Investigating the Role of Prostaglandin System Dysregulation in Radiation Resistance of Triple Negative Breast Cancer Cells

by

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A thesis submitted in partial fulfillment

of the requirements for the degree of

Master of Science (MSc) in Biology

The Faculty of Graduate Studies

Laurentian University

Sudbury, Ontario, Canada

THESIS DEFENCE COMMITTEE/COMITÉ DE SOUTENANCE DE THÈSE
Laurentian Université/Université Laurentienne
Faculty of Graduate Studies/Faculté des études supérieures

Title of Thesis Titre de la thèse	Investigating the Role of Prostaglandin System Dysregulation in Radiation Resistance of Triple Negative Breast Cancer Cells
Name of Candidate Nom du candidat	Dickinson, Noah
Degree Diplôme	Master of Science
Department/Program Département/Programme	Biology
Date of Defence Date de la soutenance	December 13, 2024

APPROVED/APPROUVÉ

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ACCESSIBILITY CLAUSE AND PERMISSION TO USE

Abstract

The overall goal of this research program was to elucidate the molecular mechanisms underlying radiation resistance in breast cancer. Prostaglandin (PG) signaling dysregulation has been implicated in various aspects of cancer progression, including tumor growth, metastasis, and inflammation, but its potential role in promoting radiation resistance remains underexplored. Among the key components of the PG system, prostaglandin-endoperoxide synthase 2 (PTGS2) emerged as a critical mediator potentially driving this resistance mechanism. Therefore, the primary aim of this study was to investigate the role of PTGS2 dysregulation in the development of radiation resistance in triple-negative breast cancer cells. To address this gap, radiation resistant variants of MDA-MB-231 cells were generated by repeated exposures to x-ray radiation (57 Gy total dose) followed by clonal cell selection. RT-qPCR and Western blot analysis revealed robust upregulation of *PTGS2* mRNA and protein expression in radiation resistant cells compared to the parental MDA-MB-231^{Control} cells. Whole-transcriptome analysis further corroborated these results, whereby radiation resistant variants demonstrated a 16.7-fold ($p<0.05$) increase in *PTGS2* mRNA expression. In addition, 6 Gy radiation challenge further increased *PTGS2* expression 48 hours post radiation exposure (76% increase; $p<0.05$) in radiation resistant variants, whereas the MDA-MB-231^{Control} cells showed lack of *PTGS2* expression changes. The next goal was to determine whether the upregulation of PTGS2 expression in MDA-MB-231 cells promoted the development of radiation resistance. Here, PTGS2 was overexpressed using the CRISPR/dCas9 system, and expression was verified using RT-qPCR and Western blotting. Surprisingly, *PTGS2* overexpression led to decreased survival following radiation exposure. This suggests that although *PTGS2* is upregulated in radiation-resistant cells, its overexpression alone makes the cells more susceptible to radiation-induced damage. In addition, *PTGS2* overexpression reduced adhesion to fibronectin and increased anchorage independent growth. These changes suggest that *PTGS2* promotes a more aggressive cancer phenotype by enhancing cell detachment and survival in non-anchorage conditions. Taken together, this study highlights the role of *PTGS2* in the development of radioresistance, suggesting that *PTGS2* and its downstream effectors within the prostaglandin signaling pathway may serve as promising therapeutic targets for therapy resistant cancers.

Keywords:

Prostaglandin signaling, radiation resistance, radiotherapy, signaling pathways, breast cancer, triple negative breast cancer, cell culture, CRISPR.

Acknowledgements

A special thank you goes out to all the students and faculty of the NOSM University lab for their combined efforts in creating a supportive atmosphere in which to collaborate, as well as to share knowledge and resources. As well as to the Radiation Biology group for meeting regularly to practice presenting new findings and providing valuable feedback and encouragement throughout the thesis. Particularly, Christopher Thome and Sujeenthar Tharmalingam for their efforts in training me on various protocols in the lab as well as for the detailed feedback provided during the Radiation Biology meetings. Sujeenthar Tharmalingam provided ceaseless encouragement, patience, and understanding throughout the completion of this thesis, as well as numerous opportunities and achievements to further my knowledge and professional goals. The efforts of the co-supervisors, Tom Kovala and Sujeenthar Tharmalingam as well as the efforts of rest of the committee members, Mazen Saleh and Cristopher Thome, are greatly appreciated. The feedback provided from the committee meetings was valuable in improving the quality of my thesis as well as my general understanding of biology. A strong foundation for the thesis presented herein was formed by the combined efforts of the peers I worked alongside on the Radiation Resistance in Breast Cancer project. To all these individuals, you have my deepest gratitude.

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List of Abbreviations

AA	arachidonic acid
ABCC3	ATP binding cassette subfamily C member 3
ABCC4	ATP binding cassette subfamily C member 4
ACTA2	actin alpha 2
AKR1A1	aldo-keto reductase family 1 member A1
AKR1B1	aldo-keto reductase family 1 member B1
AKR1C1	aldo-keto reductase family 1 member C1
AKR1C2	aldo-keto reductase family 1 member C2
AKR1C3	aldo-keto reductase family 1 member C3
Akt	protein kinase b
AKT1	AKT serine/threonine kinase 1
AKT2	AKT serine/threonine kinase 2
ALDH	aldehyde dehydrogenase
ANOVA	analysis of variance
ATM	ataxia telangiectasia mutant kinase
ATP	adenosine triphosphate
ATP5F1B	adenosine triphosphate (ATP) synthase F1 subunit beta
AUBP	adenine and uracil-rich element-binding protein
AUF1/HNRNPD	AU-rich element RNA-binding protein 1/heterogeneous nuclear ribonucleoprotein D
Bcl-2	B-cell lymphoma 2 protein
BCL2L1	BCL2 like 1
Bcl-XL	B-cell lymphoma-extra large protein
BRCA	breast cancer gene
BSA	bovine serum albumin
cAMP	cyclic adenosine monophosphate
Cas9	CRISPR associated protein 9
CASP9	caspase 9
CBF-A	CArG-binding factor A
CD24	cluster of differentiation 24
CD44	cluster of differentiation 44
CDH2	cadherin-2
CDKN1A	cyclin dependent kinase inhibitor 1A
cDNA	complementary deoxyribonucleic acid
Chk2	a serine-threonine kinase from the checkpoint kinase 2 (CHEK2) gene
CK19	keratin 19
COL4A1	collagen type IV alpha 1 chain
COL4A2	collagen type IV alpha 2 chain
COL4A5	collagen type IV alpha 5 chain
COL6A2	collagen type VI alpha 2 chain
COX-1/PTGS1	cyclooxygenase-1/prostaglandin-endoperoxide synthase 1

COX-2/PTGS2	cyclooxygenase-2/prostaglandin-endoperoxide synthase 2
Cq	cycle threshold
CRISPR	clustered regularly interspaced short palindromic repeats
CRISPRa	CRISPR/dCas9 transcriptional activation system
CSC	cancer stem cell
CTNNB1	catenin beta-1/β-catenin
CXCL12	C-X-C motif chemokine ligand 12
DAG	diacylglycerol
dCas9	dead CRISPR associated protein 9
DMEM	Dulbecco's Modified Eagle's Media
DMSO	dimethyl sulfoxide
DNA	deoxyribonucleic acid
DP1-2/PTGDR1-2	prostaglandin D2 receptor 1-2
DSB	double-stranded break
DTT	dithiothreitol
dUTP	deoxyuridine triphosphate
DVL2	dishevelled segment polarity protein 2
ECL	enhanced chemiluminescence
ECM	extracellular matrix
EDTA	ethylenediaminetetraacetic acid
EGF	epidermal growth factor
EIF4EBP1	eukaryotic translation initiation factor 4E binding protein 1
EMT	epithelial to mesenchymal transition
EP1-4/PTGER1-4	prostaglandin E receptor 1-4
ERK	extracellular signal-regulated kinases
FGF2	fibroblast growth factor 2
FN1	fibronectin 1
FOXO1	forkhead box O1
FP/PTGFR	prostaglandin F receptor
FRAT1	FRAT regulator of WNT signaling pathway 1
FZD1	frizzled class receptor 1
gRNA	guide ribonucleic acid
H2AX	H2A histone family member X
HEK293T	human embryonic kidney 293T cells
HER2	human epidermal growth factor receptor 2
HERS	human epidermal growth factor receptors
HGF	hepatocyte growth factor
HIF	hypoxia-inducible factor
HIF1A	hypoxia-inducible factor 1 subunit alpha
hnRNP A2	heterogeneous nuclear ribonucleoprotein A2
hnRNP A3	heterogeneous nuclear ribonucleoprotein A3
hnRNP B1	heterogeneous nuclear ribonucleoprotein B1
HPGD/15-PGDH	hydroxyprostaglandin dehydrogenase 15

HR	homologous recombination
HRP	horseradish peroxidase
HSPD1	heat shock protein family D member 1
HuR/ELAVL1	Hu-antigen R/ELAV like RNA binding protein 1
ICAM-1	intercellular adhesion molecule-1
ICAM-2	intercellular adhesion molecule-2
ICAM-4	intercellular adhesion molecule-4
IGF-IR	insulin-like growth factor-I receptor
IP/PTGIR	prostaglandin I receptor
IP3	inositol triphosphate
ITGA10	integrin subunit alpha 10
ITGA2	integrin subunit alpha 2
ITGA6	integrin subunit alpha 6
ITGB1	integrin subunit beta 1
LAMA1	laminin subunit alpha 1
LAMA5	laminin subunit alpha 5
LAMB1	laminin subunit beta 1
LPC	lysophosphatidylcholine
lp-PLA2	lipoprotein-associated phospholipase A2
LRP5	LDL receptor related protein 5
MAPK	mitogen-activated protein kinase
MCP-1/CCL2	monocyte chemotactic protein-1/C-C motif chemokine ligand 2
MDA-MB-231^{Control}	typical MDA-MB-231 triple negative breast cancer cells (invasive ductal carcinoma)
MDA-MB-231$^{PTGS2\text{-}\#1\text{-}2}$	MDA-MB-231 cells modified to overexpress PTGS2 via the CRISPRa system
MDA-MB-231^{RR}	radioresistant variants of MDA-MB-231 cells
mRNA	messenger ribonucleic acid
mTOR	mammalian target of rapamycin
MYC	MYC proto-oncogene, bHLH transcription factor
NaCl	sodium chloride
NF90/ILF3	nuclear factor 90/interleukin enhancer binding factor 3
NF-κB	nuclear factor kappa B
NHEJ	non-homologous end-joining
NSAID	nonsteroidal anti-inflammatory drug
PAF	platelet activating factor
PAFAH1B	platelet activating factor acetylhydrolase 1B
PAFAH1B1	platelet activating factor acetylhydrolase 1B regulatory subunit 1
PAFAH1B3	platelet activating factor acetylhydrolase 1B regulatory subunit 3
PAFR	platelet activating factor receptor
PBS	phosphate buffered saline
PDGF	platelet-derived growth factor
PG/PTG	prostaglandin

PGD2	prostaglandin D2
PGE2	prostaglandin E2
PGF2	prostaglandin F2
PGG2	prostaglandin G2
PGH2	prostaglandin H2
PGI2	prostaglandin I2
PI3K	phosphoinositide 3-kinases/phosphatidylinositol 3-kinases
PIGF/PGF	placental growth factor
PKC	protein kinase C
PLA2	phospholipase A2
PLA2G4A	cytosolic phospholipase A2
PTB	polypyrimidine tract-binding protein
PTGDS	prostaglandin D synthase
PTGES	prostaglandin E synthase
PTGES2	prostaglandin E synthase 2
PTGES3	prostaglandin E synthase 3
PTGFS	prostaglandin F synthase
PTGIS	prostaglandin I synthase
PTGR2	prostaglandin reductase 2
RBM3	RNA-binding protein 3
RCF	relative centrifugal force (equivalent to g-force)
RIPA buffer	radioimmunoprecipitation assay buffer
RNA	ribonucleic acid
ROS	reactive oxygen species
RPS6KB1	ribosomal protein S6 kinase B1
RT-qPCR	reverse transcription quantitative polymerase chain reaction
SDS	sodium dodecyl sulfate
SEM	standard error of the means
SLCO2A1	solute carrier organic anion transporter family member 2A1
SLCO4A1	solute carrier organic anion transporter family member 4A1
SNAI1	snail family transcriptional repressor 1
SNAI2	snail family transcriptional repressor 2
SSB	single-stranded break
TBS-T	tris-buffered saline with 0.1% tween-20
TBXA2R	thromboxane A2 receptor
TGFA	transforming growth factor alpha
TIA1	T-cell-restricted intracellular antigen-1
TIAR	TIA-1-related protein
TNBC	Triple negative breast cancer
TNC	tenascin C
TNF	tumor necrosis factor
TNF-alpha	tumor necrosis factor-alpha
TP/PTGTR	thromboxane receptor

TP53	tumor protein p53 gene
TTP/ZFP36	Tristetraprolin/ZFP36 ring finger protein
TUBA1B	tubulin alpha 1b
TXA2S	thromboxane A2 synthase
VCAM-1	vascular cell adhesion molecule
VEGF	vascular endothelial growth factor
VEGFA	vascular endothelial growth factor A
VEGFB	vascular endothelial growth factor B
VIM1	vimentin 1
Wnt7B	Wnt family member 7B
ZFP36L1	ZFP36 ring finger protein like 1

Chapter 1: General Introduction

1.1 Breast Cancer

Globally, there were an estimated 2.3 million new cases of breast cancer with a mortality rate of 6.9% in 2022, demonstrating the urgency for breast cancer research (Kashyap et al., 2022). Breast cancer is the most common form of cancer in women (Phung et al., 2019). There are numerous types of breast cancer which vary in severity and ease of treatment. The most prevalent types include ductal, lobular, mixed tumor, mucinous, and inflammatory breast cancer (Weigelt et al., 2010). Ductal breast cancer is the most common, affecting 50-80% of breast cancer patients and boasting a survival rate of about 88% (Narod et al., 2015; Weigelt et al., 2010; Zhang & Weinberg, 2018). This type originates in the ducts that carry milk from the lobules to the nipples (Narod et al., 2015; Weigelt et al., 2010; Zhang & Weinberg, 2018), and its high incidence is partly due to the fluctuating size of the ducts in response to hormonal changes (Narod et al., 2015; Weigelt et al., 2010; Zhang & Weinberg, 2018).

Lobular breast cancer, which forms in the milk-producing lobules attached to the ducts, accounts for about 5-15% of breast cancers and has a survival rate of approximately 92% (Weigelt et al., 2010; Zhang & Weinberg, 2018). Mixed tumors, which involve cancer growth in both ducts and lobules, represent roughly 25.3% of all breast cancer cases and have a survival rate of around 91% (Weigelt et al., 2010; Zhang & Weinberg, 2018).

Mucinous breast cancer arises in the mucosal cells lining the milk ducts and constitutes about 2% of breast cancer diagnoses, with a survival rate of approximately 97% (Weigelt et al., 2010; Zhang & Weinberg, 2018). Lastly, inflammatory breast cancer occurs when cancer cells block lymphatic vessels, causing swelling and inflammation; this type accounts for about 2.5% of cases and has the lowest survival rate at approximately 47% (Robertson et al., 2010; Zhang & Weinberg, 2018). Overall, these forms of breast cancer have very low incidence rates (Weigelt et al., 2010).

Treatment options for breast cancer are diverse and can include surgery, radiation therapy, chemotherapy, hormonal therapy, and targeted therapy (Maughan et al., 2010; Moo et al., 2018). Often, these treatments are combined for the best outcomes (Maughan et al., 2010; Moo et al., 2018). Surgical options include lumpectomy, which involves removing the tumor along with some surrounding healthy tissue, and mastectomy, where the entire breast is excised (Maughan et al., 2010; Moo et al., 2018). Chemotherapy and radiation therapy are frequently used together, with chemotherapy employing drugs to attack cancer cells throughout the body, especially in cases of metastasis (Gray et al., 2019; Weigelt et al., 2010). In contrast, radiation therapy delivers high doses of radiation to targeted areas known to harbor cancer cells (Maughan et al., 2010; Moo et al., 2018).

External beam radiation therapy can be classified as adjuvant, neoadjuvant, or palliative (Moo et al., 2018). Adjuvant radiation aims to reduce the risk of cancer recurrence after surgery (Moo et al., 2018). Neoadjuvant radiation is used to shrink tumors before surgery or to treat breast cancer that has recurred near the mastectomy site (Moo et al., 2018). Palliative radiation is administered to patients in end-of-life care to alleviate pain and manage cancer symptoms (Spencer et al., 2018).

Hormonal therapy targets estrogen, progesterone, and human epidermal growth factor receptor 2 (HER2) receptors in breast cancer cells (Maughan et al., 2010; Moo et al., 2018). However, it is ineffective against breast cancers that do not express these receptors, a hallmark of triple-negative breast cancer (TNBC). Immunotherapy enhances the immune system's ability to attack cancer cells (Sellars et al., 2022). Lastly, targeted therapy focuses on specific genetic targets within cancer cells, aiming to identify key regulators that can be adjusted to combat breast cancer (Moo et al., 2018). This approach represents a promising avenue for future breast cancer treatments and is an area of active research.

1.2 Radiation biology and DNA damage response

Ionizing radiation induces DNA damage via direct or indirect mechanisms (Helm & Rudel, 2020). Direct damage occurs when DNA is influenced directly by the radioactive particle, while indirect damage is when the radioactive particle causes the formation of a reactive oxygen species (ROS) which then reacts with DNA to cause damage. (Ma & Dai, 2018). Typically in response to this damage, the cell halts cell cycle progression to allow time to repair the DNA prior to completing cell division, although the cell can also bypass the damage by translesion synthesis to survive at the expense of genomic instability (Abbotts & David M Wilson, 2016). Alternatively, in response to the DNA damage the cell may also permanently arrest cell division (senescence), or undergo controlled cell death (apoptosis) (Abbotts & David M Wilson, 2016).

Depending on the location of the damaged sites of the DNA, the damage can be categorized as either single-stranded breaks (SSB) or double-stranded breaks (DSB; Ma & Dai, 2018). As the name implies, SSBs occur when the damaged site exists on a single strand. The undamaged strand is used as a template to correct the damage via the base excision repair pathway (Abbotts & David M Wilson, 2016). DSBs occur when a damaged site exists on both DNA strands in close proximity to one another. DSBs are more challenging to fix and often lead to mutations (Ma & Dai, 2018). If the DSB occurs during S or G_2 phase of the cell cycle, the undamaged copy of DNA can sometimes be used as a template to repair the damage in a process referred to as homologous recombination (HR). Alternatively, in G_1 phase the cell does not have an undamaged copy of DNA to use as a template and must use non-homologous end-joining (NHEJ), a more error prone method to repair the damage (Featherstone & Jackson, 1999; Shibata & Jeggo, 2014). Mammalian cells often favor the use of NHEJ over HR since repetitive sequences could result in gene deletion or amplification in HR (Shibata & Jeggo, 2014). For this reason, as well as the fact that NHEJ is more prone to causing mutations, NHEJ is more often studied in relation to the development of radiation resistant cancers.

1.3 Radiation resistance

Irradiating cancerous cells can sometimes cause the surviving cancerous cells to develop increased radioresistance (Lewis & Kemp, 2021). Extended and frequent exposure to radiation, such as during cancer treatment, can inflict sufficient DNA damage to lead to genetic changes in some cells, prompting either cell death (apoptosis) or enhanced radiation resistance (Lewis & Kemp, 2021). Cancers may achieve radioresistance via numerous mechanisms such as survival signaling pathways, DNA damage repair, post transcriptional regulation of miRNAs (Perez-Añorve et al., 2019), and epigenetic modifications (Wu et al., 2018). This effect may be advantageous in healthy cells, but it complicates treatment in cancer cells (Lewis & Kemp, 2021).

There is no singular cause of radioresistance known to date, although the dysregulation of cell cycle damage checkpoints and DNA damage repair pathways is typically associated with radioresistance (Jameel et al., 2004). Ataxia telangiectasia mutant kinase (ATM) is involved in DNA damage repair and PI3K signaling and has been previously demonstrated to influence radioresistance (Jameel et al., 2004). Additionally, radioresistance has been associated with elevated expression of cell surface insulin-like growth factor-I receptor (IGF-IR), human epidermal growth factor receptors (HERS), and vascular endothelial growth factor (VEGF), as well as greater concentrations of epidermal growth factor (EGF) in the extracellular fluid (Jameel et al., 2004). BRCA, p53, and Bcl-2 genes have also been implicated in radioresistance in breast cancer (Jameel et al., 2004).

Cancerous cells sometimes develop into cancer stem cells, which are quiescent and slowly proliferating variants of the cancerous cells that are capable of trans-differentiation (Liang & Kaufmann, 2023). This means they are capable of epithelial to mesenchymal transition (EMT), which increases detachment, migration, intra and extravasation (movement in or out of blood circulation), invasion and metastasis (Liang & Kaufmann, 2023). There are two types of cancer stem cell populations that are typical for breast cancer and both of which demonstrate increased radioresistance (Walker et al., 2021). One of which is characterized by cluster of differentiation 44 (CD44) positive and cluster of differentiation 24 (CD24) negative cell surface marker expression (CD44+/CD24-), while the other involves increased aldehyde dehydrogenase activity (ALDH) (Walker et al., 2021). Relative to typical breast cancer cell lines (MDA-MB-231 and MCF-7), the CD44+/CD24- variant has been shown to be more resistant to radiation, and in response to radiation has a lower increase in reactive oxygen species, and no change in phosphorylation of H2A histone family member X (H2AX), while normal breast cancer cells showed an increase (Phillips et al., 2006). Additionally, fractionated doses increased activation of Notch-1 in CD44+/CD24- cells and increased the percentage of breast cancer stem cells in typical breast cancer cells (Phillips et al., 2006). Notch-1 is a protein involved in cell differentiation, cleavage, and proliferation (J. Wang et al., 2001), so this indicates that as long as CD44 is being expressed, CD24 gene knockout can be induced by fractionated doses of radiation and causes radioresistance, tumorigenesis, and decreased apoptosis. Since this outcome has been induced by radiation multiple times (Phillips et al., 2006; Murray et al., 2024) and has been observed to have a significant impact on tumorigenesis, proliferation (Walker et al., 2021), angiogenesis (H. Sun et al., 2013), and metastasis (Abraham et al., 2005; Sheridan et al., 2006), this has important implications for the development of radioresistant and recurring forms of breast cancer especially resulting from gaps in radiotherapy.

Despite the numerous studies which have examined the post irradiation DNA damage response and biomarkers for those at risk of developing radioresistant cancers, relatively few studies have focused on the radiosensitization of radiation resistant breast cancer. Many studies focus on potential biomarkers for patients at risk of developing radioresistant breast cancer to identify patients most at risk prior to radiotherapy. However, the cause of radiation resistance is complex and still poorly understood, so even individuals that test negative for those particular biomarkers may still develop radioresistant variants after treatment. A treatment which could either reverse or prevent the development of radioresistance could be hugely beneficial in preventing this recurrent and treatment resistant form of cancer, although no such treatment has been discovered yet. It is for this reason the present research aimed to identify a novel, druggable target within the prostaglandin signaling pathway, a previously poorly studied pathway in relation to radioresistance in breast cancer.

1.4 Prostaglandin signaling and cancer progression

Prostaglandin (PG) signaling dysregulation has been implicated in various aspects of cancer progression, including tumor growth, metastasis, and inflammation, but its potential role in promoting radiation resistance remains underexplored. At an organism level it plays a role in inflammation, pain, fever, and regulation of blood flow (Zeng et al., 2023).

The prostaglandin signaling system (see Figure 1) includes a chain of enzymatic reactions originating from polyunsaturated omega−6 fatty acid in the cell membrane. These are utilized by the enzyme phospholipase A2 (PLA2) to create arachidonic acid (AA). AA is catalyzed by prostaglandin-endoperoxide synthase 1 (COX-1, also known as PTGS1) and prostaglandin-endoperoxide synthase 2 (COX-2, also known as PTGS2) into Prostaglandin G2 (PGG2) and subsequently to Prostaglandin H2

(PGH2) (Walker et al., 2021). From this point PGH2 is used as the substrate of the prostaglandin synthase enzymes (PTGDS, PTGFS, TXA2S, PTGIS and PTGES1-3) which convert it into a variety of prostaglandins (PGD2, PGF2, TXA, PGI2, or PGE2 respectively) (Walker et al., 2021). Each of these prostaglandins exit the cell via ATP binding cassette subfamily C member 4 (ABCC4) and bind to either prostaglandin D receptor 1 or 2 (DP1-2, also known as PTGDR1-2), prostaglandin F receptor (FP, also known as PTGFR), thromboxane receptor (TP, also known as PTGTR), prostaglandin I receptor (IP, also known as PTGIR), or prostaglandin E receptors 1, 2, 3 or 4 (EP1-4, also known as PTGER1-4) on nearby cells (Walker et al., 2021).

Generally, prostaglandin binding to IP, DP1 and DP2, contribute to an anti-cancer effect and binding to FP, TP, or EP1-4 promote the formation of tumors, especially EP2 and EP4 (see Figure 1; (Walker et al., 2021). More specifically, EP3 and DP2 receptors inhibit cyclic adenosine monophosphate (cAMP) signaling, while EP2, EP4, DP1 and IP receptors activate cAMP signaling (Zeng et al., 2023). Also, EP1, FP, and TP receptors activate PKC/Ca^{2+} signaling, TP and EP3 receptors activate Rho, and EP2 and EP4 receptors activate PI3K and β-arretin pathways (Zeng et al., 2023).

