trefoil factor 2 (spasmolytic protein 1)	5
TFF3	7033	Trefoil factor 3 (intestinal)	4
TGFB2	7042	Transforming growth factor, beta 2	5
TGFBR3	7049	Transforming growth factor, beta receptor III	5
TGFBRAP1	9392	Transforming growth factor, beta receptor associated protein 1	5
TJP2	9414	Tight junction protein 2 (zona occludens 2)	5
TLK1	9874	Tousled-like kinase 1	5
TNFRSF10A	8797	Tumor necrosis factor receptor superfamily, member 10a	5
TNFRSF10B	8795	Tumor necrosis factor receptor superfamily, member 10b	5
TNFSF10	8743	Tumor necrosis factor (ligand) superfamily, member 10	5
TRADD	8717	TNFRSF1A-associated via death domain	4
TRAIP	10293	TRAF interacting protein	5
TRIB2	28951	Tribbles homolog 2 (Drosophila)	5
TRIM11	81559	Tripartite motif-containing 11	5
TRIM13	10206	Tripartite motif-containing 13	5
TRIM17	51127	Tripartite motif-containing 17	5
TRIM22	10346	Tripartite motif-containing 22	3
TRIM27	5987	Tripartite motif-containing 27	4
TRIM3	10612	Tripartite motif-containing 3	5
TRIM31	11074	Tripartite motif-containing 31	5
TRIM35	23087	Tripartite motif-containing 35	4
TRIM39	56658	Tripartite motif-containing 39	5
TRIM44	54765	Tripartite motif-containing 44	5
TRIM46	80128	Tripartite motif-containing 46	5
TRIM48	79097	Tripartite motif-containing 48	5
TRIM49	57093	Tripartite motif-containing 49	5
TRIM54	57159	Tripartite motif-containing 54	5
TRIM58	25893	Tripartite motif-containing 58	5
TRIM62	55223	Tripartite motif-containing 62	5

TRIM68	55128	Tripartite motif-containing 68	5
TRIM7	81786	Tripartite motif-containing 7	5
TRIM8	81603	Tripartite motif-containing 8	5
TSPAN17	26262	Tetraspanin 17	5
UBADC1	10422	ubiquitin associated domain co	5
UBE1DC1	79876	ubiquitin-activating enzyme E1	4
UBE2V1	7335	Ubiquitin-conjugating enzyme E2 variant 1	5
UGT1A6	54578	UDP glucuronosyltransferase 1 family, polypeptide A6	5
UGT2B28	54490	UDP glucuronosyltransferase 2 family, polypeptide B28	5
UMPS	7372	Uridine monophosphate synthetase (orotate phosphoribosyl transferase and orotidine-5'-d	4
VPS41	27072	Vacuolar protein sorting 41 homolog (<i>S. cerevisiae</i>)	4
WBSCR16	81554	Williams-Beuren syndrome chromosome region 16	5
WIF1	11197	WNT inhibitory factor 1	5
WISP1	8840	WNT1 inducible signaling pathway protein 1	4
WISP2	8839	WNT1 inducible signaling pathway protein 2	5
WISP3	8838	WNT1 inducible signaling pathway protein 3	5
WNK4	65266	WNK lysine deficient protein kinase 4	5
WNT2	7472	Wingless-type MMTV integration site family member 2	5
WNT2B	7482	Wingless-type MMTV integration site family, member 2B	5
WNT3	7473	Wingless-type MMTV integration site family, member 3	5
WWOX	51741	WW domain containing oxidoreductase	5
XYLT1	64131	Xylosyltransferase I	4
XYLT2	64132	Xylosyltransferase II	5
ZCCHC14	23174	Zinc finger, CCHC domain containing 14	5
ZFPL1	7542	Zinc finger protein-like 1	5
ZNF179	7732	Zinc finger protein 179	5
ZNF294	26046	Zinc finger protein 294	5