These downstream pathways dictate the overall effect caused by each prostaglandin. PGD2 has been shown to promote sleep, trigger allergic reactions, prevent platelet aggregation, and relax both vascular and non-vascular smooth muscles (Zeng et al., 2023). PGE2 contributes to tumor growth, tissue repair and inflammation, and regulates blood pressure (with EP2 and EP4 receptor activation lowering blood pressure, and EP1 and EP3 receptor activation raising it; Zeng et al., 2023). PGF2α stimulates uterine contraction and vasoconstriction (Zeng et al., 2023). PGI2 encourages vasodilation and bronchial relaxation, while also inhibiting platelet aggregation, inflammation, and cell proliferation (Zeng et al., 2023). TXA2 supports platelet aggregation, airway constriction, and arterial contraction (Zeng et al., 2023).

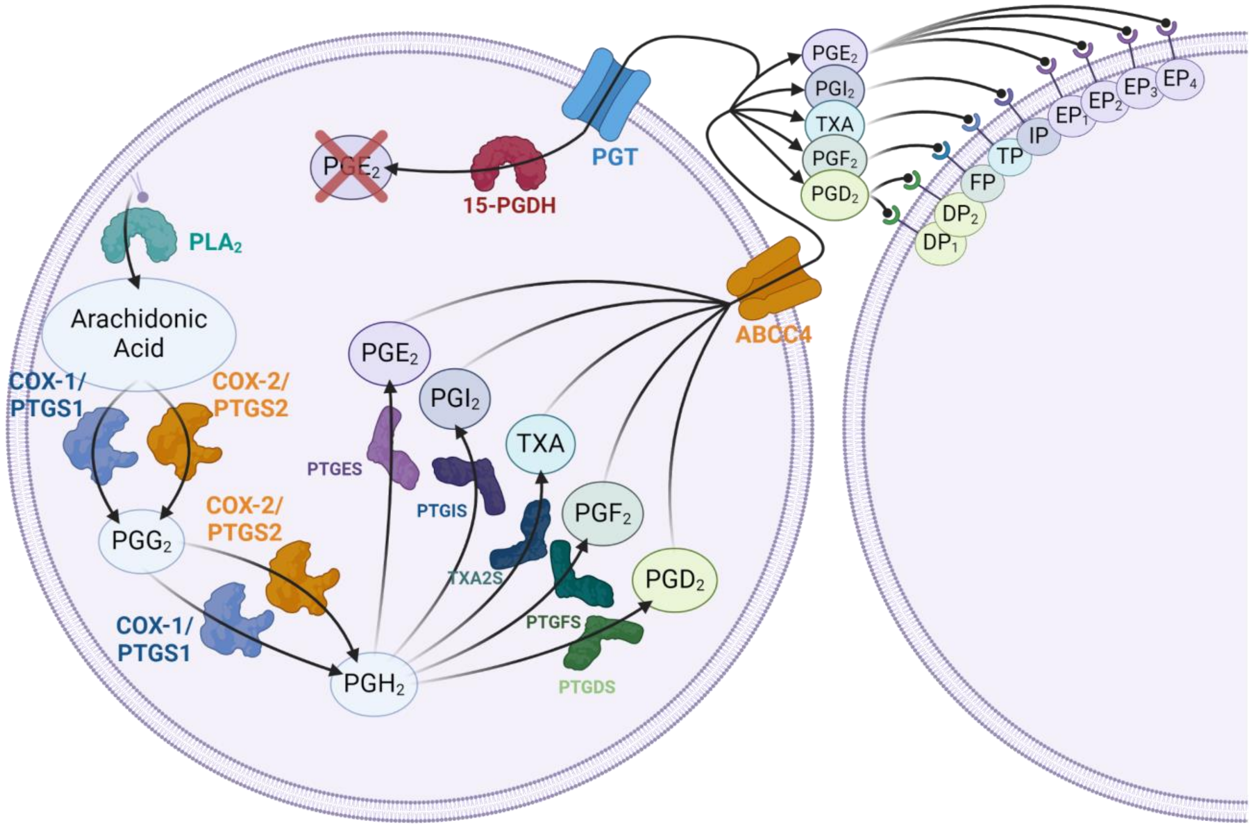

Figure 1. The prostaglandin signaling system. PLA_2 converts a membrane lipid into arachidonic acid (AA; Walker et al., 2021).. AA is then converted into PGH_2 in a two-step reaction by either PTGS1 or PTGS2 (Walker et al., 2021). PGH_2 is then converted into one of the prostaglandins by its respective synthase (Walker et al., 2021). Prostaglandins are transported out of the cell where they can either bind to their respective prostaglandin receptors or reenter the cell and be degraded by hydroxyprostaglandin dehydrogenase 15 (15-PGDH; Walker et al., 2021).

PTGS1 and 2 are the rate limiting step in the prostaglandin signaling pathway (Walker et al., 2021), so an increase in the expression of either could potentially increase the speed of the entire process resulting in an increase in the cell adhesion, proliferation, and tumorigenesis. In fact, this has been observed as far back as 1980 when Rolland et al. found unusually high quantities of prostaglandins in breast tumors, and more recently this has been observed in both ALDH and CD44+/CD24- forms of breast cancer stem cells (Walker et al., 2021). COX-1 is typically expressed to some extent in all human cells, however PTGS2 is only expressed in certain tissues such as the brain, kidneys, and placenta unless the cell is exposed to cytokines, growth factors, or oncogenes as a part of the inflammatory response (Howe, 2007). Interestingly, 40 percent of breast carcinomas and 85 percent of colorectal adenocarcinomas overexpress PTGS2 despite this protein typically being nearly undetectable in these tissues under normal non-cancerous state (Howe, 2007). It is for these reasons that COX enzymes (PTGS1 and 2) and prostaglandins have recently been the target of several studies, including some which have investigated the use of non-steroidal anti-inflammatory drugs to inhibit PTGS2 activity and decrease the incidence of colon and breast cancers (Howe, 2007) as well as lung cancers (Sandler & Dubinett, 2004).

Many pathways have been proposed to be involved in developing radioresistance, however no specific answer has yet been identified regarding how radiation resistance develops in breast cancer cells nor how to adequately prevent it. For instance, Xia et al. (2010) suggests that the PI3K/Akt/PTGS2 pathway is involved in the development of radioresistance and can be slightly lessened by treatment with both a PTGS2 inhibitor and a P13K inhibitor in HeLa cells (cervical cancer cells). Although the data used to make these conclusions have a high amount of variation and no replicates for each treatment. Other studies have also suggested the use of PTGS2 inhibitors in combination with chemotherapy and radiotherapy in lung cancer to avoid the increased angiogenesis, tumorigenesis, and metastasis often seen with high PGE_2 expression (a prostaglandin produced downstream from PTGS2) (Krysan et al., 2006). PTGS2 overexpression has also been identified to cause radioresistance in glioblastoma by increasing production of PGE_2 which binds to EP_4 thereby causing activation of the ERK/MAPK signaling pathway (Cook et al., 2016). In addition to PTGS2, five other potential therapeutic targets, p38, Bcl-2, Bcl-XL, β-catenin, and E-cadherin have been suggested due to their changes in expression after silencing PTGS2 and the effects they have been shown to have on cell migration and apoptosis (Lin et al., 2013).

Changes in expression within the ATM/Chk2/p53 pathway (Squatrito et al., 2010), the Wnt/β-catenin signaling pathway (Troschel et al., 2018; Y. Yang et al., 2019), and the PI3K/Akt pathway (Hong et al., 2021; J. Wu et al., 2018; Xia et al., 2010) have been observed to play a role in radiation resistance in human cells. Since many of these are also common target pathways for cancers affecting other tissues, the majority of research focuses on these rather than prostaglandin signaling despite some of the promising implications of the pathway. PTGS2 seems to be an effective target for CRISPR gene upregulation or knockout experiments, and for the design of new or more effective therapeutic agents. If PTGS2 overexpression is shown to increase radioresistance, then the use of nonsteroidal anti-inflammatory drugs (NSAIDs) which inhibit PTGS2 activity such as celecoxib, naproxen, or ibuprofen should be investigated to determine their effectiveness in radiosensitizing radioresistant breast cancer and preventing radioresistance from developing.

1.5 Rationale, objective and hypothesis

The published research on radioresistance in breast cancer highlights the involvement of growth factors such as IGF-IR, HERS, VEGF and EGF, common cancer progression biomarkers such as BRCA, p53 and Bcl-2, cancer stem cell and EMT biomarkers such as CD44, CD24 and ALDH, and signaling by Notch, Wnt/β-catenin, PI3K/Akt, ERK/MAPK, and ATM/Chk2/p53 pathways. Despite the fact that prostaglandin signaling occurs upstream from many of these pathways and has the potential to influence these biomarkers, it remains relatively poorly explored as a potential cause for the development of radioresistance in breast cancer. For this reason, it was chosen as the target pathway for the current research project. The primary objective of this study was to investigate the role of PTGS2 dysregulation in the development of radiation resistance in triple-negative breast cancer cells. Furthermore, the secondary objective was to determine whether the upregulation of PTGS2 expression in MDA-MB-231 cells promoted the development of radiation resistance. It was hypothesized that the prostaglandin signaling pathway would be significantly dysregulated in radioresistant variants of breast cancer and that overexpression of PTGS2 would increase radiation resistance in breast cancer cells.

Chapter 2: Gene Dysregulation in Radiation Resistant Variants of Triple Negative Breast Cancer Cells

2.1. Introduction

Prostaglandin signaling has been shown to be involved in the development of radioresistance in multiple different cancers, although the mechanism by which this is proposed to be accomplished varies. In glioma cells, PTGS2 has been demonstrated to have an effect on radiation resistance and cell proliferation via the nuclear factor kappa B (NF-κB) signaling pathway (Tan et al., 2019). Additionally, overexpression of aldo-keto reductase 1C3 (AKR1C3), a $PGF_{2\alpha}$ synthase, in esophageal cancer, non-small-cell lung cancer, and prostate cancer has been demonstrated to increase radioresistance via the MAPK pathway and its effect on decreasing reactive oxygen species (S.-Q. Sun et al., 2016). The effect of miR-620 has been investigated in breast, prostate and pancreatic cancer cell lines and was shown to inhibit the expression of the hydroxyprostaglandin dehydrogenase 15 (HPGD/15-PGDH) tumor suppressor gene (Huang et al., 2015). 15-PGDH is responsible for degrading PGE2, so increased miR-620 expression resulted in increased PGE_2 levels and greater radioresistance (Huang et al., 2015). PTGS2 expression and PGE_2 production have also been demonstrated to cause radioresistance by influencing the PI3K/Akt and ERK/MAPK signaling pathways in cervical cancer cells (Xia et al., 2010) and glioblastoma respectively (Cook et al., 2016).

Based on these findings, the prostaglandin signaling pathway seems to be involved in the development of radioresistance, although there is relatively little published literature discussing the effect of the prostaglandin signaling pathway on radioresistance in breast cancer. These findings seem to suggest that upregulation of PTGS2 and increased production of $PGF_{2\alpha}$ and PGE_2 increase radioresistance.

The prostaglandin system has been poorly explored relative to many other areas in the published literature, especially in relation to breast cancer. MDA-MB-231 cells were used as a model for the present study because they are a common model of triple negative breast cancer and can develop radioresistant variants with high dose fractionated x-ray irradiation. With triple negative breast cancer being difficult to treat and having a relatively high likelihood of recurrence, novel treatment methods, especially those capable of preventing radioresistance, would be valuable in preventing recurrence of the cancer and may improve overall patient outcomes. The objective of the present study was to develop radioresistant variants of MDA-MB-231 cells and determine to what extent prostaglandin was dysregulated. A secondary objective was to investigate other dysregulated biological processes and signaling pathways in the radioresistant breast cancer cells. It was hypothesized that these radioresistant variants would demonstrate a significant dysregulation throughout most of the prostaglandin signaling pathway, particularly demonstrating upregulation in PTGS2, as well as PGE_2 and $PGF_{2\alpha}$ synthases and receptors. Additionally, it was hypothesized that the ERK/MAPK and PI3K/Akt signaling pathways would be dysregulated in the radioresistant variants.

2.2. Methodology

2.2.1 Cell Culture

MDA-MB-231 cells were each maintained in Dulbecco's Modified Eagle's Media (DMEM; Cytiva HyClone™, Logan, Utah, Catalog Number: SH3028501) supplemented with 10% fetal bovine serum (Cytiva HyClone™, Logan, Utah, Catalog Number: SH3039603HI), 1 U/mL penicillin-streptomycin solution (Cytiva HyClone™, Logan, Utah, Catalog Number:SV30010), and 6 mM L-glutamine (Cytiva, Marlborough, Massachusetts, Catalog Number: SH3003401). Cells were incubated at 37 °C with humid air and 5% CO2. Cells were maintained in T-75 flasks and either plated into T-25 flasks for RNA extraction or plated into 100 mm dishes for protein extraction. All flasks were vented for adequate air flow, and all flasks and dishes were sterile and tissue culture treated.

Whenever necessary, cells were passaged by first aspirating the spent supernatant, then washing the adhered cells with phosphate buffered saline (PBS) before adding 0.25% trypsin. The trypsin was neutralized with an equal amount of complete media and transferred to a sterile centrifuge tube for centrifugation at 4 °C for 5 minutes at 1000 relative centrifugal force (RCF; Equivalent to g-force). The supernatant was then discarded. The pellet was resuspended in a small volume of complete media for counting via a hemocytometer to determine the resulting cell concentration. This concentration was then used to calculate the appropriate volume of the cell solution to plate into the new flask to achieve the desired number of cells.

When cryogenically storing cells, after determining the cell concentration, a solution was prepared containing one million cells per mL, 5% dimethyl sulfoxide (DMSO), and complete media. 1 mL of this solution was then aliquoted to each necessary cryovial, before placing the cryovials into a Mr. Frosty™ Freezing Container (Thermo Scientific™, Waltham, Massachusetts, Catalog number: 5100-0001). This freezing container was placed into a -80 °C freezer for 24 - 48 hours, then transferred to a cryobox and stored in liquid nitrogen until needed. To revive cells from this frozen state, they were removed from liquid nitrogen, thawed at room temperature and immediately transferred to a T-75 flask with prewarmed complete media. 24 hours later, once the cells had adhered, the supernatant was aspirated and replaced with complete media to remove any DMSO from the freezing solution.

2.2.2 Development of Radioresistant Variants of MDA-MB-231 cells

MDA–MB-231 cells were grown in a T-75 flask and irradiated at 1.5 Gy/min once a week using an X-RAD 320 irradiation cabinet (Precision X-Ray, Madison, Connecticut) operated at 320 kV and 12.5 mA with a 2 mm aluminum filter. The initial dose given was 2 Gy, and the dose given each week was increased by 0.5 Gy until 7.5 Gy was delivered after 11 weeks (57 Gy delivered total). Three colonies were clonally selected from the resulting cells and used for subsequent experiments (MDA-MB-231^{RR1-3}).

2.2.3 RNA Sample Preparation

Cells were plated into the necessary number of T-25 flasks and allowed to grow to 70 % confluency before the media was removed, the adhered cells were washed with 4 °C PBS, and 1 mL of TRIzol was added per flask. Once all cells were lysed by the TRIzol, the solution was transferred to a microcentrifuge tube for a standard TRIzol extraction (Al-Khayyat et al., 2023). Purified RNA concentration was determined via a NanoDrop spectrophotometer (ThermoScientific, Waltham, Massachusetts, Catalog number: ND-1000). This stage of RNA was used for reverse transcription quantitative polymerase chain reaction (RT-qPCR), but further purification and processing was completed for RNA sequencing.

2.2.4 RNA Sequencing and Gene Ontology

RNA samples were further purified via the NEB Monarch® RNA cleanup kit (NEB, Ipswich, Massachusetts, Catalog number: T2040L). The NEBNext® Ultra™ II Directional RNA Library Kit (NEB, Ipswich, Massachusetts, Catalog number: E7765S) was then used for library preparation. This kit isolated the poly-A messenger ribonucleic acid (mRNA) and created strand-specific directional libraries using the deoxyuridine triphosphate (dUTP) method. The prepared library samples were then quantified using the NEBNext® Library Quant Kit (NEB, Ipswich, Massachusetts, Catalog number: E7630S). These samples were combined at an equimolar concentration and sequenced at TCAG using a NovaSeq 6000 Illumina platform, achieving roughly 35 million reads per sample (paired-end 100 base-pair reads). The sequencing data was processed in-house using a variety of bioinformatics toolkits provided by DRAGEN Inc. through the Illumina Sequence Hub platform (Illumina, San Diego, California). Specifically, DRAGEN FASTQ was utilized for sequencing data quality checks and read trims, while DRAGEN RNA was used to align reads to the human reference genome (GRCh38.p13) and carry out transcript-count analysis. DRAGEN Differential Expression was used to analyze differential expression based on the DESeq2 platform. The criteria for selecting differentially expressed genes were set based on a gene-fold change of less than -2 or greater than 2, false discovery rate (FDR) corrected p-values of less than 0.05, and a minimum average read count of 30 transcripts per million. Lastly, iPathwayGuide (AdvaitaBio, Ann Arbor, Michigan) was used to perform gene ontology analysis.

2.2.5 RT-qPCR

The RNA sequencing, gene ontology results and the published literature were examined to determine a pathway that was suspected to be involved in the development of radiation resistance. Several genes within this pathway were chosen. qPCR primers were designed by using a primer BLAST for these required sequences. Only primers with an adequate melting temperature, GC content, and without self-complementarity were selected. These primers were then checked for consistent amplification between 54 to 64 degrees Celsius and at various concentrations. The primers (sequences listed in appendix table A1) that had a uniform reaction efficiency, an R squared value greater than 0.99 and an amplification efficiency of 90-110% were considered valid and used for the subsequent RT-qPCR experiments.

Samples of both radiation resistant variants and MDA-MB-231 cells were collected using the same protocol described in section "1.2.2 RNA Sample Preparation". Complementary deoxyribonucleic acid (cDNA) was prepared from these RNA samples by using a Bi2M cDNA Synthesis Kit (Medi-Res Corp., Sudbury, Ontario, Catalog number: Bi2M-SSRT2) according to the manufacturer's instructions. Roughly 1 μg of sample RNA was treated with DNAse, annealed to random hexamers, then treated with a reverse transcriptase. 10 ng of the resulting cDNA was added to each well of a 96 well qPCR plate. Each well also contained 1X SYBR qPCR master mix (MediRes Corp., Sudbury, Ontario, Catalog number: Bi2M-2xqPCR), and 600 nmol of both the forward and reverse primers for the gene in a total reaction volume of 15 uL. The qPCR plate was then placed into a QuantStudio 5 Real-Time PCR instrument (ThermoScientific, Waltham, Massachusetts, Catalog number: A34322) which completed 40 cycles of 95 degrees Celsius for 15 seconds, followed by 60 degrees Celsius for 30 seconds. A fluorescence measurement was taken after each cycle. The fluorescence data was analyzed using the QuantStudio TM Design and Analysis Software v1.5.1 (Applied Biosystems) to obtain the cycle threshold (C_q) of each sample. The samples were then normalized to the geometric mean of the three control housekeeping genes: heat shock protein family D member 1 (*Hspd1*), tubulin alpha 1b (*Tuba1b*), and adenosine triphosphate (ATP) synthase F1 subunit beta (*Atp5f1b*). Relative gene expression was determined by the formula:

$$2^{\Delta\Delta C_q} = 2^{(\Delta C_q\ gene\ -\ \Delta C_q\ housekeeping\ genes)}$$

Average $2^{\Delta\Delta C_q}$ and standard error of the means (SEMs) were calculated and used to create figures representing the data.

2.2.6 Protein Extraction and Western Blot

Cells were collected with radioimmunoprecipitation assay (RIPA) lysis buffer (150 mM NaCl, 5 mM ethylenediaminetetraacetic acid (EDTA), 50 mM Tris, 1% NP-40, 0.5% sodium deoxycholate, and 0.1% sodium dodecyl sulfate (SDS); pH 7.5) in 100mm dishes at approximately 70–80% confluency for the purpose of protein extraction. This process involved removing the media, rinsing the cells with ice-cold

PBS, and lysing the cells with 200 μL of fresh RIPA lysis buffer supplemented with a protease inhibitor mix (ThermoScientific, Waltham, Massachusetts, Catalog number: A32955). The lysis mixture was agitated for 30 minutes at 4 °C with intermittent vortexing, followed by centrifugation at 20,000× g for 20 minutes at 4 °C. The soluble protein fraction was transferred to a 1.5 mL tube and stored at −80 °C. The protein concentration was determined using the Pierce BCA Protein Assay Kit (ThermoScientific, Waltham, Massachusetts, Catalog number: PI23225) as per the manufacturer's instructions.

The protein samples were examined via gel electrophoresis using the BOLT Bis-Tris Plus gel system (ThermoScientific, Waltham, Massachusetts). In brief, samples were prepared for gel electrophoresis in 50 μL of reaction volumes consisting of 25 μg of RIPA solubilized protein sample, 1X Bolt LDS Sample Buffer (ThermoScientific, Waltham, Massachusetts, Catalog number: LSB0007), and 1X Bolt Reducing Agent (ThermoScientific, Waltham, Massachusetts, Catalog number: LSB0004). The samples were then heated at 70 degrees Celsius for 10 minutes. The protein ladder (ThermoScientific, Waltham, Massachusetts, Catalog number: 26619) and samples were loaded onto a Blot Bis-Tris Plus Mini Gel (ThermoScientific, Waltham, Massachusetts, Catalog number: NW04120BOX) and electrophoresed for 22 minutes at a constant 200 V.

The contents of the gel were transferred to a nitrocellulose membrane (PALL, Port Washington, New York, Catalog number: 66593) using the Mini Bolt Module (B1000) according to the manufacturer's instructions. The blots were blocked with 5% bovine serum albumin (BSA) in TBS-T buffer (Tris-buffered saline with 0.1% Tween-20) for 60 minutes at room temperature. The blots were washed three times with TBS-T for 5 minutes each at room temperature, followed by incubation with the following primary rabbit monoclonal antibodies overnight at 4 °C: PTGS2 (1:1000; Cell Signaling Technology, Danvers, Massachusetts, Catalog number: #12282). The blots were washed four times with TBS-T and incubated with horseradish peroxidase (HRP)-conjugated goat anti rabbit secondary antibody (MediRes Corp., Sudbury, Ontario, Catalog number: Bi2M-GB23303) at 1:5000 dilution for 1 hour at room temperature. After four washes with TBS-T, the blots were incubated with 2mL of enhanced chemiluminescence (ECL) mixture (MediRes Corp., Sudbury, Ontario, Catalog number: Bi2M-CK-ECL) for 5 minutes followed by signal imaging using the ChemiDoc Imaging System (Bio-Rad, Hercules, California). The antibodies were stripped from the blots using a mild stripping buffer (0.2 M glycine, 0.5% SDS, and 1% Tween-20; pH 2.2) for 10 minutes at room temperature. The blocking, washing, and antibody incubation procedure described above were repeated for the mouse monoclonal α-Tubulin (1:1000; MediRes Corp., Sudbury, Ontario, Catalog number: Bi2M-GB15200) housekeeping antibody, followed by the HRP-conjugated goat anti-mouse secondary antibody (1:5000; MediRes Corp., Sudbury, Ontario, Catalog number: Bi2M-GB23301). The band intensities were quantified using the ImageJ analysis software.

2.2.7 Statistical analysis

The RT-qPCR $\Delta\Delta C_q$ results were assessed for significance using Jamovi via a one-way ANOVA followed by a post-hoc Tukey's test, and displayed in figures as the mean of all replicates ± SEM. Significance in quantified Western blot results was determined by a student's t-test, and reported in figures as the average quantified PTGS2 expression relative to the alpha-tubulin expression within the same cell lines ± SEM.

2.3. Results

2.3.1 RNA Sequencing and Gene Ontology

Once the radioresistant variants of the MDA-MB-231 cells (MDA-MB-231^{RR}) were generated, RNA sequencing and gene ontology was performed to determine which genes and pathways were dysregulated. In total, 1801 genes were dysregulated (positive or negative fold change of 2 or greater), with 638 genes being upregulated and 1163 genes being downregulated as shown in figure 1. The most significantly dysregulated biological processes (Table 1) were associated with adhesion, multicellular processes, and signaling. Further examining the significantly dysregulated signaling pathways emphasized the involvement of specific signaling and adhesion pathways (Table 2). For example, many of the genes listed in the Pathways in Cancer section are involved in Wnt, cAMP, and PI3K-Akt signaling as well as cell adhesion and extracellular matrix (ECM) binding (integrins, fibronectin, collagen, laminin; Agrawal et al., 2024). 5 genes involved in the creation, secretion and reception of PGE2 were found in 3 of the top 5 significantly dysregulated signaling pathways. PTGER4 in particular is capable of influencing Wnt, cAMP, and PI3K-Akt signaling (Agrawal et al., 2024; Zeng et al., 2023). Additionally, numerous drugs exist which target prostaglandin signaling. As a result, the prostaglandin signaling pathway was chosen for further investigation.

Analyzing the dysregulated genes within the prostaglandin signaling pathway revealed downregulation in *PTGS1*, *PTGES*, *PTGES2*, *AKR1C3*, *TBXAS1*, and *ABCC4* as well as upregulation of *PTGS2*, *PTGES3*, cytosolic phospholipase A2 (*PLA2G4A*), *PTGER4*, *PTGFR*, and *HPGD* (Table 3). In particular the upregulation of *PTGS2*, *PTGES3*, and *PTGER4* are noteworthy. The expression level of *PTGS2* was 16.73 times higher in the radioresistant variants compared to the parental controls ($p=2.32*10^{-6}$). PTGS2 is responsible for converting arachidonic acid into PGH2, which is further converted to PGE2 by PTGES1, PTGES2, and PTGES3 (also referred to as cytosolic prostaglandin E synthase (cPGES)). *PTGES1* and *PTGES2* were both downregulated, although *PTGES3* was upregulated and had a far greater mean count in both the radioresistant variants and the typical MDA-MB-231 cells ($\text{MDA-MB-231}^{\text{Control}}$). *PTGER4* expression was also increased by 2.77 fold and had a p-value of $3.03*10^{-70}$.

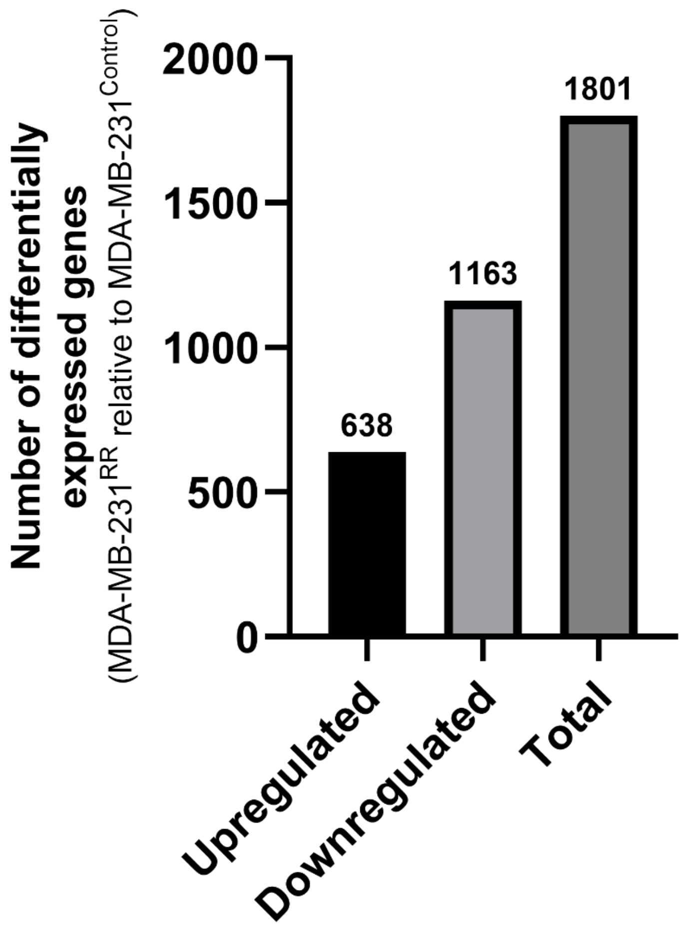

Figure 2. Differentially expressed genes between radioresistant variants (MDA-MB-231^{RR}) and typical MDA-MB-231 cells (MDA-MB-231^{Control}). A gene was determined to be differentially expressed if it had a positive or negative fold change greater than 2 and a p value less than 0.05. In total 1801 genes were differentially expressed between the RR cells and the parental MDA-MB-231 cells. 638 genes were upregulated, and 1163 were downregulated.

Table 1. The top 10 significant biological processes identified by iPathwayGuide to be affected by the changes in gene expression observed in the radioresistant variants. The gene ontology identifier (ID) is a value provided for each of the biological processes below and allows individuals to locate information on each process within numerous gene ontology databases (The Gene Ontology Consortium et al., 2000, 2023). The differentially expressed genes (DEGs) include any gene that had a positive or negative fold change of greater than two and a p value of less than 0.05 in MDA-MB-231^{RR} relative to MDA-MB-231^{Control}. A false discovery rate adjusted p value (p (adj) for FDR) is included for each biological process to give an indication of its significance.

Gene Ontology ID	Biological Process	DEGs	Total Genes	p (adj) for FDR
GO:0022610	Biological Adhesion	214	805	3.81E-18
GO:0007155	Cell Adhesion	212	802	6.50E-18
GO:0032501	Multicellular Organismal Process	722	3968	4.62E-16
GO:0051239	Regulation of Multicellular Organismal Process	323	1515	4.11E-13
GO:0009653	Anatomical Structure Morphogenesis	336	1621	4.91E-12
GO:0098609	Cell-Cell Adhesion	130	468	4.91E-12
GO:0023052	Signaling	627	3509	5.32E-11
GO:0007154	Cell Communication	632	3552	8.66E-11
GO:0007165	Signal Transduction	580	5258	2.02E-09
GO:0050896	Response to Stimulus	830	4973	3.12E-09

Table 2. Top 10 significant signaling pathways as determined by iPathwayGuide to be affected by the changes in gene expression observed in the radioresistant variants. Genes involved in the prostaglandin signaling pathway are underlined. The gene ontology identifier (ID) is a value provided for each of the pathways below and allows individuals to locate information on each pathway within numerous gene ontology databases (The Gene Ontology Consortium et al., 2000, 2023). The differentially expressed genes (DEGs) include any gene that had a positive or negative fold change of greater than two and a p value of less than 0.05 in MDA-MB-231^{RR} relative to MDA-MB-231^{Control}. If this fold change was positive, the gene is listed under the upregulated column, while if it was a negative fold change, it is listed under the downregulated column. A false discovery rate adjusted p value (p (adj) for FDR) is included for each biological process to give an indication of its significance.

Pathway (ID)	p (adj) for FDR	Upregulated DEGs	Downregulated DEGs
Complement and Coagulation Cascades (04610)	0.008	*FGB*, *F2RL2*, *SERPINB2*, *F3*, *CD55*, *ITGB2*, *PROS1*	*SERPINA1*, *CFD*, *C1R*, *PLAU*, *C4BPB*, *F12*
Neuroactive Ligand-Receptor Interaction (04080)	0.01	*HTR2C*, *GABRA3*, *P2RY10*, *GABBR2*, *F2RL2*, *ADM*, *S1PR3*, *GRPR*, *PRLR*, *KISS1*, <u>*PTGER4*</u>, *HRH1*	*VIPR1*, *SSTR2*, *NMB*, *GRIK4*, *ADORA2A* *S1PR5*, <u>*PTGER2*</u>, *HTR7*, *P2RY2*, *LPAR2*
Cell Adhesion Molecules (04514)	0.027	*VCAN*, *NEO1*, *CD22*, *CD274*, *ITGB2*, *CDH4*	*CD40*, *L1CAM*, *CLDN2*, *ICAM1*, *HLA-DRB1*, *ITGA6*, *NRCAM*, *HLA-A*, *HLA-DRA*, *CLDN3*, *NCAM2*, *VSIR*, *HLA-F*, *ICOSLG*, *HLA-C*, *HLA-B*
ABC Transporters (02010)	0.033	*ABCB7*, *ABCA3*	*ABCC3*, *ABCB9*, *ABCG2*, *TAP1*, *ABCA2*, *ABCD1*, *TAP2*, *ABCA1*, <u>*ABCC4*</u>

Pathways in Cancer (05200)	0.033	*CCND2*, *MMP1*, *PTGS2*, *LAMA1*, *HEYL*, *FN1*, *PLCB1*, *IL7R*, *FGF5*, *COL4A5*, *FGF1*, *ESR2*, *PTGER4*, *IL13RA1*, *CAMK2D*, *HHIP*, *MGST3*, *WNT7B*, *MITF*, *EGF*, *GADD45B*, *GNAS*, *GADD45A*, *CXCL8*	*PDGFRB*, *EGLN3*, *FGFR4*, *JAG2*, *FHH*, *GSTM2*, *SUFU*, *JUP*, *PTGER2*, *PGF*, *FLT3LG*, *ITGA6*, *LAMA5*, *TERT*, *IL15RA*, *CDKN1A*, *ADCY6*, *FRAT1*, *NCOA1*, *TGFBR2*, *CCND3*, *IL15*, *ADCY7*, *CCNA1*, *PLCG1*, *DDB2*, *PLCG2*, *NCOA3*, *ITGA2*, *GSTM4*, *HES1*, *COL4A1*, *COL4A2*, *GNG11*, *RALB*, *PLD2*, *DVL2*, *LPAR2*, *LRP5*, *FZD1*, *TRAF5*, *EML4*, *TRAF3*, *AKT1*, *LAMB1*, *EPOR*, *STAT1*
Protein Digestion and Absorption (04974)	0.033	*CPA3*, *ATP1A3*, *COL8A1*, *COL4A5*	*COL5A1*, *COL6A2*, *COL6A3*, *COL27A1*, *COL7A1*, *COL13A1*, *COL4A1*, *COL4A2*, *KCNN4*
ECM-Receptor Interaction (04512)	0.033	*LAMA1*, *FN1*, *TNC*, *COL4A5*	*COL6A2*, *COL6A3*, *ITGB4*, *ITGA6*, *LAMA5*, *FREM2*, *ITGA2*, *COL4A1*, *COL4A2*, *ITGA10*, *DAG1*, *LAMB1*
AGE-RAGE Signaling Pathway in Diabetic Complications (04933)	0.033	*FN1*, *PLCB1*, *COL4A5*, *F3*, *PRKCZ*, *EGR1*, *CXCL8*	*NFATC1*, *ICAM1*, *PLCD1*, *MAPK13*, *TGFBR2*, *PLCG1*, *PLCG2*, *COL4A2*, *PRKCE*, *PLCD3*, *AKT1*, *STAT1*

Cytokine-Cytokine Receptor Interaction (04060)	0.034	*IL7R, TNFRSF10D, PRLR, IL13RA1, IL1RL2, CXCL8*	*CD40, INHBB, TNFRSF1B, NGFR, CX3CL1, IL11, GDF5, IFNLR1, TNFSF12, IL24, TNFRSF11B, IL15RA, CRLF2, TGFBR2, IL15, IL17RE, TNFRSF19, EPOR*
Insulin Secretion (04911)	0.04	*RYR2, ATP1A3, SNAP25, PLCB1, CAMK2D, KCNMB4, RIMS2, GNAS*	*KCNMB3, ADCY6, ADCY7, PCLO, ATF6B, KCNN4*

Table 3. Normalized RNA sequencing data comparing various components of the prostaglandin signaling system between the radiation resistant (MDA-MB-231^{RR}) and control cells (MDA-MB-231^{Control}).

Prostaglandin synthesis	Fold change	p_{adj}	Control; Mean transcript counts per million	RR; Mean transcript counts per million
PTGS1	0.22	2.58E-05	26	6
PTGS2	16.73	2.32E-06	18	300
PTGES	0.31	2.97E-16	424	132
PTGES2	0.69	6.58E-27	1376	952
PTGES3	1.13	2.84E-02	8582	9676
PTGDS	NOT DETECTED			
PTGIS	NOT DETECTED			
PLA2G4A	1.30	6.26E-03	86	111
AKR1C3	0.63	2.28E-08	369	231
TBXAS1	0.78	7.85E-02	63	49
Prostaglandin receptors	Fold change	p_{adj}	Control; Mean transcript counts per million	RR; Mean transcript counts per million
PTGER1	NOT DETECTED			
PTGER2	NOT DETECTED			
PTGER3	NOT DETECTED			
PTGER4	2.77	3.03E-70	177	489
PTGFR	2.35	1.94E-04	14	32
PTGDR	NOT DETECTED			
PTGDR2	NOT DETECTED			
PTGIR	NOT DETECTED			
TBXA2R	NOT DETECTED			

Prostaglandin transport and degradation	Fold change	p_{adj}	Control; Mean transcript counts per million	RR; Mean transcript counts per million
ABCC4	0.50	7.42E-35	893	443
SLCO2A1	NOT DETECTED			
HPGD	1.34	1.63E-01	24	33

2.3.2 RT-qPCR

RT-qPCR confirmed the dysregulation of *PTGS1*, *PTGS2, PTGES, PTGER4*, and *CD24* mRNA (Figure 3). *PTGS2* in particular had a 14.28-fold increase in expression in the radioresistant variants relative to the typical MDA-MB-231 cells (n=4, p<0.05). *PTGS1* on the other hand was downregulated, with a 2.95-fold decrease in expression (n=4, p<0.05). Similarly, the PGE2 synthase, *PTGES* had a 3.38-fold decrease in expression (n=4, p<0.05), although the PGE2 receptor, *PTGER4* had a 3.24-fold increase (n=4, p<0.05). This may indicate that *PTGER4* binding was contributing a greater effect in the radioresistant variants than the MDA-MB-231^{Control}. If this is indeed the case, then PGE2 production must be primarily accomplished via either PTGES2 or PTGES3 to compensate for the downregulation of PTGES.

One of the biomarkers for a cancer stem cell phenotype in human breast cancer is CD24 knockdown. Here, *CD24* was observed to have an 18.03-fold decrease in expression (n=4, p<0.05), which may indicate that the radioresistant cells were transitioning into a cancer stem cell phenotype. If this were the case, the radioresistant cells may have increased EMT, migration, and likelihood of metastasis compared to the typical MDA-MB-231 cells.

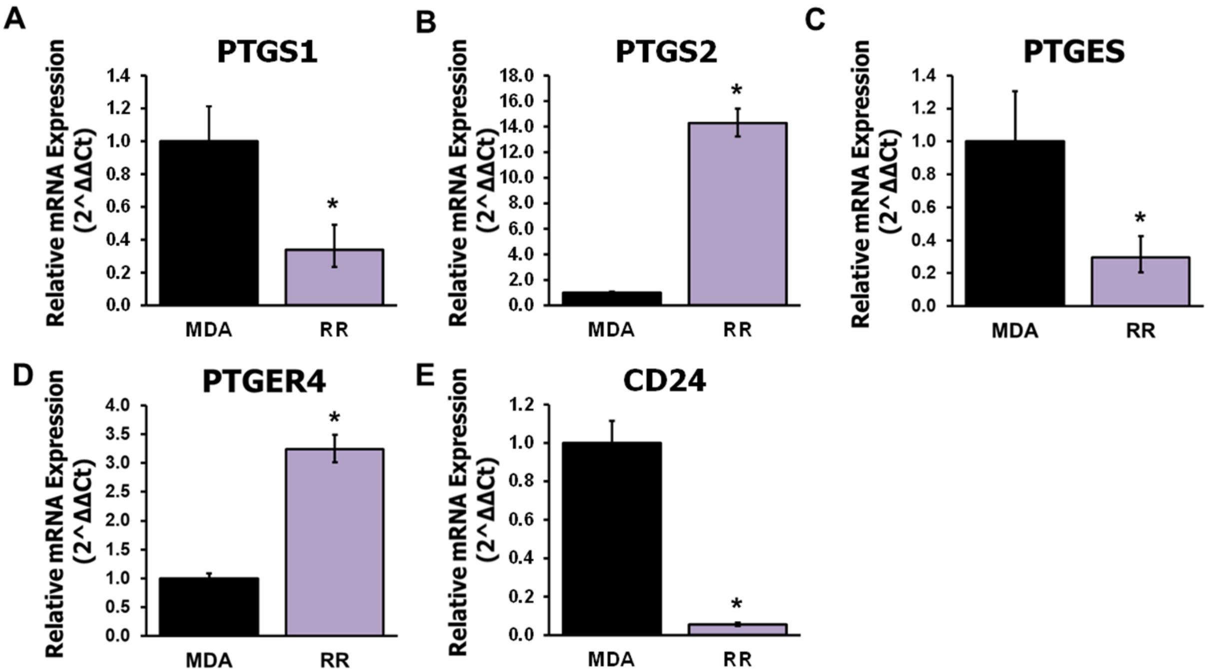

Figure 3. RT-qPCR results for five dysregulated genes within the prostaglandin system. "*" denotes significance ($p<0.05$; n = 4), MDA refers to MDA-MB-231^{Control} cells, and RR refers to radiation resistant variants of MDA-MB-231 cells (MDA-MB-231^{RR}). All samples were standardized against three housekeeping genes, *TUBA1B*, *HSPD1*, and *ATP5F1B*. Error bars are shown as ± the standard error of the means (SEM).

2.3.3 Western Blot

To ensure *PTGS2* mRNA was being translated into PTGS2 protein, a western blot was used. The western blot revealed that PTGS2 was indeed overexpressed at the protein level as well (n=3, $p<0.05$) Figure 4). This seems to indicate that *PTGS2* was not degraded at the mRNA level in the radioresistant cells and was accumulating at the protein level. Assuming an adequate supply of arachidonic acid, the high quantity of PTGS2 would have caused a buildup of PGH2, providing a sufficient substrate supply for whatever prostaglandin synthases were available.

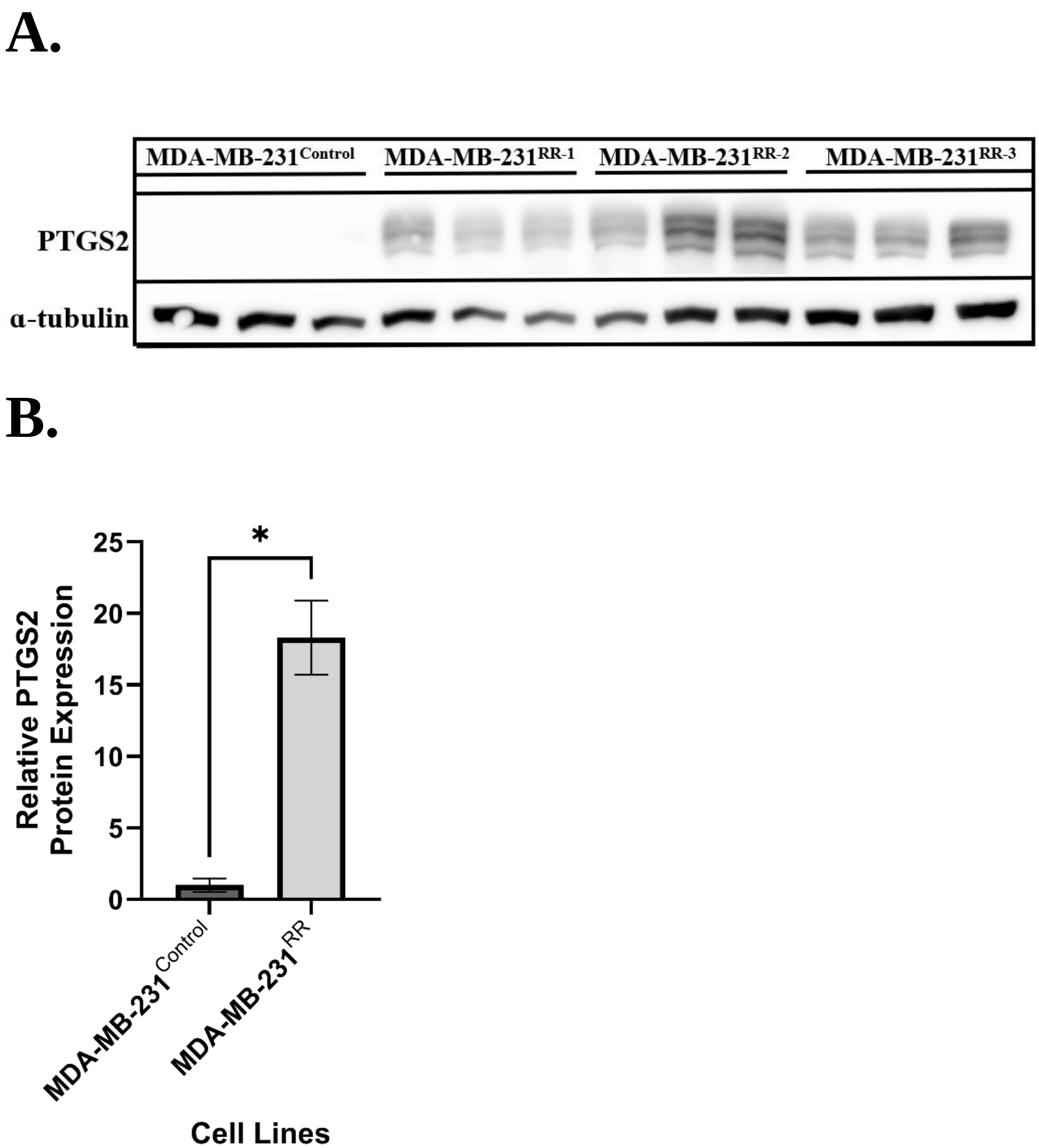

Figure 4. Western blot and quantified PTGS2 protein expression in typical MDA-MB-231 cells (MDA-MB-231^{Control}) and radioresistant variants (MDA-MB-231^{RR}). A. Western blots of PTGS2 (roughly 90 kDa) and the housekeeping protein, α-tubulin (roughly 55 kDa) demonstrating the upregulation of PTGS2 in radioresistant variants of MDA-MB-231 cells. **B.** Quantified analysis of the western blot in "A" revealed a significant ($p<0.05$, $n=3$) 18.3 fold upregulation of PTGS2 protein expression in radiation resistant cells compared to the unmodified MDA-MB-231 cells. Error bars are shown as ± the standard error of the means (SEM).

2.4. Discussion

2.4.1 Objectives and summary of results

The objective of these experiments was to develop radioresistant variants of MDA-MB-231 cells and determine to what extent prostaglandin signaling was dysregulated. This goal was accomplished, the radioresistant variants of MDA-MB-231 cells were successfully developed and the extent of prostaglandin signaling dysregulation was characterized. In particular, PTGS2 was consistently highly expressed relative to the typical MDA-MB-231 cells, while the other cyclooxygenase, PTGS1 was significantly downregulated. Additionally, at the mRNA level, *PTGER4* and *PTGFR* were shown to be significantly upregulated. PTGES and PTGES2 were also somewhat downregulated, although PTGES3 was upregulated. Taken together, it appears as though PGE2 production and reception were especially influenced in the radioresistant variants.

These experiments also aimed to investigate other dysregulated biological processes and signaling pathways in the radioresistant breast cancer cells. Many pathways were dysregulated to some extent in the radioresistant cells, although Wnt, cAMP and PI3K/Akt signaling are particularly noteworthy due to their potential to influence apoptosis evasion.

Within the top ten significant biological processes differentially expressed in the radioresistant variants (table 1), many of the categories listed described similar processes. For example, biological adhesion, cell adhesion, and cell-cell adhesion all seemed to describe focal adhesion. By loosely lumping these categories together, three categories of biological processes seemed to be significantly dysregulated, cellular adhesion, multicellular organismal processes, and cell signaling. This may suggest that the changes in these processes were responsible for the increased radioresistance of the cells.

2.4.2 Prostaglandin signaling dysregulation

The “Pathways in Cancer” category listed within the top ten significant signaling pathways of table 2, contains numerous methods by which the cancer cells can evade apoptosis. One such method, and a likely contributor to the radioresistance, is via PGE2 binding to its receptors. This would have the potential to influence BIRC5 through Wnt signaling via both cAMP signaling and PI3K-Akt signaling, as well as caspase 9 (CASP9), BCL2L1, forkhead box O1 (FOXO1), and tumor protein p53 gene (TP53) via PI3K-Akt signaling on its own. Moreover, the RNA sequencing and RT-qPCR results revealed elevated expression of both PTGS2 and PTGES3, which seems to indicate increased PGE2 production.

A further look into the RNA sequencing results for the prostaglandin signaling pathway indicated a significant dysregulation throughout the pathway. The expression of PTGS2 in particular was far greater in the radioresistant variants than the MDA-MB-231^{Control}. This prostaglandin signaling dysregulation was further confirmed by RT-qPCR, and the increased quantity of PTGS2 was confirmed at the protein level. PTGS2 is one of the first proteins in the prostaglandin signaling pathway and is responsible for bis-dioxygenation of arachidonic acid into PGG2 and further reduction of PGG2 into PGH2 (Thorn et al., 2011). PGH2 is the precursor to multiple other prostaglandins which each can produce either pro-tumorigenic or anti-tumorigenic effects downstream, including increased apoptosis or evasion of apoptosis. In this way, PTGS2 expression along with the other changes in expression within the prostaglandin signaling pathway may be partially responsible for the radioresistance observed in the radioresistant cells. PTGS2 also seems like a viable target for further experimentation due to the common use of NSAIDs, such as ibuprofen, naproxen, or celecoxib which inhibit cyclooxygenase enzymes such as PTGS2 (also referred to as cyclooxygenase-2, or COX-2) to exert an anti-inflammatory effect, typically for the purpose of pain relief. For these reasons, PTGS2 was selected as the potential target for further investigation into its role in radiation resistance.

PTGES1-3 were also viable candidates for further investigation, since they are the synthases for PGE2, the prostaglandin which was predicted to have the greatest effect on radioresistance. However, the RNA sequencing revealed downregulation in PTGES and PTGES2 with an upregulation in PTGES3. This resulted in a roughly equivalent mean transcript count per million being produced in both the radioresistant variants and the typical MDA-MB-231 cells. As a result, PTGES1-3 were not chosen as the proposed targets for further investigation, and PTGS2 was chosen instead.

2.4.3 Other mechanisms involved (Wnt signaling and focal adhesion)

Aside from the effect caused by prostaglandin signaling, Wnt signaling also seemed to be dysregulated in the radioresistant cells. Wnt family member 7B (Wnt7B), frizzled class receptor 1 (FZD1), LDL receptor related protein 5 (LRP5), FRAT regulator of WNT signaling pathway 1 (FRAT1), and disheveled segment polarity protein 2 (DVL2) were highlighted in the gene ontology for being significantly dysregulated and were highlighted within the significant signaling pathways (as seen in table 2). Radioresistance via Wnt signaling may be achieved by increased production of BIRC5, an apoptosis inhibitor. However, despite Wnt7B, FZD1, LRP5, FRAT1, and DVL2 all being highlighted in the gene ontology (Table 2), only Wnt7B was differentially expressed in the direction that should increase radioresistance, which makes this mechanism unlikely to be the main cause of radioresistance in the radioresistant variants generated.