Supplementary Table 2

shRNA Target Sequences

shRNA description		Target Sequence
GFP	#1:	GTCGAGCTGGACGGCGACGTA
	#2:	ACAACAGCCACAACGTCTATA
	#3:	GGCCCGCAAGCTGACCCTGAAGTTCAT
Nek4	#1:	GATTACTGTTTACTGAGCCTT
	#2:	CCAGCTCTTGTCTCAGTTGAA
GNL3	#1:	GCTAAACTGTTCTCTGTATAA
	#2:	CCTGATATTAAGCCATCAAAT
Nat10	#1:	CCACAGGAAATTCACACCGTA
	#2:	GCAATTGTACACAGTGACTAT
MCM7	#1:	GCGCAGATTTGAGCTGTATTT
	#2:	GCTAGTAAGGATGCCACCTAT
PCNA	#1:	CACGTATATGCCGAGATCTCA
	#2:	TGAAGCACCAAACCAGGAGAA
GNL3L	#1:	GCCAATCGAGAGGCTGAATTA
	#2:	CCAAACCCAATACCCTCTATT
RAB3B	#1:	GAGTCCTTCAATGCTGTCCAA
	#2:	AGTGCAAAGGAGAACATCAGT
	#3:	AGAGTCCTTCAATGCTGTCCA
	#4:	GCTACTCAGATCAAGACCTAC
WDR79	#1:	TGCCTCGATTTCTCAGTGGTT
	#2:	CACCAATCAGCGCATCTACTT
	#3:	CACCCAACCTGAGAACTTCTT
PRKACB	#1:	AGGAGTGCTAATCTATGAAAT
	#2:	GCCAACTGACTTAACAACATT
	#3:	ACTCAGAATAATGCCGGACTT
	#4:	CACGACAGATTGGATTGCTAT
FBXW7	#1:	CCTAAAGAGTTGGCACTCTAT
	#2:	CCAGAGACTGAAACCTGTCTA
ZNF193	#1:	CCTTTCTCCATGAAATGTGTT
	#2:	CGGCGTTCATTTCTCATTGAA
	#3:	CCTAAGATAGTGGAACCAT
	#4:	CCACAATATACAGAAACGGTA
	#5:	ACAGACAAGAAGTCCTCTGTA
RUNX3	#1:	CCCAGCACTTTGTAGTCTCAT
	#2:	CCAAGGCACCTCGGAACTGAA
	#3:	CGAGA ACTACTCCGCTGAGCT
EHBP1	#1:	CCAGTTTACAAAGACAGTCTT
	#2:	GCCTTAATAAGGAGAATGAAT
	#3:	CCAGATAAACTGGTGGTAGTT

	#4:	CCGAAGAAGAAGATGAGCATT
CHEK2	#1:	CGCCGTCCTTTGAATAACAAT
	#2:	GCCAATCTTGAATGTGTGAAT
	#3:	GCTCTCAATGTTGAAACAGAA
	#4:	TACATAGAAGATCACAGTGGC
	#5:	TGTAAGAAAGTAGCCATAAAG
	#6:	AGCTAAATCATCCTTGCATCA
TCF20:	#1:	CGTGATTCTTTATGTTGTGTT
	#2:	GCCACAGAAATGCAGAGCAAA
	#3:	CGCTTGATGATATACTGTCTT
	#4:	GCTAGTTTCAACAACAAGAAA
	#5:	GCACAGGCTTATGGAACACAA
CDC2:		TCCAGGTTATATCTCATCTTT
CSNK1E:		CCAGTGTTTGCTTAGTGTCTT
MCTP1:		CAGAAGTACATTGAAGAGGAA
SNF1LK:		CCATTTATTACCTCCTCCTTG
CHRM3:		CCTGGTAATTGTGTCATTTAA
KLF11:		CGCAGTTGACATCATGGACAT
RAB14:		AGGAGCGATTTAGGGCTGTTA

Those shRNAs indicated in bold face were identified in the screen as increasing the time to replicative senescence (Table 1).