Another possible mechanism by which radioresistance may have been achieved is through changes in expression and adhesion to fibronectin, collagen, and laminin, which in turn influence the PI3K-Akt signaling pathway. The gene ontology highlighted collagen type 4 alpha 1, 2 and 5 chain (COL4A1, COL4A2, COL4A5), fibronectin 1 (FN1), laminin subunit alpha 1 (LAMA1), laminin subunit alpha 5 (LAMA5), laminin subunit beta 1 (LAMB1), integrin subunit alpha 6 (ITGA6), integrin subunit alpha 2 (ITGA2), and AKT1. The COL, FN, LAM and ITG proteins are components of collagen, fibronectin, laminin and integrins respectively. The binding of these ECM proteins to their respective integrins, increases activation of the PI3K-Akt signaling pathway which can either increase or decrease the likelihood of apoptosis depending on various factors such as the proportions of isoforms of AKT, and the production of downstream pro-apoptotic proteins CASP9, FOXO1 and TP53, as well as the production of downstream anti–apoptotic protein BCL2L1. AKT signaling may also increase inhibition of GSK3B, which inhibits β-catenin (CTNNB1) phosphorylation in Wnt signaling. In these ways, this mechanism describes how three pro-apoptotic and two anti-apoptotic genes may be dysregulated via PI3K-Akt signaling and to a lesser extent, Wnt signaling. However, the quantity of protein subunits involved in the production of collagen, fibronectin, laminin, and integrin make this a difficult candidate for drug-induced radiosensitization.

Additionally, influencing focal adhesion proteins could have undesired consequences for EMT and metastasis.

Chapter 3: Establishing PTGS2 Overexpressing Variants of Triple Negative Breast Cancer Cells, and Assessing Cell Physiology and Radiosensitivity

3.1. Introduction

The objective of this study was to determine whether overexpression of *PTGS2* increases radioresistance. Another objective was to assess how *PTGS2* overexpression altered the cancer phenotype in terms of cell proliferation, adhesion to fibronectin, laminin, and collagen, as well as anchorage-independent growth. To achieve *PTGS2* overexpression, MDA-MB-231 cells were engineered using the CRISPR/dCas9 transcriptional activation (CRISPRa) system. This system employs a dead CRISPR associated protein 9 (dCas9) enzyme, which lacks endonuclease activity, fused to the VP64 transcriptional activator. Guide RNAs (gRNA) were designed to direct dCas9 to the *PTGS2* gene, resulting in the upregulation of endogenous PTGS2 expression at physiologically relevant levels.

We hypothesized that the PTGS2 overexpressing cells (MDA-MB-231^{PTGS2}) would have significantly increased survival post-irradiation, decreased cell adhesion to fibronectin, collagen, and laminin, and increased cell proliferation and anchorage independent growth relative to MDA-MB-231^{Control}.

3.2. Methodology

3.2.1 Cell Culture

The same methodology as described in chapter 1 for cell culture was used here as well for the culture of both human embryonic kidney 293T cells (HEK293T) cells, and MDA-MB-231 cells.

3.2.2 Design and Cloning of CRISPRa gRNA Sequences into Lentiviral Transfer Plasmid

The CRISPRa system was used for the overexpression of the PTGS2 gene. To this end, gRNA target sequences were designed using the Sigma-Aldrich Advanced Genomics bioinformatics tool (Millipore Sigma, 2021). This CRISPRa system used the dCas9 variant and the VP64 transcriptional activator (Tyumentseva et al., 2023). This dCas9 variant originates from the S. pyogenes Cas enzyme, and so to function, it required a 20 nucleotide guide sequence that matched the PTGS2 gene and was followed by a 5′NGG PAM sequence (Tyumentseva et al., 2023). The design tool produced gRNA sequences that were optimized for gene overexpression and had minimal off-target activity (Millipore Sigma, 2021). The top three PTGS2 gRNA target sequences [#1: 5′-AAATTGCGTAAGCCCGGTGG-3′; #2: 5′-AAAATTGCGTAAGCCCGGTG-3′; and #3: 5′-AAAAAATTGCGTAAGCCCGG-3′] were chosen for insertion into the third generation lentiviral gRNA cloning backbone vector (Addgene, Watertown, Maryland, Catalog number: 73795). This plasmid has BsmBI cut sites for seamless insertion of the gRNA target sequences. As a result, the BsmBI overhang sequences were taken into account when designing the gRNA target sequences. The gRNA sequences with the newly appended overhangs were ordered as single-stranded oligonucleotides from IDT. The forward and reverse oligonucleotides were phosphorylated and annealed using a 10 μL reaction volume of 10 μM forward and reverse oligonucleotides, 1 mM adenosine triphosphate (ATP; NEB, Ipswich, Massachusetts), 1X Kinase Reaction Buffer A (NEB, Ipswich, Massachusetts), and 5 units of T4 polynucleotide kinase (NEB, Ipswich, Massachusetts). The reaction was carried out in a thermocycler in three stages: 37 °C for 30 min, 95 °C for 5 min, and temperature ramp down to 25 °C at 0.1 °C /s. The samples were diluted 250-fold by mixing 2 μL of the reaction mix with 498 μL of molecular grade water (Cytiva HyClone™, Logan, Utah, Catalog number: SH30538.LS). A single-step digestion and ligation of the vector and annealed oligonucleotides was performed in a 20 μL reaction volume that consisted of 100 ng of the lentiviral gRNA transfer plasmid, 2 μL of the diluted and annealed oligonucleotides, 1X Tango Buffer (ThermoScientific, Waltham, Massachusetts), 1 mM dithiothreitol (DTT; NEB, Ipswich, Massachusetts), 1 mM ATP (NEB, Ipswich, Massachusetts), 10 units of BsmBI restriction endonuclease (ThermoScientific, Waltham, Massachusetts), and 1 μL of T4 Quick Ligase (NEB, Ipswich, Massachusetts). The reaction was carried out in a thermocycler by repeating these two steps for 6 cycles: 37 °C for 5 minutes, then 23 °C for 5 minutes. 2 μL of the final ligation product was transformed into NEB Stable Competent E. coli cells according to the manufacturer's instructions and selected for ampicillin resistance (100 μg/mL). Selected clones were amplified and subjected to plasmid purification using the GeneJet Plasmid Miniprep Kit (ThermoFisher, Waltham, Massachusetts , Catalog number: K0502), according to the manufacturer's instructions.

3.2.3 Preparation of CRISPRa Lentiviral Particles via Calcium Phosphate Transfection

HEK293T cells were distributed into three 10 cm dishes at a density of 1.0 × 106 cells per dish 48 hours before the transfection process. On the day of transfection, the cells were approximately 50–60% confluent. Two hours before the transfection, the media was replaced with 9.0 mL/dish of prewarmed complete media that did not contain antibiotics. In a 15 mL tube, specific amounts of third generation lentiviral plasmids were combined to a final volume of 1.35 mL with molecular grade water: 10 μg of pMD2.G (Addgene, Watertown, Maryland, Catalog number: 12259), 30 μg of psPAX2 (Addgene, Watertown, Maryland, Catalog number: 12260), and 40 μg of transfer plasmid (Addgene, Watertown, Maryland, Catalog number: 61425-dCas9 or cloned CRISPRa gRNA plasmids as described earlier); 150 μL of 2.5 M CaCl2 were added to the plasmid mixture and mixed by vortexing. Subsequently, 1.5 mL of 2× HEPES-buffered saline (0.05 M HEPES, 0.28 M NaCl, 1.5 mM Na2HPO4, pH 7.0) were added gradually while the solution was being continuously vortexed. After allowing the transfection solution to incubate for 15 minutes at room temperature, 1 mL of the solution was added dropwise into each 10 cm plate. After 20 hours post-transfection, the media was replaced with 7 mL of complete media per 10 cm dish. The supernatant, which contained the lentiviral particles, was collected 8 hours after the media change. The supernatant was centrifuged at 500× g for 5 minutes at 4 °C to remove cellular debris and then cleared using a 0.45 μm syringe filter. The viral solution was divided into 1 mL aliquots and stored at −80 °C.

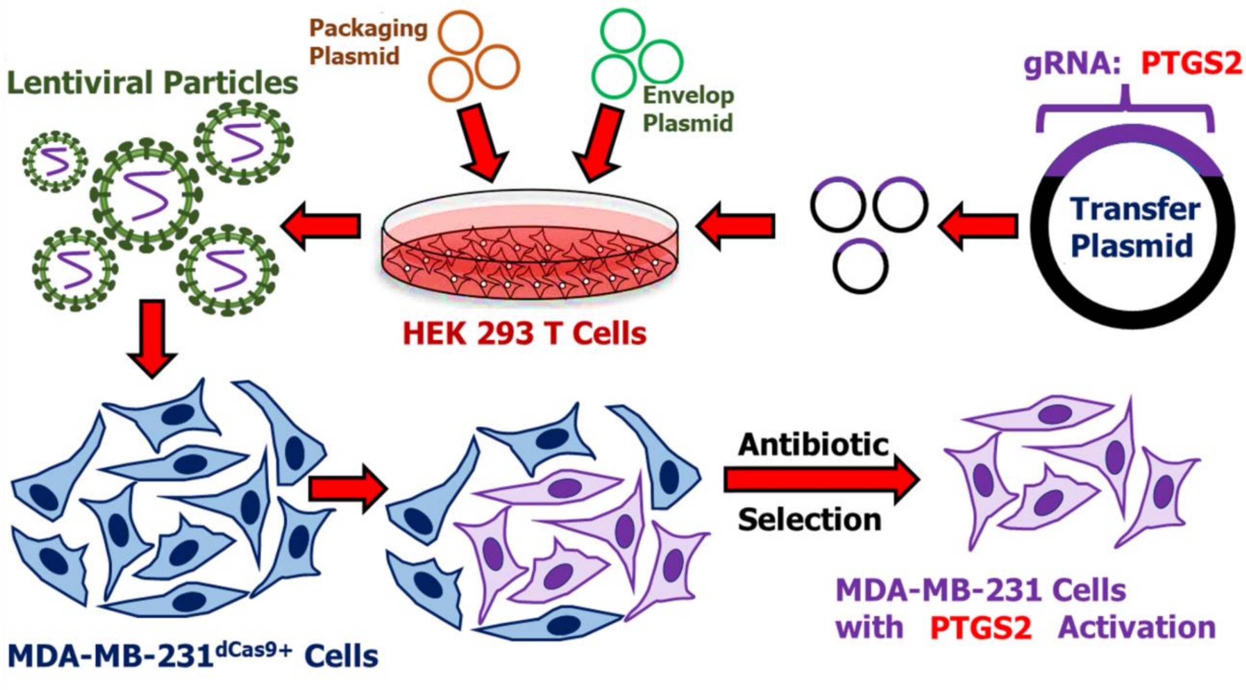

Figure 5. A simplified workflow depicting the process used to generate lentiviral particles capable of delivering CRISPRa gRNA for stable PTGS2 overexpression in MDA-MB-231 cells.

3.2.4 Lentiviral Infection for Producing CRISPRa Mediated PTGS2 Overexpression

MDA-MB-231 cells were placed into a six-well plate in complete media at a density of 100,000 cells per well 24 hours before the lentiviral infection. On the day of the infections, the cells were approximately 40–50% confluent. Two hours before the infection, the media was replaced with 0.9 mL/well of complete media. The infection process was started by adding 1 mL of lentiviral solution and 100 µL of 20X polybrene solution (8 µg/mL final concentration). After 16 hours, the virus solution was removed and each well was incubated with 2 mL of complete media. After 48 hours, the cells were passaged and moved to T25 flasks under antibiotic selection (0.8 µg/mL blasticidin for dCas9 selection; 8 µg/mL puromycin for gRNA selection). The antibiotic selection was maintained for four rounds of passage, after which the cells were maintained without the selection antibiotic. PTGS2-overexpressing MDA-MB-231 cells were created through sequential viral infections. Initially, MDA-MB-231 cells expressing dCas9 were generated (MDA-MB-231^{dCas9}). Subsequently, the MDA-MB-231^{dCas9} cells were infected with two unique lentiviral preparations containing varying gRNA sequences designed for PTGS2 overexpression (herein referred to as MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-231$^{PTGS2\text{-}\#2}$), as well as one unmodified transfer plasmid to serve as a control (herein referred to as MDA-MB-231^{Control}).

3.2.5 Verification of PTGS2 Overexpression by RT-qPCR and Western Blot

Using the same methodology as described in Chapter 1, PTGS2 overexpression was confirmed in the MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-231$^{PTGS2\text{-}\#2}$ relative to MDA-MB-231^{Control}.

3.2.6 Survival Assay

MDA-MB-231^{Control} and the two PTGS2 overexpressing cell lines were plated in T-25 flasks in triplicate for each of the following conditions: 8, 6, 4, 2, and 0 Gy. These flasks were plated with 6000, 4000, 1200, 800, and 500 cells respectively. 24 hours after plating, the flasks were irradiated at the corresponding doses, then incubated for 11 days at 37 degrees Celsius, 5% CO_2 and humid air. Every four days during this incubation period, the media was replaced with fresh complete DMEM. After the 11 days, the media was removed from the flasks, and stained for 20 minutes with crystal violet before being gently rinsed with deionized water. The flasks were left open overnight to dry, then the colonies were counted. For this purpose, any group of cells surpassing 30 cells in size was considered a colony.

3.2.7 Cell Proliferation Assay

One hundred thousand cells were plated into fourteen T-25 flasks with complete media. Cells from two T-25 flasks were trypsinized and counted twice each at 24-hour intervals for a period of seven consecutive days. The media was replaced on the third and fifth days to ensure healthy conditions for cell growth. The cells were collected and counted using a hemocytometer. The average of the two counts was used to determine the total cell count for each T-25 flask. The average cell count from three separate experiments, along with the standard error of the mean (SEM), is provided for each cell line.

3.2.8 Cell Adhesion Assay

7.5 ng/µL fibronectin (Sigma-Aldrich, St. Louis, Missouri, Catalog number: F2006), 20 ng/µL laminin (Sigma-Aldrich, St. Louis, Missouri, Catalog number: L2020), 25 ng/µL collagen (Sigma-Aldrich, St. Louis, Missouri, Catalog number: C5533), or 100 ng/µL poly-d-lysine positive control (Sigma-Aldrich, St. Louis, Missouri, Catalog number: P7280) were spread on flat-bottom 96-well plates and left to incubate at 4 °C overnight. The plates were then rinsed with a wash solution (0.2% BSA in PBS) and blocked with 2% BSA. The cells were gathered by trypsinization and resuspended in cell recovery media (serum-free media supplemented with 20 mM HEPES and 0.1% bovine serum albumin, pH 7.4). After a 30-minute cell recovery period at 37 °C, the cells were plated at 40,000 cells/well . After one hour, the cells spread on fibronectin, laminin and collagen were rinsed three times with a prewarmed wash solution. All wells were then fixed with 4% paraformaldehyde for 10 minutes at room temperature, followed by a 0.1% crystal violet stain for 30 minutes at room temperature. The wells were rinsed with water three times and left to air-dry. The cell count for wells coated with fibronectin, laminin and collagen were normalized against the poly-d-lysine positive control wells. The relative cell adhesion was reported as fold change ± SEM relative to MDA-MB-231^{Control}.

3.2.9 Soft Agar Colony Formation Assay

Four solutions were prepared prior to beginning the assay, two solutions of noble agar, one at 1% and the other at 0.6%, 1X complete DMEM, and 2X complete DMEM. The 1% and 0.6% noble agar solutions were created by dissolving 1 g and 0.6 g of noble agar (Thermo Scientific™, Waltham, Massachusetts, Catalog number: AAJ1090722) respectively in 100 mL of deionized water before autoclaving the solutions to sterilize them. After autoclaving, these solutions were cooled to 38.5 degrees Celsius before use. The 1X complete DMEM was prepared following the same protocol outlined at the beginning of section 1.2.1. 2X complete DMEM was prepared 50 mL at a time by the following process: 1.348 g of powder DMEM (Gibco™, Waltham, Massachusetts, Catalog number: 12800082) and 0.37 g of sodium bicarbonate were dissolved in 30 mL of deionized water. The pH of this solution was then adjusted to 7.0 before adding enough deionized water to bring the total volume up to 37 mL. This solution was sterilized by a 0.2 μm sterile filter before adding 10 mL of fetal bovine serum (Cytiva HyClone™, Logan, Utah, Catalog Number: SH3039603HI), 1 mL of penicillin-streptomycin solution (Cytiva HyClone™, Logan, Utah, Catalog Number:SV30010), and 2.041 mL of 200 mM L-Glutamine (Cytiva, Marlborough, Massachusetts, Catalog Number: SH3003401).

All four solutions were warmed to 38.5 degrees Celsius prior to the following steps. 1.5 mL of a mixture of equal parts the 2X complete DMEM and 1 % noble agar solution was used to coat the bottom of each well of the 6-well plates. The plates were then placed at 4 degrees Celsius for 10 minutes to allow the noble agar to set, then moved to 37 degrees Celsius for 30 minutes. During this time, MDA-MB-231^{Control} and both PTGS2 overexpressing cell lines were trypsinized and counted via the same method outlined in section 1.2.1. These cells were serially diluted with 2X complete DMEM to create 6 mL solutions of 80000, 53333, 16000, 10667 and 6667 cells/mL. 6 mL of the 0.6 % noble agar solution was added to each of these cell dilutions before plating 1.5 mL of this mixture into each well of a 6-well plate, resulting in five 6-well plates per cell line containing 60000, 40000, 12000, 8000, and 5000 cells per well. Again, the plates were placed at 4 degrees Celsius for 10 minutes to allow the noble agar to set, then moved to 37 degrees Celsius for 30 minutes before adding 1 mL of 1X complete DMEM to each well. The plates were incubated at 37 °C with humid air and 5% CO_2. 24 hours later the 60000, 40000, 12000, and 8000 cell per well plates were irradiated with 8, 6, 4 and 2 Gy respectively, with the 5000 cell per well plate being an unirradiated sham. Every four days the liquid was carefully pipetted out and replaced with fresh 1X complete DMEM. 28 days after initially plating the cells, the liquid media was pipetted off and 300 μL of a 5 mg/mL solution of nitroblue tetrazolium chloride (Thermo Scientific™, Waltham, Massachusetts, Catalog number: N6495) in 1X PBS was added to each well. 24 hours later, the 6-well plates were imaged with a ChemiDoc Imaging System (Bio-Rad, Hercules, California), and colony counts were determined using ImageJ analysis software.

3.2.10 Prostaglandin signaling system, EMT and ECM Gene Profiling by RT-qPCR

Both PTGS2 overexpressing cell lines and MDA-MB-231^{Control} were grown and harvested as described in section 1.2.3 and used for RT-qPCR as described in section 1.2.5. The genes investigated were selected from those involved in interacting with and producing PGE2 (PTGER4 and PTGES), ECM binding and cell adhesion (FN1, integrin subunit beta 1 (ITGB1), LAMB1, integrin subunit alpha 10 (ITGA10), COL4A2, COL4A1, ITGA2, ITGA6, collagen type 6 alpha 2 chain (COL6A2), tenascin C (TNC)), biomarkers of an EMT phenotype (vimentin 1 (VIM1), keratin 19 (CK19), snail family transcriptional repressors 1 and 2 (SNAI1 and SNAI2), AKT2, cadherin-2 (CDH2), CD44, CTNNB1, and actin alpha 2 (ACTA2)), and cell cycle arrest (cyclin dependent kinase inhibitor 1A (CDKN1A)).

3.2.11 RNA sequencing of PTGS2 overexpressing cells

To explore the effects on additional genes and pathways beyond that described by RT-qPCR gene profiling, RNA sequencing was performed. This was accomplished using the same method as described in chapter 1. Gene ontology was performed on the resulting data by the PANTHER Overrepresentation Test, as well as by the DAVID Functional Annotation tool. The PANTHER Overrepresentation Test determined which of the Reactome pathways were most significantly dysregulated, while the DAVID Functional Annotation tool determined the differentially expressed biological processes, cellular components, and molecular functions.

3.2.12 Statistical analysis

The survival, cell adhesion, soft agar colony formation, and growth assays were examined for statistical significance using Jamovi statistical analysis software to conduct an ANOVA followed by a post hoc tuckey's test. The RT-qPCR data was examined for statistical significance while generating figures with GraphPad Prism by using a one-way analysis of variance (ANOVA) with a Dunnett's multiple comparisons test to check for significant differences of the PTGS2 overexpressing cell lines relative to MDA-MB-231^{Control}.

3.3. Results

3.3.1 Verification of PTGS2 Overexpression by RT-qPCR and Western Blot

To generate *PTGS2* overexpressing MDA-MB-231 cells, lentiviral-mediated genomic integration of the CRISPRa components (dCas9 and two gRNA designs targeting the *PTGS2* promoter) was employed. First, dCas9-expressing MDA-MB-231 cells (MDA-MB-231^{dCas9}) were created through lentiviral delivery of the dCas9 gene. Subsequently, these cells were infected with two lentiviral preparations containing distinct gRNA sequences designed to upregulate the endogenous *PTGS2* gene (MDA-MB-231$^{PTGS2\text{-}\#1}$, MDA-MB-231$^{PTGS2\text{-}\#2}$), resulting in stable *PTGS2* overexpression. RT-qPCR analysis demonstrated approximately 8 and 2 fold increase in *PTGS2* mRNA expression in MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-

231$^{PTGS2\text{-}\#2}$ respectively, and approximately a 2 fold increase in PTGS2 protein expression in both cell lines (figure 6).

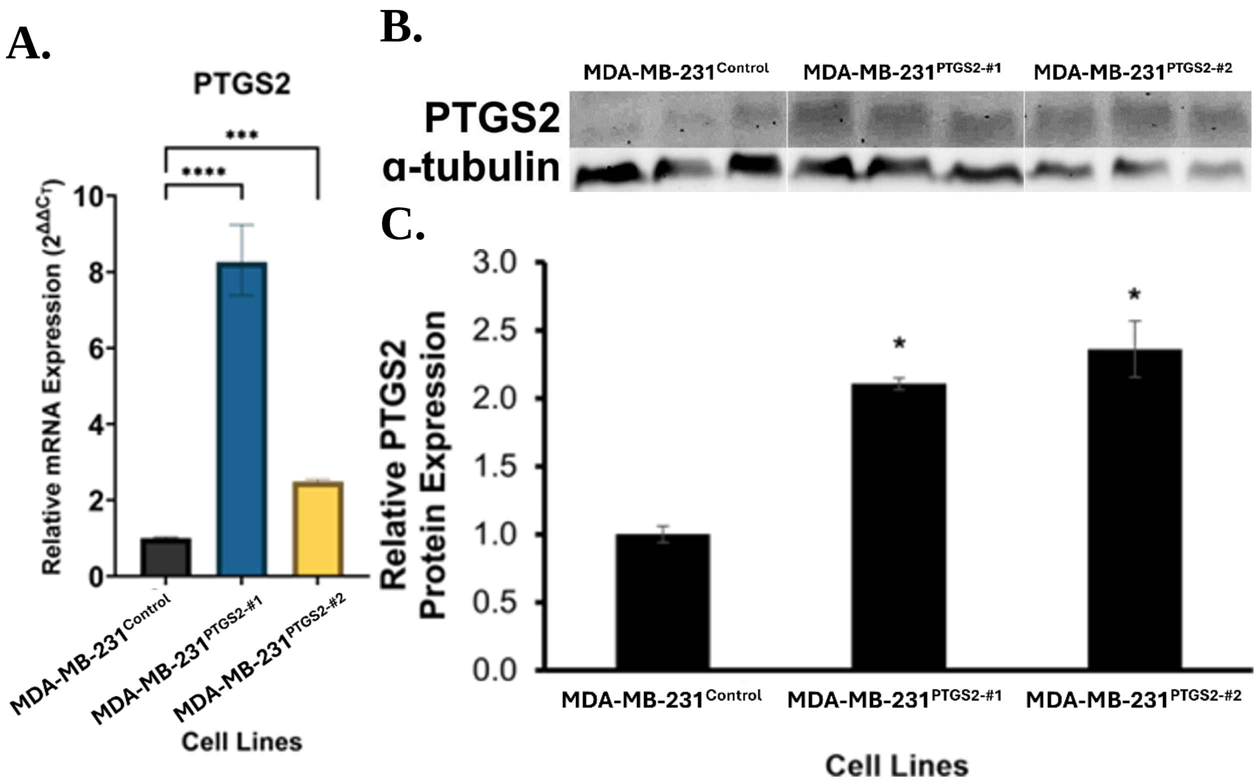

Figure 6. Establishing *PTGS2* overexpressing MDA-MB-231 cells through stable integration of CRISPR transcriptional activation system. A. Significant *PTGS2* overexpression is demonstrated at the mRNA level via RT-qPCR. There was a fold change of 8.3 and 2.5 relative to MDA-MB-231^{Control} for MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-231$^{PTGS2\text{-}\#2}$ respectively. "****" denotes $p<0.0001$, "***" denotes $p=0.0001$, n=4. Error bars are shown as ± the standard error of the means (SEM). **B.** Western blots demonstrated the greater expression of PTGS2 (roughly 90 kDa) relative to a housekeeping protein, alpha-tubulin (roughly 55 kDa) in the PTGS2 overexpressing cell lines. **C.** Quantified PTGS2 protein expression from western blots shown in B show a 2.1 and 2.4 fold increase in PTGS2 protein expression in MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-231$^{PTGS2\text{-}\#2}$ respectively relative to the MDA-MB-231^{Control} ($p<0.05$, n=3). Error bars are shown as ± the standard error of the means (SEM).

3.3.2 Survival Assay

Assessing clonogenic survival post irradiation with the PTGS2 overexpressing cells revealed a significant decrease in survival relative to MDA-MB-231^{Control} (figure 7). Specifically, MDA-MB-231$^{PTGS2\text{-}\#1}$ and MDA-MB-231$^{PTGS2\text{-}\#2}$ were not significantly different from each other ($p=0.686$), however MDA-MB-231^{Control} was significantly different from both MDA-MB-231$^{PTGS2\text{-}\#1}$ ($p=0.004$) and MDA-MB-231$^{PTGS2\text{-}\#2}$ ($p=0.027$). When the colonies were compared between the varying doses and cells, it was clear that colony size appeared to decrease as dose increased (figure 8). Interestingly, colony size seemed to decrease to comparable sizes at lower doses in the PTGS2 overexpressing cells than in the MDA-MB-231^{Control}. For example, at 2 Gy the PTGS2 overexpressing cells typically had a colony size closer to that of MDA-MB-231^{Control} at 4 or 6 Gy. Contrary to the initial hypothesis, these results demonstrate that PTGS2 overexpression significantly reduces clonogenic survival following irradiation, with a more pronounced reduction in colony size as the radiation dose increases compared to control cells. This suggests that PTGS2 overexpression may enhance radiation sensitivity in MDA-MB-231 cells, potentially influencing their ability to recover and proliferate after radiation exposure. To further understand the effects of PTGS2 overexpression, cell proliferation, adhesion to fibronectin, collagen and laminin, and anchorage-independent growth were assessed.

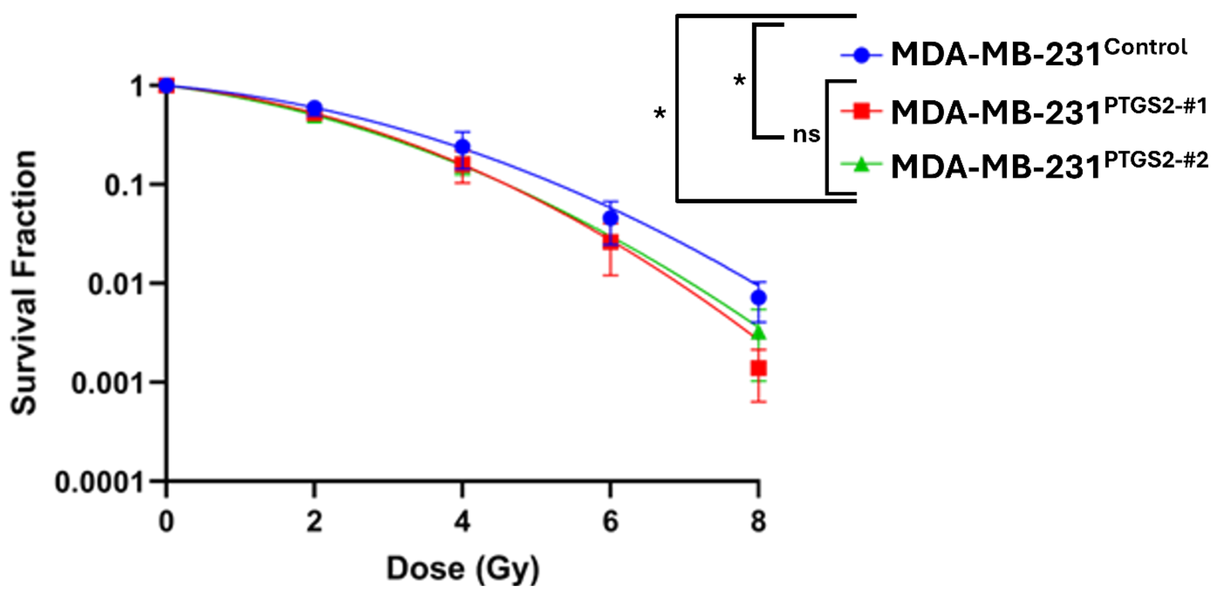

Figure 7. Clonogenic survival assay post-irradiation at 0 (sham), 2, 4, 6, and 8 Gy. There was a significant decrease in survival of MDA-MB-231$^{PTGS2-\#1}$ (n=3, p=0.004) and MDA-MB-231$^{PTGS2-\#2}$ (n=3, p=0.027) relative to the MDA-MB-231^{Control} (n=3). MDA-MB-231$^{PTGS2-\#1}$ and MDA-MB-231$^{PTGS2-\#2}$ were not significantly different from each other (n=3, p=0.686). Error bars are shown as ± the standard error of the means (SEM).

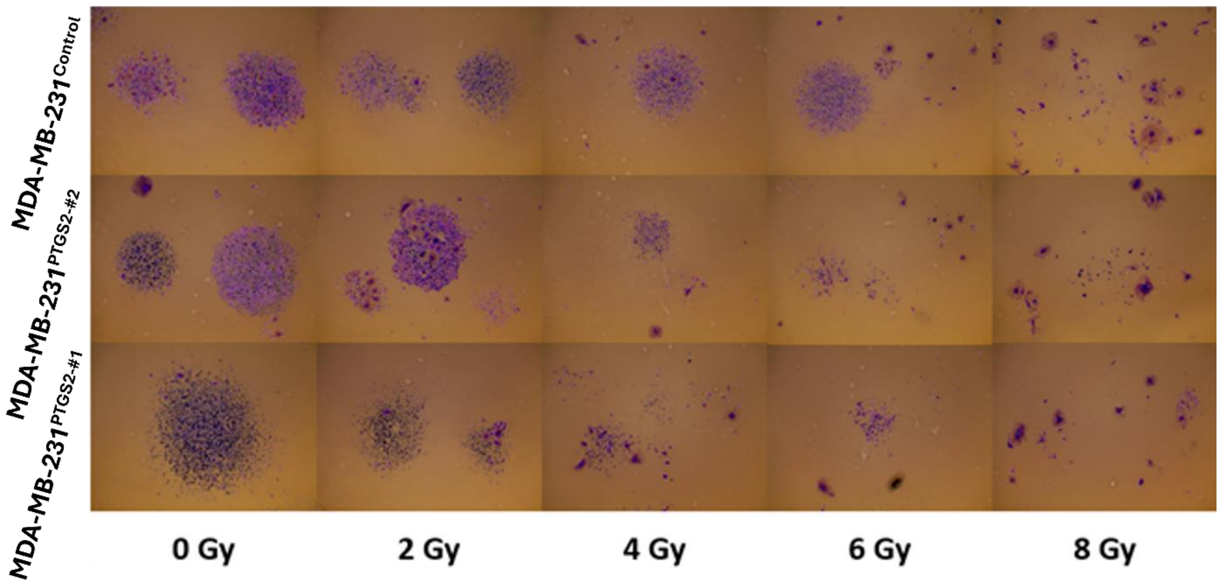

Figure 8. Images of typical colonies within each condition of the radiation survival assay. Notably, colony sizes appear to shrink with increasing x-ray dosage but seem to do so at a quicker rate in the PTGS2 overexpressing cells.

3.3.3 Cell Proliferation Assay

In order to assess whether PTGS2 overexpression affected the cell growth pattern, a growth-curve analysis was performed using MDA-MB-231$^{PTGS2\text{-}\#1}$, MDA-MB-231$^{PTGS2\text{-}\#2}$, and MDA-MB-231^{Control} cell lines (Figure 9). Cell growth was quantified at 24 hour intervals for seven consecutive days. There were no significant differences in the cell growth patterns for all three cell lines (n = 3, $p>0.05$).

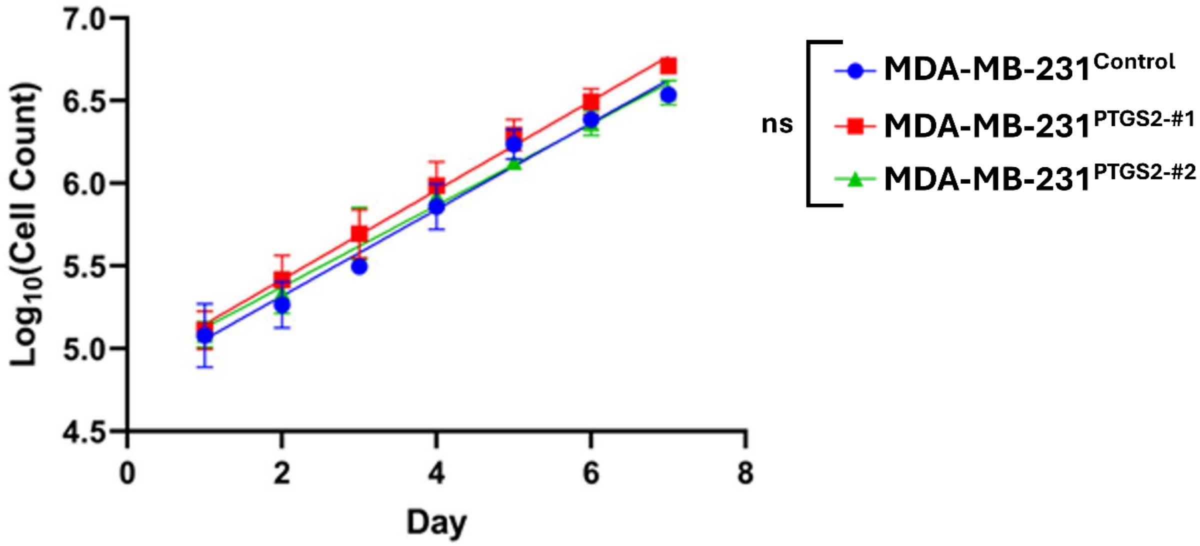

Figure 9. Cell proliferation assay with PTGS2 overexpressing cells and MDA-MB-231^{Control}. No significant differences were observed in growth between the PTGS2 overexpressing cells and MDA-MB-231^{Control} ($p>0.05$, n=3). Error bars are shown as ± the standard error of the means (SEM).

3.3.4 Cell Adhesion Assay

Cell adhesion plays a critical role in cancer progression and metastasis, and is negatively impacted in EMT and cancer stem cells. Therefore, assessing whether PTGS2 overexpression influences cell adhesion was essential to understanding the broader impact PTGS2 has on cancer cell behavior. In both PTGS2 overexpressing cell lines, cell adhesion to fibronectin was significantly decreased ($p<0.05$, n=3), and adhesion to collagen was only significantly decreased in MDA-MB-231$^{PTGS2\text{-}\#2}$ ($p<0.05$, n=3). Collagen adhesion in MDA-MB-231$^{PTGS2\text{-}\#1}$, and laminin adhesion in both cell lines were not significantly different ($p>0.05$, n=3; Figure 10). These findings suggest that PTGS2 dysregulation may selectively alter cell-extracellular matrix interactions, which could influence cancer cell motility and invasive potential.

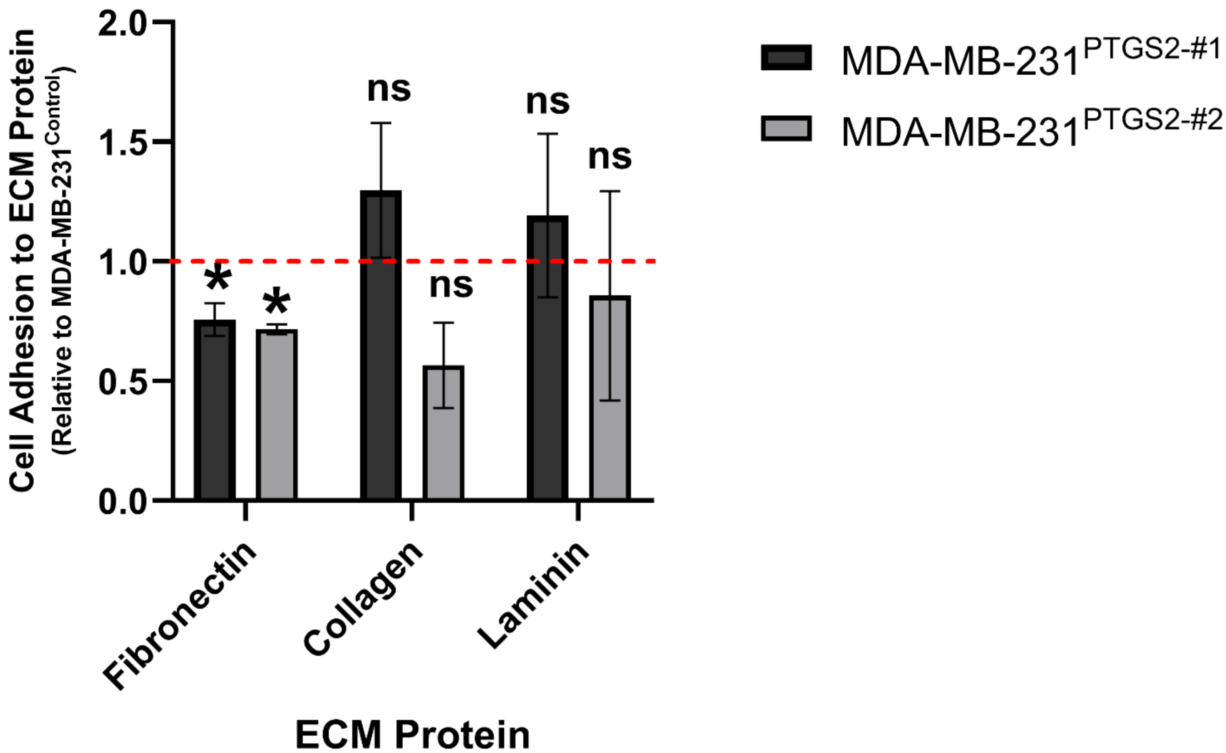

Figure 10. Cell adhesion to fibronectin, collagen and laminin assay with PTGS2 overexpressing cells and MDA-MB-231^{Control}. Relative to MDA-MB-231^{Control}, both PTGS2 overexpressing cells demonstrated a significant decrease in cell adhesion to wells coated with fibronectin ($p<0.05$, n=3). However, there was a relatively high amount of variation in wells coated with collagen or laminin, with only MDA-MB-231$^{PTGS2\text{-}\#2}$ having significantly affected binding to collagen ($p<0.05$, n=3). Error bars are shown as ± the standard error of the means (SEM).

3.3.5 Soft Agar Colony Formation Assay

Since anchorage-independent growth is a hallmark of cancer cell transformation and a predictor of metastatic potential, assessing its changes in PTGS2 overexpressing cells was crucial to understanding how PTGS2 influences malignancy. Anchorage-independent growth was significantly increased in PTGS2 overexpressing cells (n=3, $p<0.05$; Figure 11). This indicates that PTGS2 may promote more aggressive cancer phenotypes associated with enhanced survival and proliferation in detached environments.

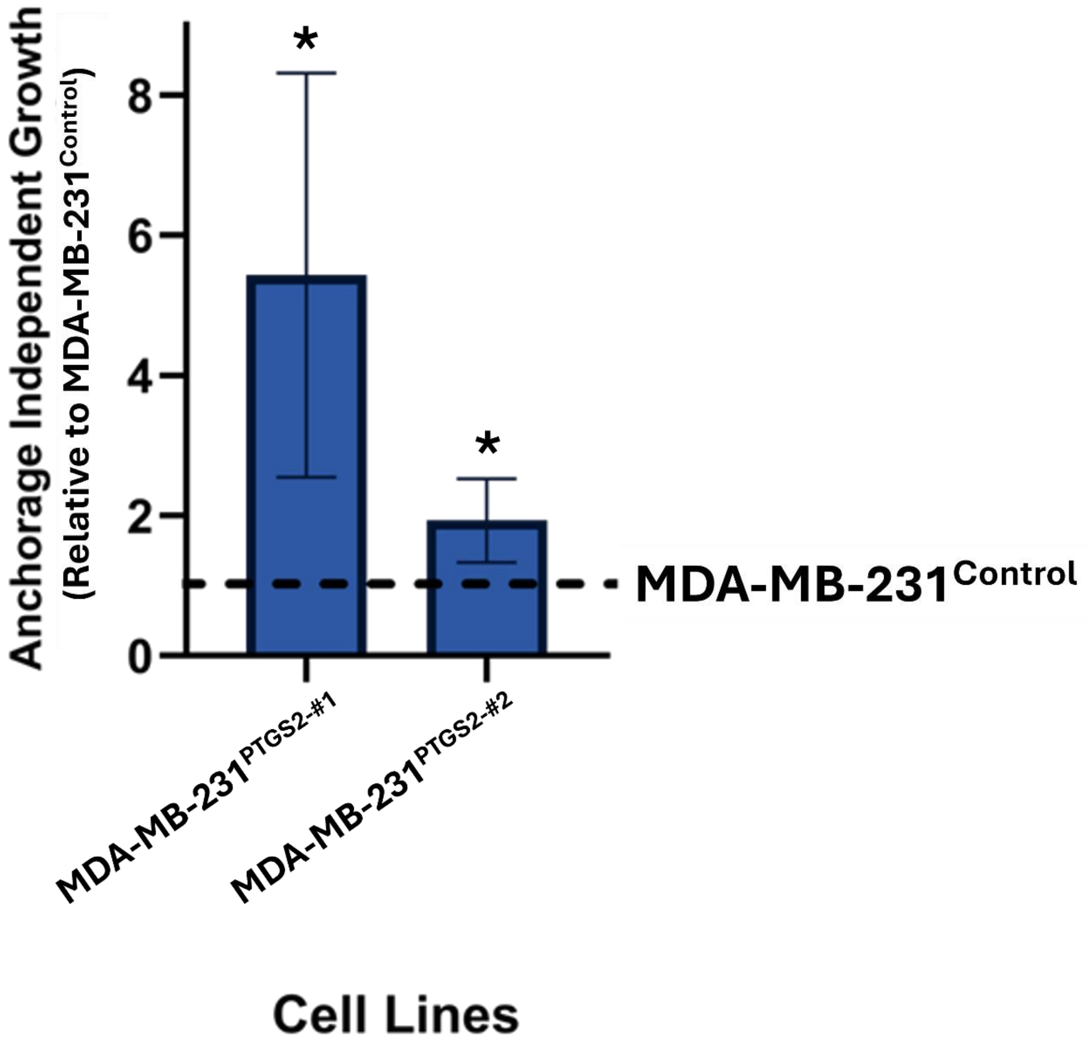

Figure 11. Soft agar colony formation assay between PTGS2 overexpressing cells and MDA-MB-231$^{\text{Control}}$. MDA-MB-231$^{\text{PTGS2-\#1}}$ and MDA-MB-231$^{\text{PTGS2-\#2}}$ both demonstrated a significant increase in anchorage independent growth relative to MDA-MB-231$^{\text{Control}}$ ($p<0.05$, $n=3$). Error bars are shown as ± the standard error of the means (SEM).

Together, these results suggest that *PTGS2* overexpressing cells may have been more prone to detachment from their original colonies during the survival assay, particularly during media changes. To address this, the clonogenic survival assay was repeated using soft agar to prevent cell displacement from their colony of origin. However, no significant differences were observed between the *PTGS2* overexpressing cells and the MDA-MB-231$^{\text{Control}}$ cells (figure 12).

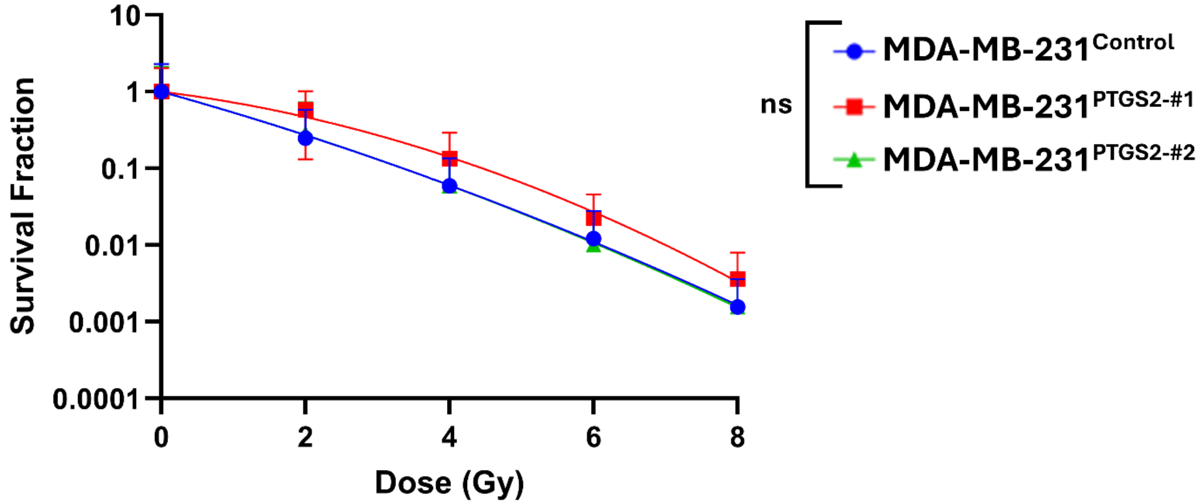

Figure 12. Soft agar colony formation assay post-irradiation at 0 (sham), 2, 4, 6, and 8 Gy with PTGS2 overexpressing cells and MDA-MB-231^{Control}. There were no significant changes in survival between the PTGS2 overexpressing cells compared to MDA-MB-231^{Control} ($p>0.05$, n=3). Error bars are shown as ± the standard error of the means (SEM).

3.3.6 Prostaglandin signaling system, EMT and ECM Gene Profiling by RT-qPCR

To further investigate how *PTGS2* overexpression influences cancer progression and resistance, gene profiling was conducted using RT-qPCR to examine the expression of genes involved in epithelial-mesenchymal transition (EMT), adhesion, and prostaglandin signaling. Previous results with the radioresistant variants of MDA-MB-231 cells and the literature seemed to implicate PGE2 as likely to contribute to radioresistance due to the downstream effect of binding to PTGER1-4. However, the survival assay post irradiation showed decreased radioresistance and the soft agar colony formation assay post irradiation showed no change, so the expression of a PGE2 synthase and receptor (PTGES and PTGER4) were investigated. The expression of PTGES was not significantly affected, and PTGER4 expression appeared to be downregulated but it was only significantly downregulated in MDA-MB-231$^{PTGS2\text{-}\#2}$ (figure 13).

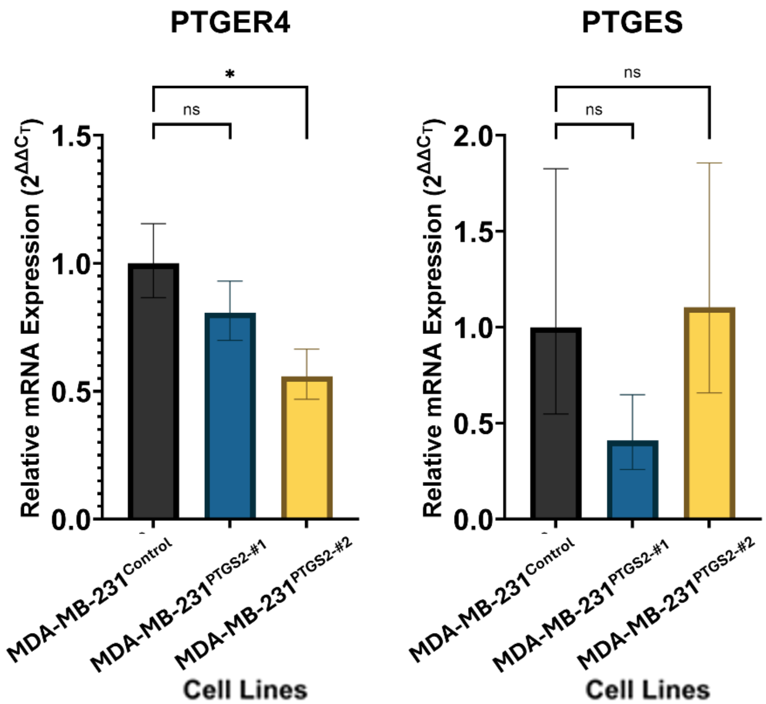

Figure 13. RT-qPCR of selected genes involved in the prostaglandin signaling system in PTGS2 overexpressing cells. These genes are involved in the production and reception of PGE2. * ($0.05 > p \geq 0.01$), ** ($0.01 > p \geq 0.001$), *** ($0.001 > p \geq 0.0001$), and **** ($p < 0.0001$) are used to denote statistically significant differences in mRNA expression from MDA-MB-$231^{Control}$. Error bars are shown as ± the standard error of the means (SEM).

Of the ECM and cell adhesion genes, only three genes were differentially expressed in the same direction for both PTGS2 overexpressing cell lines: LAMB1, COL4A1, and ITGA6 (figure 14). LAMB1 (n=3, and p<0.0001 for both MDA-MB-231^{PTGS2}) and COL4A1 (n=3, p<0.01 and p<0.05 for MDA-MB-$231^{PTGS2\text{-}\#1}$ and MDA-MB-$231^{PTGS2\text{-}\#2}$ respectively) were significantly decreased, while ITGA6 (n=3, p<0.001 and p<0.0001 for MDA-MB-$231^{PTGS2\text{-}\#1}$ and MDA-MB-$231^{PTGS2\text{-}\#2}$ respectively) was significantly increased. TNC was differentially expressed in both PTGS2 overexpressing cell lines as well, however it was upregulated in MDA-MB-$231^{PTGS2\text{-}\#1}$ and downregulated in MDA-MB-$231^{PTGS2\text{-}\#2}$, which may indicate an off-target effect for one of the gRNA used in the CRISPRa system. No significant change was observed in CDKN1A expression, which may indicate that the cell cycle is not behaving abnormally. Out of the 10 ECM genes tested, 8 showed no significant differential expression. Similarly, none of the 9 EMT related genes were significantly differentially expressed in both PTGS2 overexpressing cell lines (figure 15). Together, this demonstrated that PTGS2 expression may influence ECM composition and binding, but is not likely to impact EMT.

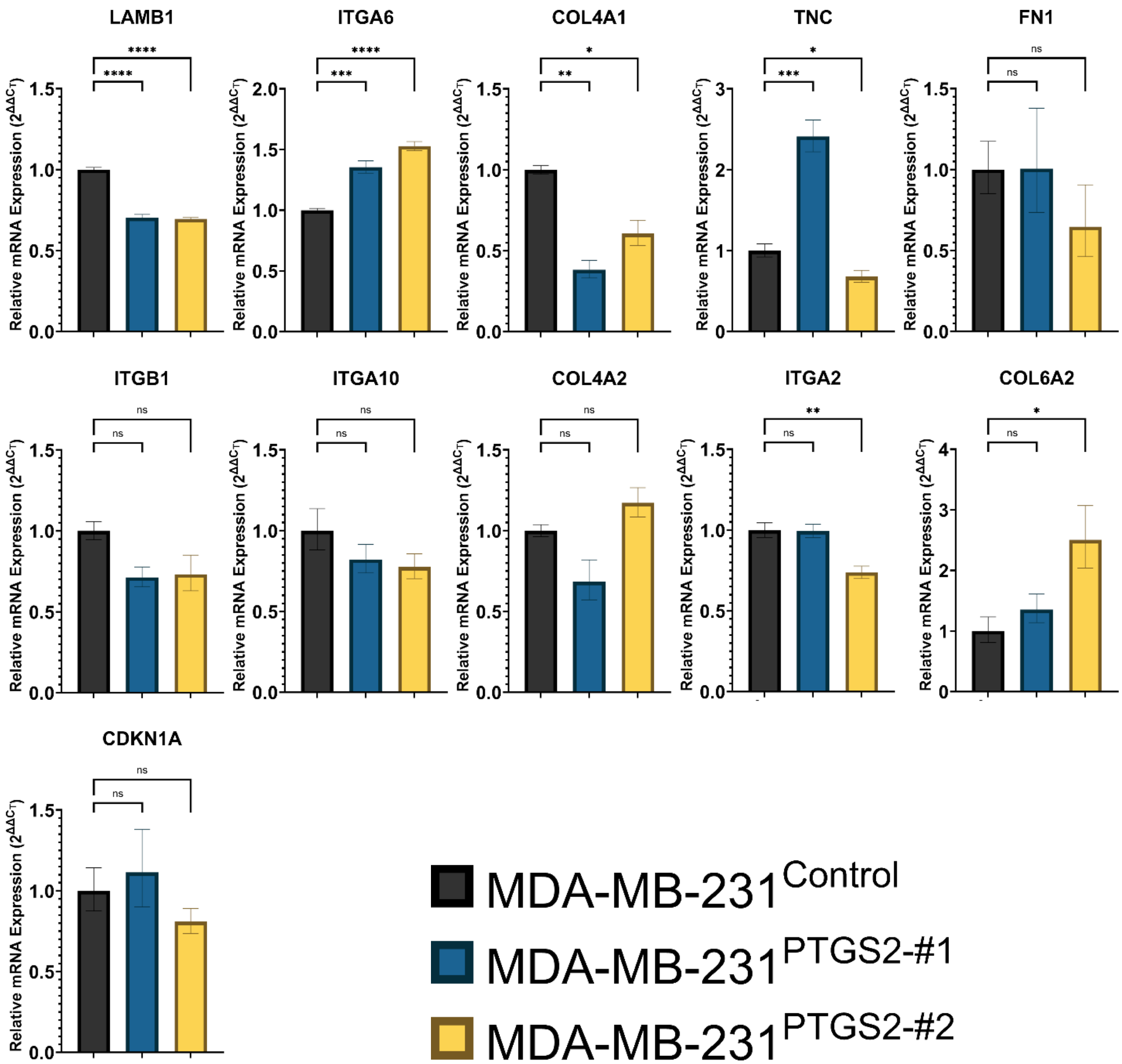

Figure 14. RT-qPCR of selected genes involved in ECM binding and cell adhesion (FN1, ITGB1, LAMB1, ITGA10, COL4A2, COL4A1, ITGA2, ITGA6, COL6A2, TNC) and one gene associated with cell cycle arrest (CDKN1A) in PTGS2 overexpressing cells. * (0.05>p>0.01), ** (0.01>p>0.001), *** (0.001>p>0.0001), and **** (p<0.0001) are used to denote statistically significant differences in mRNA expression from MDA-MB-231^{Control}. LAMB1, ITGA6, and COL4A1 were the only genes that showed a significant change in expression in the PTGS2 overexpressing cells. Error bars are shown as ± the standard error of the means (SEM).

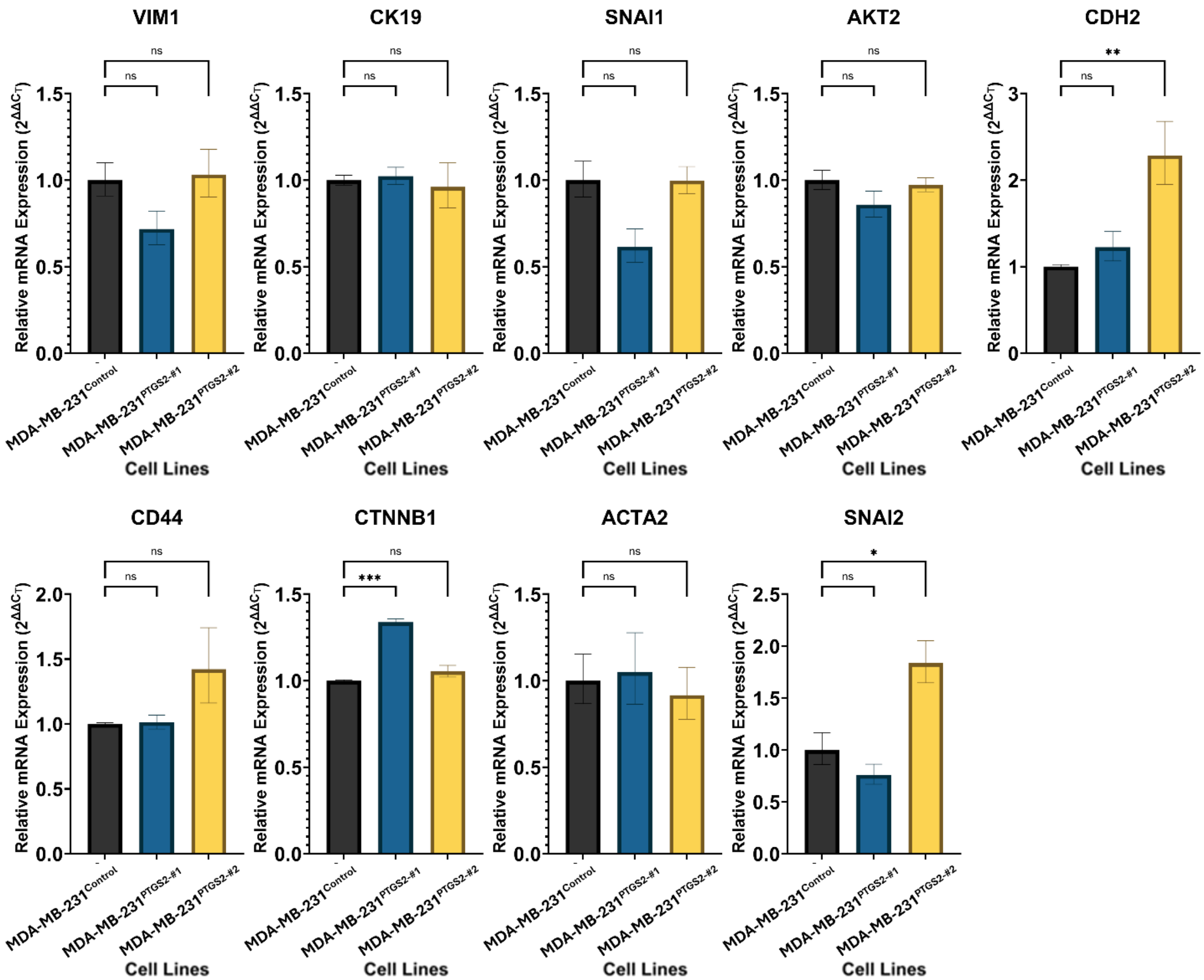

Figure 15. RT-qPCR results of selected genes associated with an EMT phenotype (VIM1, CK19, SNAI1, AKT2, CDH2, CD44, CTNNB1, ACTA2, SNAI2) in PTGS2 overexpressing cells. * (0.05>p0.01), ** (0.01>p0.001), *** (0.001>p0.0001), and **** (p<0.0001) are used to denote statistically significant differences in mRNA expression from MDA-MB-231^{Control}. Error bars are shown as ± the standard error of the means (SEM).

3.3.7 Whole transcriptome profiling of MDA-MB-231^{PTGS2}

RNA-seq analysis was performed on the *PTGS2* overexpressing cells to gain a comprehensive understanding of the broader transcriptional changes associated with *PTGS2* transcriptional upregulation. This approach allows for the identification of potential pathways and gene networks involved in cancer progression, adhesion, and radiation resistance, providing deeper insights into the molecular mechanisms driven by *PTGS2* dysregulation. In total 3161 genes were significantly differentially expressed, with 1396 upregulated genes and 1765 downregulated genes (appendix table A3). Within the prostaglandin pathway, PTGS2 was overexpressed 3.91 fold (p_{adj}=7.67E-02), resulting in differential expression in PTGES (1.75 fold, p_{adj}=8.40E-10), PTGER4 (0.53 fold, p_{adj}=4.00E-06), PTGER2 (0.32 fold, p_{adj}=1.82E-02), and PTGR2 (0.42 fold, p_{adj}=2.46E-02). Additionally, some other genes closely involved in prostaglandin signaling were differentially expressed, such as solute carrier organic anion transporter family member 4A1 (SLCO4A1; 4.48 fold, p_{adj}=3.11E-51), aldo-keto reductase family 1 member B1 (AKR1B1; 2.17 fold, p_{adj}=6.35E-23), aldo-keto reductase family 1 member A1 (AKR1A1; 1.65 fold, p_{adj}=9.02E-07), AKR1C3 (1.70 fold, p_{adj}=1.39E-03), and ATP binding cassette subfamily C member 3 (ABCC3; 2.11 fold, p_{adj}=1.50E-10). The top 10 most significantly differentially expressed Reactome pathways are reported in table 4. Particularly of note are the downregulation of Hippo signaling, and the dysregulation of apoptosis. Biological processes, cellular components and molecular functions were also examined; the top 10 of each are summarized in table 5, while table 6 includes a more extensive breakdown of the biological processes. Some important biological processes to note include DNA damage, which showed upregulation in 20 genes and downregulation in 60, as well as apoptosis, which had 64 downregulated genes and 51 upregulated genes. The cellular components affected were most significantly associated with the cytosol and nucleus, however membrane associated genes and focal adhesion were also among the most significantly influenced. Among the top 10 most significantly dysregulated molecular functions, protein kinases appear in three slots. In addition, binding to protein, ATP, metal ions, actin, and cadherin also were affected with PTGS2 overexpression. Taken together, the RNA-seq findings reveal that *PTGS2* overexpression induces widespread transcriptional changes, particularly within the prostaglandin pathway and processes related to DNA damage, apoptosis, and cellular adhesion, highlighting its potential role in cancer progression and radiation resistance.

Table 4. Top 10 Reactome Pathways as determined by the PANTHER Overrepresentation Test.

Pathway (ID)	p (adj) for FDR	Upregulated DEGs	Downregulated DEGs
Coenzyme A biosynthesis	4.81E-02	*PPCS* *DCAKD* *PPCDC*	*PPAT* *PANK3*
Glutamate and glutamine metabolism	4.99E-02	*AC145207.5* *RIMKLA* *KYAT1*	*RIMKLB* *GLS* *OAT*
Signaling by Hippo	1.08E-02		*SAV1* *STK4* *CASP3* *MOB1A* *WWC1* *LATS2* *LATS1* *TJP1* *WWTR1*
ERK/MAPK targets	9.96E-03	*MEF2C* *RPS6KA2* *DUSP6* *RPS6KA1* *DUSP4*	*MAPK1* *MAPK14* *PPP2R1B* *PPP2CA* *MEF2A* *RPS6KA5*
Termination of translesion DNA synthesis	2.69E-03	*POLE* *POLD4* *RPA3* *POLD1* *RFC2* *AP001324.1* *UBE2L6* *ISG15*	*POLD3* *RFC3* *RFC1* *USP43* *USP10* *POLI* *POLK* *TRIM25* *AL161891.1*
BMAL1:CLOCK,NPAS2 activates circadian gene expression	4.62E-02	*DBP* *NPAS2* *HELZ2* *BHLHE40* *RXRA*	*CLOCK* *CHD9* *MED1* *NOCT* *NCOA2* *KLF15*
Thrombin signalling through proteinase activated receptors (PARs)	4.62E-02	*F2RL3* *ARRB2* *GNB2* *GNG11*	*MAPK1* *GNAQ* *AL031282.2* *GNG12* *GNA13* *GNB4* *THRB* *F2RL2*
Presynaptic phase of homologous DNA pairing and strand exchange	4.64E-02	*RAD51B* *RPA3* *RFC2* *HUS1*	*EXO1* *CHEK1* *TOPBP1* *RFC3* *DNA2* *RAD50* *MRE11* *ATR* *WRN* *BRIP1* *BACH1* *AL161891.1*

Intrinsic Pathway for Apoptosis	3.02E-02	*BAD* *CASP9* *SFN* *APAF1* *AL049840.5* *DIABLO* *GSDME* *GSDMD*	*CASP3* *BCL2* *UACA* *MAPK1* *DLC1* *MAPK8* *AKT3* *AL442125.1* *AC016397.2* *STAT3* *BMF*
Transcriptional activity of SMAD2/SMAD3:SMAD4 heterotrimer	4.19E-02	*HDAC1* *TRAC* *NCOR2*	*WWTR1* *SKIL* *EP300* *MYC* *MAPK1* *USP9X* *RBL1* *TRIM33* *SMURF2* *CCNT1* *CCNT2* *SMAD4* *AL442125.1* *NEDD4L*

Table 5. Top 10 significant biological processes, cellular components, and molecular functions of PTGS2 overexpressing cells relative to MDA-MB-231^{Control} as determined by DAVID Functional Annotation for gene ontology.

Biological Process	p (adj) for FDR	Count	Downregulated	Upregulated
DNA damage response	3.90E-05	80	60	20
protein phosphorylation	6.72E-04	87	64	23
phosphorylation	1.51E-03	129	96	33
axon guidance	3.77E-02	51	33	18
negative regulation of transcription by RNA polymerase II	3.77E-02	174	101	73
positive regulation of translation	3.77E-02	26	18	8
peptidyl-serine phosphorylation	3.77E-02	41	34	7
apoptotic process	3.78E-02	115	64	51
ventricular septum morphogenesis	4.47E-02	16	11	5
microtubule cytoskeleton organization	4.64E-02	39	28	11
Cellular Component	p (adj) for FDR	Count	Downregulated	Upregulated
cytosol	7.14E-44	1074	646	428
cytoplasm	1.61E-25	1011	626	385
nucleoplasm	6.67E-20	730	468	262
nucleus	1.51E-09	978	604	374
Golgi apparatus	6.76E-07	215	135	80
focal adhesion	8.49E-07	103	57	46
perinuclear region of cytoplasm	1.24E-06	158	96	62
membrane	4.65E-06	789	449	340
centrosome	3.20E-04	132	96	36
mitochondrion	3.20E-04	258	111	147
Molecular Function	p (adj) for FDR	Count	Downregulated	Upregulated

protein binding	1.44E-33	2091	1183	908
ATP binding	5.85E-06	297	213	84
protein kinase activity	1.92E-05	74	58	16
metal ion binding	1.82E-04	486	299	187
protein serine kinase activity	2.25E-04	88	67	21
protein serine/threonine kinase activity	3.48E-04	90	69	21
actin binding	1.53E-03	70	45	25
cadherin binding	2.31E-03	78	49	29
ATP-dependent chromatin remodeler activity	5.44E-03	16	15	1
small GTPase binding	9.12E-03	68	49	19

Table 6. Top 10 significant biological processes of PTGS2 overexpressing cells relative to MDA-MB-231^{Control} as determined by DAVID Functional Annotation for gene ontology.

Pathway (ID)	p (adj) for FDR	Upregulated DEGs		Downregulated DEGs		
DNA damage response	3.90E-05	*HUS1*	*IRF3*	*SMG1*	*MCM10*	*CCND1*
		PAXX	*CENPS*	*UBA6*	*POLK*	*ACER2*
		CIB1	*NSMCE1*	*ZBTB1*	*NFAT5*	*SMC5*
		PLK3	*OARD1*	*BCLAF1*	*NEDD4*	*BCL2*
		GNL1	*IER3*	*ZBTB38*	*PIAS1*	*WRN*
		BRAT1	*ZC3H12A*	*SMC6*	*CIP2A*	*UFL1*
		CASP9	*DDB2*	*MAPK1*	*APLF*	*RNF169*
		IKBKG	*NPAS2*	*SHPRH*	*RAD18*	*CLOCK*
		ALKBH7	*BCL3*	*RIF1*	*SETX*	*ATR MRE11*
		FANCG	*APC*	*WAC*	*MCM8*	*NFATC2*
				RAD50	*SLF2*	*PPP4R3B*
				STXBP4	*BOD1L1*	*TAOK3*
				DYRK2	*USP47*	*MASTL*
				SIRT1	*KIN*	*VCPIP1*
				USP10	*PRKDC*	*TIGAR*
				FBH1	*CHD2*	*NIPBL*
				TOPBP1	*SUSD6*	*CHEK1*
				CASP3	*MTREX*	*FBXW7*
				RBM24	*PPP1R15A*	*MYC*
				NKX3-1	*ZMAT3*	
protein phosphorylation	0.000672	*PRAG1*	*FASTK*	*PRKAA1*	*EPHA5*	*PRKG2*
		DMPK	*PINK1*	*WNK4*	*DCLK1*	*ABL2*
		PASK	*PLK3*	*NUAK2*	*TXK*	*PEAK1*
		PICK1	*TESK2*	*NEK10*	*IRAK3*	*ADAM10*
		RPS6KA1	*MAP3K6*	*CDK12*	*FER*	*STK26*
		LTK	*CDC42BPG*	*CDC42BPA*	*PKN2*	*MAPK1*
		CDK5	*MAST1*	*PRKAA2*	*NEK7*	*AKT3*
		RIPK4	*LIMK1*	*MORC3*	*RPS6KA5*	*ROCK2*
		ADM2	*PRRT1*	*STK38L*	*CAMK4*	*BMPR1B*
		TGFBR2	*LMTK3*	*COPS2*	*LATS1*	*LATS2*
		FAM20C	*PDK3*	*FNIP2*	*PRKCI*	*WNK1*
		EPHB3		*PPP4R1*	*CDKL5*	*TAOK3*

			WNK3 DYRK2 GRK3 HIPK3 CAMK2D NEK1 PRKCZ ROCK1 MAP4K3 INSR PLK4 SNRK MAPK8 PRKDC STK4 GMFB YES1 TEC CHUK NEK2 CHEK1 LRRK1 MAP3K21 MAP3K1 EIF2AK4 CREB1 LIPE CSNK2A3
phosphorylation	0.00151	*FASTK DMPK OBSL1 EPHA2 CHKB PASK PLK3 MAP2K2 EPHB4 PMVK PICK1 STK16 TESK2 RPS6KA1 STK11IP DTYMK PPM1F CDK5 CKB IKBKG RIPK4 MAP2K6 LIMK1 NME1- NME2 SPEG TGFBR2 NME3 LMTK3 ITPKA RPS6KA2 CERKL PDGFRB PIK3C2B*	*PIK3CG SMG1 COQ8B PRKAA1 CMPK1 EPHA5 STAT3 PRKG2 DCLK1 MET SGMS2 PRPS2 NRK NUAK2 TXK MAPK14 IRAK3 CDK12 KSR1 FER STK26 PRKAR2B CDC42BPA RPS6KL1 AK9 PKN2 PANK3 GK5 KDRMAPK1 PRKAA2 EGFR BMP2K PIK3CA NEK7 DGKE IRAK4 CDC7 KIDINS220 AKT3 CASK TRPM7 PAPSS2 MAP3K3 PIP4K2A ATR RPS6KA5 RYK ROCK2 CAMK4 BMPR1B PRKCI WNK1 GK CDKL5 TAOK3 MASTL TTBK2 GRK3 RPS6KB1 BUB1B PIKFYVE CAMK2D NEK1 ETNK1 TAB2 PRKCZ ROCK1 MAP4K3 CNKSR2 INSR PLK4 SNRK MAPK8 PRKDC NOL9 STK4 CSNK1G3 YES1 TEC NEK2 IPMK NADK2 EPS8 CHEK1 LRRK1 WSB1 EIF2AK4 PI4K2B CDK5R1 PPIP5K2 PIK3C3 RFK MAPKBP1 CSNK2A3 LIMD1*
axon guidance	0.0377	*LYPLA2 EPHA2 EPHB4 KLF7 SCN1B ETV1 FEZF1 EFNA4 SEMA4C PLXNA3 ARHGEF40 SEMA4D ARTN PAPLN NRCAM ARHGEF25 EPHB3 PLEKHG4B*	*GLI3 NOTCH2NLCRELN MATN2 SEMA3F SEMA6C CYFIP2 SEMA3E EPHA5 GATA3 SLIT2 EMB DSCAM NOTCH2NLASEMA3A NEXN SMAD4 SEMA3C ENAH SLC7A11 RPS6KA5 RYK KIF5B NOTCH2 PTPRS NRP2 MYCBP2 NOTCH1 APBB2 IGDCC4 PALLD CDK5R1 CDH4*

negative regulation of transcription by RNA polymerase II	0.0377	*CBX7 ZSCAN18 KLF10 FOXP4 DMAP1 SFN HES2 MAGED1 IRF3 IRF2BPL TADA3 NCOR2 PLK3 SUFU RXRA HDAC1 ENO1 TSC22D4 DRAP1 MAGED2 HSPA1A MDM2 NKX3-2 KLF7 MAD2L2 BMP4 NELFE CCND3 WWP2 GTF2IRD1 CXXC5 WDTC1 BHLHE40 EHMT2 FEZF1 JDP2 HEXIM2 UXT ZBTB25 VEGFA KLF2 HES1 SP5 EGR1 ZBTB42 OSR1 NPAS1 SEMA4D BIN1 NR1H3 ZNF219 ZBTB17 DAB2IP RPL10 SOX4 MAGED4B CREB3L1 MLXIPL ID3 ID1 ID4 ID2 HSF4 FOXQ1 ZFPM1 NOTCH4 NFATC4 SPDEF MEF2C MDFI PARP15 PCBP3 AR*	*GLI3 NOTCH2NLCRB1 ZNF148 TFCP2L1 NKX2-5 WWTR1 STAT3 PARP9 BACH1 CCND1 PDE2A HDAC9 GATA3 USP9X BMP6 NSD1 NRIP1 THRB IMPACT ZBTB1 SIM2 WWC2 ATF7IP SUV39H2 TCERG1 NCOA2 ZEB1 FNIP1 AASS NEDD4 MCPH1 RLIM BMI1 FST ZBTB21 PIAS1 SMAD4 SMAD5 DLG1 NFKB1 DKK1 ZBTB10 CREBRF ZFPM2 RIF1 MORC3 CTBP2 COPS2 HCFC2 NFATC2 FNIP2 ZBTB33 FOXO3 ARID5B TPR DNAJB4 MIER1 NOTCH2 DNMT3B NR1D2 ZEB2 SIRT1 NR3C1 RBPJ KDM5A MEF2A NR2F2 MED1 AEBP2 CDC73 WWC1 BRMS1L ZNF141 EP300 SMURF2 ZNF281 CRY1 ZBTB26 SKIL RFC1 NIPBL CTR9 TCF7L2 NOTCH1 KLF11 APBB2 SUZ12 ZBTB6 TRIM33 ARID4A TRIM37 SNW1 OGTMYC CNOT2 MYNN MIER3 RBL1 NKX3-1 KLF5*
positive regulation of translation	0.0377	*EIF3C PINK1 MIF4GD NSUN5 PASK CYP1B1 BCL3 SOX4*	*FMR1 PRR16 LARP4B LARP4 METTL14 DDX3X SAMD4A YTHDF3 OTUD6B RPS6KB1 PRKDC GUF1 TENT5B ZCCHC4 OGTITGA2 MYC FXR1*
peptidyl-serine phosphorylation	0.0377	*DMPK PINK1 RPS6KA1 CDK5 MAST1 RPS6KA2 PDK3*	*SMG1 MAPK14 RICTOR UHMK1 PKN2 MAPK1 NEK7 CDC7 AKT3 ATR MORC3 RPS6KA5 STK38L CAMK4 LATS1 LATS2 PRKCI WNK1 DYRK2 MASTL TTBK2 RPS6KB1 HIPK3 CAMK2D*

			PRKCZ ROCK1 MAPK8 PRKDC STK4 CSNK1G3 CHUK PRKX CDK5R1 CSNK2A3
apoptotic process	0.0378	*STEAP3 PML IRF3 DIABLO IFI6 MRPL41 PHLDA2 CIB1 MUL1 TMEM219 TNFRSF12A MIEN1 IFI27L1 PLK3 TMEM102 SHB EMP3 RASSF7 MDM2 TMEM14A IER3 BRAT1 BCL7B PPIA APAF1 ZC3H12A MTCH1 RNF34 TRADD LGALS1 CASP9 TRIM69 BCAP31 UXT VEGFA BAD PEG10 IKBKG PLEKHF1 MAP2K6 TGFBR2 APLP1 NME3 IFI27L2 GPER1 ITGB2 PCSK9 DDIT4 PYCARD NOX5 MEF2C*	*NOTCH2NLC CTSS ARHGEF6 ALDH1A3 BMF CYFIP2 ITCH KMT2A SRGN TRAF3 NLRP1 NUAK2 HIP1 MAPK14 CTSC DRAM1 STK26 BCLAF1 BCL2 TIA1PKN2 TRAF5 RNF152 KCNJ8 MAPK1 GLRX2 API5 NFKB1 OPA1 CCAR1 MINDY3 MECOM CASP4 CKAP2 CD2AP NOTCH2 HELLS TRIM39 NR3C1 G2E3 RPS6KB1 BUB1B MEF2A HIPK3 DDIAS EP300 DLC1 STK4 RABEP1 DPP8 KLF11 PDCD4 CHEK1 CASP3 TNFRSF10DFEM1B RASSF5 SAV1 RFK PPP1R15A OGT NKX3-1 FXR1 ZMAT3*
ventricular septum morphogenesis	0.0447	*FGFRL1 HES1 TGFBR2 SOX4 ZFPM1*	*NOS3 NKX2-5 SLIT2 TGFB2 SMAD4 ZFPM2 RBPJ NOTCH1 ROBO1 SAV1 TGFBR3*
microtubule cytoskeleton organization	0.0464	*OBSL1 CCDC8 GABARAP CDK5 SPATA7 CUL9 UXT TUBA4A EML3 ATAT1 TOGARAM2*	*SPAST FER TTLL7 ATXN7 KIF2A HAUS6 CGN DDX21 CAMSAP2 MAP7D3 GAS2L3 FIGN SON DOCK7 PPP2R3C PHLDB2 TTBK2 RNF19A PRKCZ TTLL5 DYNC1LI2 TBCEL CLASP2 PAFAH1B1 CDK5R1 PARD3B EML4 CDC14B*

3.4. Discussion

3.4.1 Objectives and summary of results

The overall objective of this experiment was to determine if PTGS2 overexpression leads to an increase in radioresistance. However, contrary to the initial hypothesis, PTGS2 overexpressing cells had lower survival post-irradiation compared to MDA-MB-231^{Control}. In this case, changes in PTGS2 expression alone were not enough to induce radioresistance. RNA sequencing of the PTGS2 overexpressing cells also revealed dysregulation in the genes involved in the intrinsic apoptotic signaling pathway in response to DNA damage, as well as numerous other genes involved in either positively or negatively influencing apoptosis. If the overexpression of PTGS2 somehow influenced the likelihood of the cancerous cells to undergo apoptosis, especially in response to DNA damage, this may explain the observed decrease in survival of the PTGS2 overexpressing cells in the survival assay.

The other objective was to determine the impact of PTGS2 overexpression on cell proliferation, cell adhesion to fibronectin, laminin and collagen, and anchorage independent growth. Elevated PTGS2 expression had no effect on cell proliferation or cell adhesion to laminin and collagen, however it did show decreased adhesion to fibronectin and increased anchorage independent growth. After completing the survival assay, it appeared as though PTGS2 overexpression may have been influencing adhesion, so an adhesion assay and an anchorage-independent growth assay were conducted (soft agar colony formation assay). These seemed to indicate that the PTGS2 overexpressing cells had decreased adhesion to fibronectin, a large variation in adhesion to collagen and laminin, and increased anchorage-independent growth. This is further supported by the RNA sequencing results which demonstrate dysregulation in focal adhesion at the level of the ECM, integrins, and downstream in the PI3K/Akt and mammalian target of rapamycin (mTOR) signaling pathways (see table 5).

3.4.2 The impact of AU-rich element binding proteins

The RT-qPCR and Western blot results clearly demonstrated that the CRISPRa system was delivered and functioned correctly, although there was a slight discrepancy between the relative amounts of mRNA and protein observed. A potential explanation for this discrepancy is the limited supply of AU-rich element-binding proteins (AUBPs). AUBPs control the stability and translation of roughly 8% of all mRNAs by binding to an AU-rich element within the 3'UTR of these mRNA. AUBPs have previously been shown to be involved in inflammatory processes and in the progression of various cancers (Dolicka et al., 2020). There are a variety of AUBPs which are either bound to processing bodies and promote the decay of the mRNA, are bound to stress granules and increase mRNA stability but inhibit translation, or bind to the mRNA alone and increase the stability and translation of the mRNA (Dolicka et al., 2020). In RAW 264.7 macrophages, PTGS2 has been demonstrated to be targeted by a variety of AUBPs, such as Hu-antigen R/ELAV like RNA binding protein 1 (HuR), T-cell-restricted intracellular antigen-1 (TIA1), TIA-1-related protein (TIAR), AU-rich element RNA-binding protein 1/heterogeneous nuclear ribonucleoprotein D (AUF1), CArG-binding factor A (CBF-A), RNA-binding protein 3 (RBM3), heterogeneous nuclear ribonucleoprotein (hnRNP) A3, and hnRNP A2/B1 (Dolicka et al., 2020). mRNA transcript regulation by AUBPs is sometimes cell type-dependent (Dolicka et al., 2020), so while these AUBPs target PTGS2 in macrophages, they may or may not target PTGS2 in breast cancer or MDA-MB-231 cells specifically. Unfortunately, as this is a relatively recent area of study, not much information exists yet on AUBPs for PTGS2 in breast cancer cell types.

One possible mechanism by which cancerous cells can increase PTGS2 expression is by producing hypoxia-inducible factor 1 subunit alpha (HIF1A) proteins, typically in response to hypoxia (Khabar, 2017). Increased production of HIF1A induces the expression of the hypoxia-inducible factor (HIF)-responsive genes, VEGFA, placental growth factor (PIGF), platelet-derived growth factor (PDGF), PTGS2, C-X-C motif chemokine ligand 12, (CXCL12), fibroblast growth factor 2 (FGF2), hepatocyte growth factor (HGF), and transforming growth factor alpha (TGFA; Khabar, 2017). All of these, including HIF1A are AU-rich element-containing mRNAs with their own respective AUBPs (Khabar, 2017). Of these mRNAs, the PTGS2 overexpressing cells only showed increased expression of VEGFA and its family member VEGFB. Increased expression of VEGF family members is capable of triggering increased vascular growth, and sustained tumor growth and maintenance (Khabar, 2017). However, several AUBP exist which target the VEGF mRNA for degradation, such as HuR, polypyrimidine tract-binding protein (PTB), poly(A)-binding protein-interacting protein 2, AUF1, nuclear factor 90 (NF90), ZFP36 ring finger protein like 1 (ZFP36L1), and Tristetraprolin (TTP) (Khabar, 2017). Although the expression of VEGFA and VEGFB were increased by 2.0 and 1.6 fold respectively, increased expression of these AUBPs may limit the amount of VEGF family proteins produced, causing no significant change to be produced in the physiology of the PTGS2 overexpressing cells. Additionally, the RNA sequencing of the radioresistant variants showed decreased HIF1A mRNA expression relative to MDA-MB-231$^{\text{Control}}$, which suggests that HIF1A expression, hypoxia-induced or otherwise, is likely not responsible for the overexpression of PTGS2.

3.4.3 The involvement of platelet activating factor

In osteosarcoma it was demonstrated that knockdown of platelet activating factor acetylhydrolase 1b catalytic subunit 3 (PAFAH1B3) resulted in increased expression of ribosomal protein S6 kinase B1 (RPS6KB1), and downregulation of eukaryotic translation initiation factor 4E binding protein 1 (EIF4EBP1), MYC and PTGS2 (Fan et al., 2021). In the PTGS2 overexpressing cells platelet activating factor acetylhydrolase 1B regulatory subunit 1 (PAFAH1B1), another component of the PAFAH1B complex, was downregulated, and similar to the results of Fan et al. MYC and EIF4EBP1 were also downregulated, although contrary to their results, RPS6KB1 was downregulated as well. RPS6KB1 is involved in mTOR signaling which is influenced downstream from prostaglandin, focal adhesion, and PI3K-Akt signaling so some other mechanism may be decreasing expression within this signaling pathway. MYC on the other hand is a transcription factor for approximately 15% of all expressed genes (Ahmadi et al., 2021). MYC expression influences ribosome biogenesis, mRNA translation, cell-cycle regulation, and stress responses, and as a result its expression impacts proliferation, differentiation, survival, programmed cell death, and immune regulation (Ahmadi et al., 2021). MYC is typically dysregulated in many cancers and is known to induce apoptosis (Ahmadi et al., 2021), so its downregulation in the PTGS2 overexpressing cells may partly explain the cause of the decreased survival post-irradiation demonstrated by the survival assay.

The similarities between the RNA sequencing results and the findings of Fan et al. (2021) seem to indicate that this may be a mechanism by which the cells attempted to decrease PTGS2 expression. In fact, the heterotrimeric complex formed by PAFAH1B1 is also referred to as lipoprotein-associated PLA2 (lp-PLA2) involved in the biosynthesis of platelet-activating factor (PAF) which contributes to prostaglandin signaling (Ashraf & Nookala, 2024). More specifically, PLA2 converts phosphatidylcholine into arachidonic acid and lysophosphatidylcholine (LPC) (Ashraf & Nookala, 2024). LPC is then converted to PAF by lp-PLA2 (Ashraf & Nookala, 2024). Increasing PAF has been shown to increase the liberation of AA from the membrane by PLA2 (Nakashima et al., 1989). The mechanism by which this occurs is somewhat complex. PAF interacts with Gq protein to increase phosphatidylinositol metabolism to produce diacylglycerol (DAG), and inositol triphosphate (IP3). PAF also interacts with Gi-protein to inhibit the conversion of ATP to cAMP by platelet activating factor receptor (PAFR) signaling (Ashraf & Nookala, 2024). The decrease in cAMP inhibits the activity of cAMP-dependent calcium ion pumps resulting in elevated intracellular calcium ion concentrations (Ashraf & Nookala, 2024). The increased calcium concentration along with increased IP3 production indirectly stimulates protein kinase C (PKC), while DAG directly stimulates PKC (Ashraf & Nookala, 2024). This activation of PKC is known to increase arachidonic acid and eicosanoid (prostaglandins and leukotrienes) production, as well as increase phosphorylation of protein tyrosine (Ashraf & Nookala, 2024). The increased calcium concentration also activates PLA2 to further increase AA production (Ashraf & Nookala, 2024).

Given PAFAH1B1 was downregulated in PTGS2 overexpressing cells, this could indicate that PAF production is decreased as well, resulting in lower intracellular calcium concentration, lower AA and eicosanoid (prostaglandins and leukotrienes) production, and less activation of PKC. PLA2 (specifically, PLA2G4A) is also significantly downregulated in the PTGS2 overexpressing cells, which implies an even greater decrease in AA and PAF production than through the effect of PAF alone, although it is unclear what caused this decrease in PLA2 expression. PKC is also involved downstream in facilitating the effect PGE2 binding to PTGER2 and PTGER4 have on cAMP and Wnt signaling pathways. This may explain why RNA sequencing showed fewer transcriptional changes in these pathways for the PTGS2 overexpressing cells than the radioresistant cells.

PAF has also been shown to have a downstream effect on NF-kB signaling, resulting in transcriptional changes in monocyte chemotactic protein-1 (MCP-1, also referred to as C-C motif chemokine ligand 2, CCL2), tumor necrosis factor-alpha (TNF-alpha), and vascular endothelial growth factor (VEGF) (Ashraf & Nookala, 2024). The changes in CCL2 and TNF-alpha were not observed in the PTGS2 overexpressing cells, although four tumor necrosis factor (TNF) receptors were differentially expressed, and both VEGFA and VEGFB were upregulated. However, as previously mentioned, VEGF translation is partially controlled by AUBPs (Khabar, 2017). Without quantifying the amount of VEGF protein produced by the PTGS2 overexpressing cells, it is uncertain whether VEGF is contributing to any of the observed changes.

Additionally, PAF been implicated in gene expression, proliferation, division, differentiation, survival, and cell death via MAPK signaling (Ashraf & Nookala, 2024). Additionally, PAF increases expression of intercellular adhesion molecule (ICAM)-1, vascular cell adhesion molecule (VCAM)-1, and other adhesion molecules (Ashraf & Nookala, 2024), which may partially explain the changes in focal adhesion and anchorage-independent growth observed in the adhesion assay, the soft agar colony formation assay, and the RNA sequencing results. According to the RNA sequencing results, ICAM-1, 2, and 4 were differentially expressed, however VCAM-1 was not detected.

3.4.4 Hippo signaling

The RNA sequencing revealed that numerous genes involved in Hippo signaling were significantly downregulated. Hippo signaling is involved in cell proliferation, differentiation, growth, and apoptosis (Fu et al., 2022). Downregulation of the Hippo pathway typically results in an increase in cell proliferation and tumor progression, as well as a decrease in apoptosis although this occasionally varies by cell line (Fu et al., 2022). This downregulation of Hippo signaling may also lead to a cancer-stem cell (CSC) phenotype with increased anchorage independent growth and increased chemotherapy resistance, primarily through increased drug metabolism and efflux (Fu et al., 2022). Perhaps this could explain the increased survival of PTGS2 overexpressing cells grown in the soft agar colony formation assay. If the downregulation in Hippo signaling were enough to begin this transition to a CSC phenotype, then the resulting anchorage-independent growth would increase the quantity of surviving PTGS2 overexpressing cells relative to MDA-MB-231^{Control}. Additionally, growing the cells in conditions requiring anchorage-independent growth to survive, may have screened for cells with the greatest downregulation of Hippo signaling. This would in turn decrease the likelihood of apoptosis and increase the radioresistance as a result. If this were the case, it may explain the non-significant difference in survival observed between PTGS2 overexpressing cells and MDA-MB-231^{Control} in the soft agar survival assay. Since the RNA sequencing results are the only supporting evidence, more experimentation is necessary to definitively state whether this is the case or not, although it seems like a promising area to explore.

3.4.5 Aldo-keto reductase family 1

Within the prostaglandin signaling pathway of the PTGS2 overexpressing cells, only aldo-keto reductase family 1 member B1 (AKR1B1), and aldo-keto reductase family 1 members C1, C2, and C3 (AKR1C1, AKR1C2, and AKR1C3 respectively) were dysregulated. These have been shown to be involved in hormone dependent cancers, particularly those of the prostate, breast and endometrium (Rižner & Penning, 2014). AKR1C1, AKR1C2, and AKR1C3 expression is often decreased in breast cancer tissues relative to healthy surrounding tissues (Rižner & Penning, 2014). A microarray of 463 invasive breast carcinoma samples demonstrated an upregulation in AKR1C1 and AKR1C3 of 12.3% and 11.1% of the 81 triple negative breast cancer cases respectively (Rižner & Penning, 2014). Overexpression of AKR1C3 in breast tumors relative to the surrounding healthy tissue has been correlated with poor survival (Rižner & Penning, 2014). AKR1C3 directly converts PGH2 into PGF2α, and AKR1C1 and AKR1C2 are able to convert PGE2 into PGF2α as well (Dozier et al., 2008). In the RNA sequencing data for the PTGS2 overexpressing cells, none of the other prostaglandin synthases were significantly differentially expressed. Taken together, this seems to imply that there is less PGE2 and more PGF2α available in the PTGS2 overexpressing cells than in MDA-MB-231^{Control}.

3.4.6 3-series prostaglandin production

Another factor that may be influencing PGE2 production and receptor binding, is the production and reception of the 3-series prostaglandins such as PGE3. The 3-series prostaglandins utilize the same mechanism for production and reception as the 2-series prostaglandins, with the exception of the substrate passing through the pathway (Rahbar et al., 2014). Instead of omega-6 fatty acids like phosphatidylcholine being converted into arachidonic acid by PLA2, this enzyme instead converts omega-3 fatty acids into eicosapentaenoic acid (Rahbar et al., 2014). The 3-series prostaglandins are anti-inflammatory, while the 2-series are pro-inflammatory so any changes in the relative proportions of the two may impact the overall effects produced downstream (Siriwardhana et al., 2012). In fact, the ratio between these two forms of prostaglandins may be impacted in the PTGS2 overexpressing cells since PTGS2 has a higher rate of production for 3-series prostaglandins relative to PTGS1 (Siriwardhana et al., 2012). Additionally, 3-series prostaglandin production competitively inhibits the production of the 3-series prostaglandins (Siriwardhana et al., 2012). Broadly this may be decreasing activity of all 2-series prostaglandins due to the increased inhibition by 3-series prostaglandin production and receptor binding, however the interaction between these two series of prostaglandins is poorly documented, especially in breast cancer.

3.4.7 Concluding statement

Despite the original hypothesis, PTGS2 overexpression in MDA-MB-231 cells was demonstrated here to cause decreased radioresistance. It was proposed that this could be influenced by the expression of AUBPs, increased production of platelet activating factor, downregulated *HIPPO* signaling, conversion of PGH2 and PGE2 to PGF2α by AKR1C1-3, and the production of the anti-inflammatory 3-series prostaglandins. It was also demonstrated that the PTGS2 overexpressing cells had no change in cell proliferation, cell adhesion to collagen and laminin, but had decreased adhesion to fibronectin, and increased anchorage independent growth.

Chapter 4: Concluding Discussion

The radioresistant variants of MDA-MB-231 cells generated demonstrated significant dysregulation in genes responsible for cell signaling and adhesion. Prostaglandin signaling was predicted to be partially responsible and the dysregulation was confirmed at the mRNA level, with PTGS2 being further verified at the protein level. In addition, MDA-MB-231 cells modified to overexpress PTGS2 demonstrated decreased survival post irradiation, which was not present after screening for cells capable of anchorage-independent growth. Additionally, these cells had decreased adhesion to fibronectin, a large variability in adhesion to collagen and laminin, and increased anchorage-independent growth. RNA sequencing and gene ontology suggested that the influence of PGE2 may have been diminished via multiple different mechanisms, while the effect of PGF2 may have been slightly increased due to additional production via the increased expression in AKR1C1 and AKR1C2. These results demonstrated dysregulation throughout apoptosis and the regulation thereof, primarily through dysregulated focal adhesion, PI3K/Akt, hippo, cAMP, MAPK, and Wnt signaling. Together, this work demonstrated that PTGS2 dysregulation may be a viable, druggable target depending on prostaglandin expression in the particular cancer, although further work is necessary to replicate the results in other cell lines, cancers, animal models, and clinical trials. Additionally, future work should focus on increasing or decreasing the effect of individual prostaglandins, or methods of controlling the proportion of all prostaglandins produced to more effectively induce apoptosis in the cancerous cells without unintentionally increasing metastasis, cell proliferation, or any other potentially harmful effects downstream from PGE2 reception.

There were many limitations which future research should address. Firstly, only MDA-MB-231 cells were used to investigate PTGS2 overexpression. Other cell lines or types of cancer or patient tumors present different expression profiles, and likely would exhibit different effects with PTGS2 overexpression or knockdown, so the current thesis should only be taken as a preliminary, explorative study. These findings should be confirmed in other cancers and in vivo to confirm that these results are not specific to MDA-MB-231 cells. Additionally, the overexpression of PTGS2 was roughly two-fold, however a 14-fold increase was observed in the radioresistant variants. This seems to indicate a natural way (perhaps a transcription factor being differentially expressed in response to DNA damage) by which the cells can increase expression to this extent which could be identified and utilized in future experiments to increase PTGS2 overexpression naturally. This method could influence prostaglandin signaling in a way that more accurately replicates the phenotype observed in the radiation resistant cells. Future work should investigate factors which influence the expression of PTGS2 and use these to investigate PTGS2 overexpression or knockdown by a mechanism other than CRISPRa.

Another limitation which may have had an effect on the results was the method by which the cells were passaged. Cell passaging only adhered cells allows for dead cell debris and waste products to be discarded with the PBS wash but may have resulted in the loss of poorly adhered cells or cells presenting an EMT or cancer-stem like phenotype. If the protocol for generating radioresistant variants is repeated in the future, perhaps the spent supernatant should be collected along with the trypsinized cells during passaging and media changes in order to not create a selective bias on the cells.

Future directions should investigate prostaglandins or prostanoids for a more accurate and detailed picture of the dysregulation, which could be done using a microarray, ELISAs, or metabolomics. Any prostaglandin dysregulation which increases the likelihood of apoptosis post irradiation should be investigated, although careful consideration should be given to not increase the likelihood of tumor growth or metastasis as these results have demonstrated decreased adhesion and increased anchorage independent growth as well as dysregulation in genes commonly associated with changes in cell proliferation despite the fact that this was not observed here. Additional work could aim to knockdown PTGER or PTGES expression, or overexpress 15-PGDH, or PTGR2 to decrease the effect of PGE2 on the cancerous cells. PGE2 seems to be studied much more extensively than the other prostaglandins, so the other prostaglandins should also be investigated to prevent any bias in the understanding of the effect of prostaglandin signaling dysregulation. These results suggest decreased adhesion and anchorage-independent growth, so migration, invasion, and wound healing should also be investigated as these could be indicators of protumorigenic activity which would be detrimental to patient outcome. Patient biopsy samples should also be investigated to determine trends in prostaglandin reception in other cancers to determine which cancers are more likely to be treatable with inducing PTGS2 expression, or PTGS2 inhibition by NSAIDs. Additionally, these results would be from a patient sample, in vivo and as such be more clinically relevant than in vitro cell studies such as this one. In particular, NSAID use could present a good opportunity for patient treatment as numerous NSAIDs have been thoroughly researched for the purpose of their anti-inflammatory and pain-relieving properties, so if their safety can be confirmed for cancer treatment, then this could improve patient outcomes as well as relieve some of the pain commonly associated with surgery and chemotherapy. In summary, this thesis underscores the critical role of *PTGS2* in the development of radioresistance and suggests that *PTGS2* and its downstream effectors in the prostaglandin signaling pathway could be valuable therapeutic targets for overcoming treatment resistance in cancers.

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Appendix

Table A1. The RT-qPCR primer sequences that were used. All primer sequences are listed in the 5' to 3' direction.

Prostaglandin genes	Forward primer sequence	Reverse primer sequence
PTGS1	TCTTGCTGTTCCTGCTCCTG	GTCACACTGGTAGCGGTCAA
PTGS2	GAAAACTGCTCAACACCGGAA	GCACTGTGTTTGGAGTGGGT
PTGES	TACGTGGTGGCCATCATCAC	TTCCGGTGGGCCCTGA
PTGER4	GGTCATCTTACTCATTGCCACC	ACGAATACTCGCACCACGAG
CD24	GCTCCTACCCACGCAGATTT	GCCTTGGTGGTGGCATTAGT
Adhesion genes	Forward primer sequence	Reverse primer sequence
FN1	CGGGACTCAATCCAAATGCC	TTCCAGGAACCCTGAACTGT
ITGB1	GCCGCGCGGAAAAGATGAAT	CACAATTTGGCCCTGCTTGTA
LAMB1	TGGTTACTGTTGCACACAACG	TTTTGCTTCAGAGACCATCTTGG
ITGA10	GGACAGAAACCGATCAGGCA	CCAGGTTAAAGGGGGAGCAG
COL4A2	TGCTTCTGGAAGGGCCAATG	GTCAGTCCCACTTAGCCTCG
COL4A1	TTTCGACTTGCGGCTCAAAG	TCAATCCTACAGAACCCGGC
ITGA2	TTAGCGCTCAGTCAAGGCAT	TGCACTGCATAGCCAAACTG
ITGA6	GCAGCCTTCAACTTGGACAC	ACGAGCAACAGCCGCTT
COL6A2	CCTGCCAAACAGAGCTGTCC	GTGGAAGTTCTGCTCACCCA
TNC	TCTCGCCCATCGGAAAGAAAA	GGCTCTAGGGCTCTAGGGTAT
Cell cycle arrest genes	Forward primer sequence	Reverse primer sequence
CDKN1A	TGTTTTCAGGTGAGGAAGGGG	TGCTTGTCATCCTTTATTTCTGG
EMT genes	Forward primer sequence	Reverse primer sequence
VIM1	TCCGCACATTCGAGCAAAGA	AACTTACAGCTGGGCCATCG
CK19	GGGCAACGAGAAGCTAACCA	GGTACCAGTCGCGGATCTTC
SNAI1	GTTTACCTTCCAGCAGCCCT	TCCCAGATGAGCATTGGCAG
AKT2	TGCAGAGATTGTCTCGGCTC	CCGTCACTGATGCCCTCTTT
CDH2	TGGATGAAAGACCCATCCACG	CAGGGAGTCATATGGTGGAGC
CD44	GCACAGACAGAATCCCTGCT	TCTTGCCTCTTGGTTGCTGT
CTNNB1	AATCAGCTGGCCTGGTTTGA	GCTTGGTTAGTGTGTCAGGC
ACTA2	GAGGGAAGGTCCTAACAGCC	TAGTCCCGGGGATAGGCAAA
SNAI2	GGACCACAGTGGCTCAGAAA	CTTCAATGGCATGGGGGTCT
Housekeeping genes	Forward primer sequence	Reverse primer sequence
TUBA1B	AGGCCCGTGAAGATATGGCT	AGCTGAAATTCTGGGAGCATGA
ATP5F1B	TGTCGATCTGCTAGCTCCCT	ACAGAGTAACCACCATGGGC
HSPD1	CGCCGCCGACGACCT	GTGGGTAACCGAAGCATTTCTGC

Table A2. Genes that were differentially expressed in the radioresistant variants of MDA-MB-231 cells relative to typical MDA-MB-231 cells.

Gene ID	Gene	Fold change	p_{adj}	Control; Mean transcript counts per million	RR; Mean transcript counts per million
ENSG00000198959.12	*TGM2*	-9.49	0.00E+00	5051	532
ENSG00000175130.7	*MARCKSL1*	-4.89	0.00E+00	2029	415
ENSG00000198804.2	*MT-CO1*	-3.02	0.00E+00	131546	43624
ENSG00000152234.16	*ATP5F1A*	-2.89	0.00E+00	9565	3315
ENSG00000147065.17	*MSN*	2.21	0.00E+00	20470	45170
ENSG00000140416.21	*TPM1*	2.93	0.00E+00	1072	3143
ENSG00000109861.16	*CTSC*	3.34	0.00E+00	2232	7458
ENSG00000102024.18	*PLS3*	3.73	0.00E+00	4209	15709
ENSG00000131171.13	*SH3BGRL*	6.12	0.00E+00	359	2195
ENSG00000182195.9	*LDOC1*	6.93	0.00E+00	142	985
ENSG00000198157.11	*HMGN5*	25.48	5.53E-241	27	693
ENSG00000077721.16	*UBE2A*	2.59	1.22E-240	1482	3842
ENSG00000123572.17	*NRK*	19.22	3.80E-240	103	1980
ENSG00000068366.20	*ACSL4*	2.47	7.02E-232	2357	5816
ENSG00000175832.13	*ETV4*	-3.23	2.80E-231	1168	362
ENSG00000011028.14	*MRC2*	-5.44	3.73E-227	794	146
ENSG00000101079.21	*NDRG3*	-3.69	1.48E-223	1165	316
ENSG00000101856.10	*PGRMC1*	2.87	1.45E-222	1183	3390
ENSG00000102241.12	*HTATSF1*	2.31	1.16E-215	1294	2989
ENSG00000104341.17	*LAPTM4B*	-2.27	3.88E-215	2832	1250
ENSG00000188706.13	*ZDHHC9*	2.94	3.11E-214	615	1805
ENSG00000169299.14	*PGM2*	2.34	1.01E-213	1786	4184
ENSG00000101444.13	*AHCY*	-2.20	4.59E-206	4417	2006
ENSG00000123562.17	*MORF4L2*	2.63	4.35E-203	3483	9151
ENSG00000156697.13	*UTP14A*	2.62	1.54E-202	814	2132
ENSG00000198938.2	*MT-CO3*	-2.02	9.26E-202	54972	27207
ENSG00000165704.15	*HPRT1*	2.25	8.10E-201	891	2004
ENSG00000198960.11	*ARMCX6*	4.01	1.68E-199	466	1868
ENSG00000139722.7	*VPS37B*	-2.28	7.10E-199	1815	795
ENSG00000101210.12	*EEF1A2*	-253.50	3.47E-195	1345	5
ENSG00000117525.14	*F3*	3.08	1.11E-193	7231	22304
ENSG00000205542.11	*TMSB4X*	2.47	3.03E-193	27010	66820
ENSG00000134602.16	*STK26*	3.88	1.16E-189	241	934
ENSG00000122126.17	*OCRL*	2.10	2.91E-187	961	2019
ENSG00000105404.11	*RABAC1*	2.65	2.73E-184	636	1688
ENSG00000101190.13	*TCFL5*	2.17	2.07E-183	774	1677
ENSG00000237973.1	*MTCO1P12*	-3.15	2.97E-182	3241	1029

ENSG00000151651.16	*ADAM8*	-4.85	1.45E-181	2159	445
ENSG00000010256.11	*UQCRC1*	-2.45	1.29E-178	3620	1476
ENSG00000148926.10	*ADM*	5.65	5.12E-176	850	4798
ENSG00000182718.16	*ANXA2*	2.09	1.44E-175	19385	40596
ENSG00000131459.13	*GFPT2*	-61.69	8.42E-175	1005	16
ENSG00000181751.10	*C5orf30*	2.83	2.98E-173	398	1126
ENSG00000196821.10	*ILRUN*	-2.25	1.66E-171	2657	1178
ENSG00000075711.21	*DLG1*	2.64	2.37E-168	2409	6357
ENSG00000118705.17	*RPN2*	-2.00	4.49E-166	7335	3662
ENSG00000173530.6	*TNFRSF10D*	3.85	6.06E-165	533	2053
ENSG00000131773.14	*KHDRBS3*	2.59	4.27E-162	738	1916
ENSG00000168952.15	*STXBP6*	108.61	8.45E-162	5	515
ENSG00000144810.16	*COL8A1*	3.92	1.52E-159	1785	6997
ENSG00000185989.11	*RASA3*	-2.53	7.96E-159	1305	515
ENSG00000115414.19	*FN1*	6.65	8.18E-155	5739	38179
ENSG00000099204.20	*ABLIM1*	-3.36	6.42E-154	2385	709
ENSG00000227234.2	*SPANXB1*	5.89	1.43E-153	345	2031
ENSG00000107897.19	*ACBD5*	-2.95	4.23E-153	1001	340
ENSG00000178695.6	*KCTD12*	-2.72	1.41E-152	1171	430
ENSG00000108961.14	*RANGRF*	-6.04	2.15E-152	421	70
ENSG00000134597.16	*RBMX2*	2.87	3.30E-151	332	954
ENSG00000166165.13	*CKB*	-9.18	8.79E-149	2013	219
ENSG00000177485.7	*ZBTB33*	2.84	4.49E-147	373	1057
ENSG00000115756.13	*HPCAL1*	-2.48	1.06E-145	3280	1322
ENSG00000135318.12	*NT5E*	2.04	7.51E-143	9389	19183
ENSG00000134590.14	*RTL8C*	2.65	8.31E-143	883	2336
ENSG00000120217.14	*CD274*	2.43	7.50E-140	641	1555
ENSG00000231991.4	*ANXA2P2*	2.04	8.27E-139	3010	6129
ENSG00000198888.2	*MT-ND1*	-2.25	9.62E-138	29684	13165
ENSG00000127324.9	*TSPAN8*	-35.68	4.17E-137	389	11
ENSG00000184292.7	*TACSTD2*	2.27	1.18E-136	597	1359
ENSG00000175745.14	*NR2F1*	6.58	1.30E-136	197	1296
ENSG00000118508.5	*RAB32*	2.78	8.66E-136	717	1995
ENSG00000115310.18	*RTN4*	2.02	4.10E-135	8819	17807
ENSG00000168785.8	*TSPAN5*	2.09	1.67E-134	1328	2770
ENSG00000204389.10	*HSPA1A*	-4.06	2.94E-134	1335	329
ENSG00000188419.14	*CHM*	2.76	6.24E-133	381	1051
ENSG00000102401.20	*ARMCX3*	2.73	1.78E-131	398	1086
ENSG00000125356.7	*NDUFA1*	2.52	3.87E-131	808	2036
ENSG00000087460.25	*GNAS*	2.10	1.17E-130	3778	7937
ENSG00000008283.16	*CYB561*	-6.29	6.13E-130	1215	193
ENSG00000143198.13	*MGST3*	2.28	2.21E-129	697	1592
ENSG00000166166.13	*TRMT61A*	-2.71	1.65E-128	790	292

ENSG00000005893.15	*LAMP2*	2.32	5.46E-127	1473	3413
ENSG00000089159.16	*PXN*	-2.56	7.74E-127	8949	3495
ENSG00000130005.13	*GAMT*	-2.58	2.07E-126	1109	431
ENSG00000116260.17	*QSOX1*	2.13	9.86E-126	15115	32169
ENSG00000142657.21	*PGD*	-2.04	1.05E-125	3751	1835
ENSG00000184838.15	*PRR16*	6.44	2.28E-121	66	428
ENSG00000005022.6	*SLC25A5*	2.22	3.28E-121	6955	15416
ENSG00000092010.15	*PSME1*	-2.43	4.07E-121	1907	785
ENSG00000069122.19	*ADGRF5*	-15.30	8.34E-120	705	46
ENSG00000062598.18	*ELMO2*	-2.40	1.73E-119	940	392
ENSG00000074211.14	*PPP2R2C*	9.05	4.19E-117	37	332
ENSG00000102144.15	*PGK1*	2.43	1.40E-116	9376	22804
ENSG00000111145.8	*ELK3*	-2.19	9.30E-116	3566	1631
ENSG00000082212.13	*ME2*	-2.20	1.08E-115	1096	499
ENSG00000213853.10	*EMP2*	2.57	2.64E-115	791	2036
ENSG00000166897.15	*ELFN2*	-30.42	1.58E-114	376	12
ENSG00000141753.7	*IGFBP4*	-2.62	3.78E-114	29348	11202
ENSG00000147202.18	*DIAPH2*	3.41	1.16E-113	217	738
ENSG00000115468.12	*EFHD1*	-31.36	1.76E-113	304	10
ENSG00000145817.17	*YIPF5*	2.09	3.61E-113	1064	2222
ENSG00000185860.13	*CCDC190*	5.75	5.32E-113	67	387
ENSG00000120129.6	*DUSP1*	4.58	1.17E-112	559	2559
ENSG00000085117.12	*CD82*	-234.19	1.77E-112	916	4
ENSG00000106683.15	*LIMK1*	-2.03	5.15E-112	1993	982
ENSG00000165996.14	*HACD1*	-3.10	2.59E-111	568	183
ENSG00000226479.4	*TMEM185B*	-2.59	2.80E-110	1027	396
ENSG00000155189.12	*AGPAT5*	2.25	7.00E-110	1166	2624
ENSG00000111275.13	*ALDH2*	-3.08	6.48E-109	1347	438
ENSG00000137200.13	*CMTR1*	-2.11	7.68E-109	1876	889
ENSG00000132688.11	*NES*	-6.68	4.28E-108	449	67
ENSG00000172889.16	*EGFL7*	-7.82	8.36E-108	309	40
ENSG00000196954.14	*CASP4*	2.67	1.17E-106	518	1385
ENSG00000151414.15	*NEK7*	2.03	1.96E-106	2942	5977
ENSG00000197971.15	*MBP*	-6.23	6.66E-106	2160	347
ENSG00000102390.11	*PBDC1*	3.16	1.80E-105	592	1873
ENSG00000204304.12	*PBX2*	-2.40	1.81E-105	1366	569
ENSG00000134775.15	*FHOD3*	-3.74	5.92E-105	647	173
ENSG00000238266.2	*LINC00707*	7.28	6.14E-105	32	235
ENSG00000136167.14	*LCP1*	30.09	1.16E-104	43	1304
ENSG00000170542.6	*SERPINB9*	-6.35	1.07E-103	481	76
ENSG00000049759.18	*NEDD4L*	2.65	1.62E-103	2629	6965
ENSG00000144118.14	*RALB*	-2.24	5.14E-103	1112	496
ENSG00000112343.11	*TRIM38*	-2.27	1.32E-102	789	347

ENSG00000165912.16	*PACSIN3*	-4.96	1.49E-102	901	182
ENSG00000148468.17	*FAM171A1*	-3.01	4.40E-102	1041	346
ENSG00000116717.13	*GADD45A*	2.13	1.38E-101	729	1555
ENSG00000137166.15	*FOXP4*	-2.75	2.11E-101	1597	581
ENSG00000114405.10	*C3orf14*	2.66	4.17E-101	295	787
ENSG00000152518.8	*ZFP36L2*	-2.42	4.49E-100	828	342
ENSG00000155008.14	*APOOL*	2.52	2.16E-99	308	776
ENSG00000198918.8	*RPL39*	2.44	6.13E-99	4499	10981
ENSG00000272398.6	*CD24*	10.13	6.99E-99	203	2058
ENSG00000100983.12	*GSS*	-2.41	1.08E-98	2711	1124
ENSG00000185222.10	*TCEAL9*	2.28	6.38E-97	892	2034
ENSG00000165752.17	*STK32C*	-2.80	2.52E-96	646	231
ENSG00000138061.12	*CYP1B1*	-8.96	5.06E-96	1582	177
ENSG00000180964.17	*TCEAL8*	3.62	1.79E-95	195	705
ENSG00000169851.15	*PCDH7*	3.78	4.17E-95	196	742
ENSG00000126005.17	*MMP24OS*	-2.59	4.78E-95	1548	598
ENSG00000177706.9	*FAM20C*	-3.15	7.29E-95	695	221
ENSG00000134470.21	*IL15RA*	-3.65	7.89E-95	333	91
ENSG00000101132.10	*PFDN4*	2.14	1.24E-94	812	1737
ENSG00000078804.13	*TP53INP2*	-4.01	1.53E-94	641	160
ENSG00000165886.5	*UBTD1*	-2.60	1.88E-94	605	233
ENSG00000244398.1	*AC116533.1*	2.44	3.31E-94	1902	4639
ENSG00000132821.12	*VSTM2L*	-12.26	2.00E-93	491	40
ENSG00000108448.21	*TRIM16L*	-3.73	3.79E-93	465	125
ENSG00000156463.18	*SH3RF2*	3.19	5.91E-93	563	1793
ENSG00000035862.12	*TIMP2*	-2.04	1.47E-92	6761	3321
ENSG00000072954.7	*TMEM38A*	-3.62	2.84E-92	448	124
ENSG00000169100.14	*SLC25A6*	-2.01	3.17E-92	6648	3313
ENSG00000126947.13	*ARMCX1*	3.03	6.37E-92	332	1003
ENSG00000119714.11	*GPR68*	-16.38	2.11E-91	247	15
ENSG00000184156.17	*KCNQ3*	16.31	3.60E-91	21	342
ENSG00000100612.14	*DHRS7*	2.40	3.74E-91	381	915
ENSG00000141295.14	*SCRN2*	-4.00	4.70E-91	352	88
ENSG00000165997.5	*ARL5B*	-3.05	7.86E-91	869	285
ENSG00000187601.5	*MAGEH1*	10.42	2.03E-90	30	316
ENSG00000125686.12	*MED1*	-2.39	1.12E-89	2524	1057
ENSG00000198756.12	*COLGALT2*	-5.61	2.17E-89	418	75
ENSG00000143924.19	*EML4*	-2.12	2.87E-89	1431	674
ENSG00000134996.12	*OSTF1*	2.11	4.36E-89	476	1003
ENSG00000148484.18	*RSU1*	-2.08	1.61E-88	1646	792
ENSG00000102349.18	*KLF8*	15.64	7.25E-88	14	215
ENSG00000006062.17	*MAP3K14*	-2.72	8.75E-88	825	303
ENSG00000102531.16	*FNDC3A*	-2.47	9.74E-88	1164	471

ENSG00000118985.16	*ELL2*	2.21	2.25E-87	1289	2845
ENSG00000077713.19	*SLC25A43*	2.74	3.55E-87	393	1076
ENSG00000102316.17	*MAGED2*	2.28	4.33E-87	1936	4421
ENSG00000163754.17	*GYG1*	2.07	5.09E-87	552	1144
ENSG00000063978.16	*RNF4*	2.05	6.75E-87	2418	4966
ENSG00000129680.16	*MAP7D3*	2.66	1.02E-86	1224	3254
ENSG00000196352.15	*CD55*	2.26	4.75E-86	2576	5825
ENSG00000101194.18	*SLC17A9*	2.29	6.69E-86	1192	2730
ENSG00000132406.12	*TMEM128*	2.89	1.36E-85	216	623
ENSG00000139318.8	*DUSP6*	-2.37	2.74E-85	3210	1353
ENSG00000174851.16	*YIF1A*	2.23	3.06E-85	670	1491
ENSG00000117676.14	*RPS6KA1*	-3.29	2.67E-84	874	266
ENSG00000206503.13	*HLA-A*	-3.51	1.81E-83	9178	2613
ENSG00000096070.19	*BRPF3*	-2.57	2.18E-83	2890	1124
ENSG00000106049.9	*HIBADH*	-2.63	6.99E-83	910	345
ENSG00000131724.11	*IL13RA1*	2.64	8.54E-83	1142	3017
ENSG00000099860.9	*GADD45B*	2.25	3.29E-82	742	1670
ENSG00000069974.16	*RAB27A*	2.87	8.61E-81	383	1100
ENSG00000204219.11	*TCEA3*	-9.13	1.39E-80	426	47
ENSG00000138073.14	*PREB*	-2.18	1.73E-80	1034	474
ENSG00000064999.15	*ANKS1A*	-2.06	4.63E-80	770	373
ENSG00000106484.16	*MEST*	-32.94	1.33E-79	323	10
ENSG00000232119.8	*MCTS1*	2.74	1.53E-79	728	1994
ENSG00000183421.12	*RIPK4*	-15.85	1.79E-79	200	13
ENSG00000157240.4	*FZD1*	-2.23	1.79E-79	876	393
ENSG00000172466.16	*ZNF24*	-2.09	2.93E-79	1330	636
ENSG00000084693.16	*AGBL5*	-4.01	7.12E-79	270	67
ENSG00000114850.6	*SSR3*	2.34	9.80E-79	1277	2992
ENSG00000151062.15	*CACNA2D4*	6.15	7.70E-78	38	232
ENSG00000184867.14	*ARMCX2*	6.04	7.99E-78	283	1705
ENSG00000164171.11	*ITGA2*	-2.65	8.06E-78	6010	2267
ENSG00000142910.16	*TINAGL1*	-3.02	9.78E-78	1491	493
ENSG00000257093.7	*DENND11*	-2.08	4.26E-77	754	362
ENSG00000101439.9	*CST3*	-2.09	4.86E-77	4044	1931
ENSG00000100982.12	*PCIF1*	-2.19	9.92E-77	856	391
ENSG00000105518.14	*TMEM205*	-2.43	1.62E-76	568	233
ENSG00000095787.23	*WAC*	-2.61	2.37E-76	1769	678
ENSG00000175928.6	*LRRN1*	13.20	7.83E-76	22	292
ENSG00000156521.14	*TYSND1*	-2.23	1.01E-75	652	292
ENSG00000167113.11	*COQ4*	-2.01	1.51E-75	810	403
ENSG00000262664.3	*OVCA2*	-2.24	3.09E-75	590	264
ENSG00000198768.11	*APCDD1L*	-60.79	3.56E-75	254	4
ENSG00000213694.5	*S1PR3*	4.12	4.30E-75	125	516

ENSG00000196154.12	*S100A4*	-8.10	6.65E-75	1901	235
ENSG00000241343.9	*RPL36A*	2.51	8.22E-75	3043	7645
ENSG00000115363.14	*EVA1A*	3.21	1.81E-74	340	1090
ENSG00000004975.12	*DVL2*	-2.20	1.82E-74	1159	527
ENSG00000123728.10	*RAP2C*	2.32	2.03E-74	553	1284
ENSG00000167772.12	*ANGPTL4*	3.01	3.70E-74	125	376
ENSG00000068001.14	*HYAL2*	-2.44	1.08E-73	809	331
ENSG00000233237.8	*LINC00472*	-3.18	1.43E-73	801	252
ENSG00000145287.10	*PLAC8*	2.23	2.46E-73	568	1269
ENSG00000162522.11	*KIAA1522*	-4.53	2.65E-73	788	174
ENSG00000198934.5	*MAGEE1*	4.81	5.59E-73	54	260
ENSG00000196187.12	*TMEM63A*	-2.65	6.07E-73	654	247
ENSG00000133104.14	*SPART*	-2.42	9.42E-73	1094	452
ENSG00000204427.12	*ABHD16A*	-2.30	1.00E-72	788	343
ENSG00000187522.16	*HSPA14*	-2.33	4.55E-72	743	319
ENSG00000126214.21	*KLC1*	-3.00	5.26E-72	2024	675
ENSG00000126215.14	*XRCC3*	-3.05	8.40E-72	961	315
ENSG00000100600.15	*LGMN*	-2.17	8.46E-72	730	336
ENSG00000104870.13	*FCGRT*	-48.13	2.87E-71	210	4
ENSG00000131263.13	*RLIM*	2.53	4.60E-71	783	1978
ENSG00000196611.5	*MMP1*	42.54	7.82E-71	168	7136
ENSG00000254726.3	*MEX3A*	-9.69	8.08E-71	162	17
ENSG00000111875.8	*ASF1A*	2.31	1.38E-70	513	1186
ENSG00000171522.6	*PTGER4*	2.77	3.03E-70	177	489
ENSG00000026751.17	*SLAMF7*	2.84	4.02E-70	540	1531
ENSG00000197355.11	*UAP1L1*	-4.23	2.82E-69	453	107
ENSG00000197892.13	*KIF13B*	-2.46	3.18E-69	701	285
ENSG00000140545.15	*MFGE8*	5.60	3.50E-69	1368	7656
ENSG00000153208.17	*MERTK*	-2.66	8.57E-69	729	274
ENSG00000104490.18	*NCALD*	16.51	8.57E-69	10	167
ENSG00000165105.10	*RASEF*	28.15	1.64E-67	6	158
ENSG00000123575.9	*FAM199X*	2.03	4.45E-67	710	1440
ENSG00000091986.15	*CCDC80*	2.43	4.73E-67	887	2153
ENSG00000163584.18	*RPL22L1*	-2.01	7.66E-67	1337	664
ENSG00000170571.12	*EMB*	2.25	8.37E-67	497	1121
ENSG00000138018.18	*SELENOI*	-2.59	9.28E-67	1478	571
ENSG00000131174.7	*COX7B*	2.26	2.00E-66	955	2160
ENSG00000080839.12	*RBL1*	-2.16	2.18E-66	1231	569
ENSG00000143842.15	*SOX13*	-2.41	2.22E-66	738	306
ENSG00000189369.9	*GSPT2*	3.12	2.91E-66	117	365
ENSG00000137198.10	*GMPR*	-3.00	3.90E-66	402	134
ENSG00000183287.14	*CCBE1*	2.84	4.95E-66	387	1097
ENSG00000180801.14	*ARSJ*	2.29	9.11E-66	1303	2977

ENSG00000182752.10	*PAPPA*	-26.38	1.69E-65	216	8
ENSG00000181192.12	*DHTKD1*	-2.28	2.16E-65	506	222
ENSG00000105409.19	*ATP1A3*	4.85	3.66E-65	104	503
ENSG00000150457.9	*LATS2*	-2.10	6.65E-65	813	386
ENSG00000148680.16	*HTR7*	-3.69	1.19E-64	502	136
ENSG00000065060.17	*UHRF1BP1*	-2.53	2.95E-64	1052	415
ENSG00000179833.4	*SERTAD2*	2.32	3.12E-64	1446	3348
ENSG00000157510.14	*AFAP1L1*	-4.72	4.81E-64	608	129
ENSG00000132109.10	*TRIM21*	2.66	5.62E-64	241	640
ENSG00000172137.19	*CALB2*	-4.20	8.74E-64	647	154
ENSG00000126001.16	*CEP250*	-2.52	9.88E-64	2655	1054
ENSG00000131435.13	*PDLIM4*	-4.58	1.51E-63	412	90
ENSG00000168685.15	*IL7R*	3.78	3.95E-63	245	927
ENSG00000101901.12	*ALG13*	2.22	6.93E-63	299	664
ENSG00000110002.16	*VWA5A*	48.19	1.72E-62	4	178
ENSG00000116701.14	*NCF2*	7.85	2.09E-62	34	270
ENSG00000041982.16	*TNC*	3.64	5.82E-62	741	2698
ENSG00000171310.11	*CHST11*	-4.36	8.82E-62	2556	587
ENSG00000171033.13	*PKIA*	3.00	1.17E-61	216	648
ENSG00000106948.16	*AKNA*	-2.97	1.36E-61	380	128
ENSG00000187325.5	*TAF9B*	2.24	2.83E-61	349	781
ENSG00000116133.13	*DHCR24*	2.46	4.45E-61	4437	10923
ENSG00000167123.19	*CERCAM*	-2.93	7.34E-61	699	239
ENSG00000152240.13	*HAUS1*	-2.56	8.69E-61	801	313
ENSG00000136754.17	*ABI1*	-2.09	1.45E-60	1196	573
ENSG00000166228.9	*PCBD1*	-2.04	2.48E-60	901	442
ENSG00000160446.19	*ZDHHC12*	-2.41	3.19E-60	612	254
ENSG00000182704.8	*TSKU*	-3.34	6.44E-60	522	156
ENSG00000107438.9	*PDLIM1*	-2.27	8.02E-60	1481	651
ENSG00000136490.9	*LIMD2*	-10.05	9.18E-60	154	15
ENSG00000075618.18	*FSCN1*	-2.03	2.20E-59	988	486
ENSG00000140937.14	*CDH11*	4.91	3.40E-59	656	3219
ENSG00000164056.11	*SPRY1*	-2.30	3.92E-59	676	294
ENSG00000102038.15	*SMARCA1*	2.02	4.75E-59	1212	2450
ENSG00000141574.8	*SECTM1*	-10.49	6.39E-59	159	15
ENSG00000189319.14	*FAM53B*	-2.56	8.58E-59	454	177
ENSG00000134871.19	*COL4A2*	-2.29	1.58E-58	2909	1269
ENSG00000011105.14	*TSPAN9*	-7.96	1.90E-58	731	92
ENSG00000134285.11	*FKBP11*	-5.31	3.83E-58	314	59
ENSG00000131746.13	*TNS4*	-48.26	4.24E-58	405	8
ENSG00000212747.5	*RTL8B*	2.32	4.53E-58	355	823
ENSG00000055163.20	*CYFIP2*	9.37	5.15E-58	28	266
ENSG00000171813.14	*PWWP2B*	-3.08	5.92E-58	342	111

ENSG00000203926.5	*SPANXA2*	33.66	6.10E-58	8	271
ENSG00000112655.16	*PTK7*	-192.48	6.77E-58	488	3
ENSG00000113504.21	*SLC12A7*	-259.92	1.41E-57	440	2
ENSG00000136720.7	*HS6ST1*	-2.25	1.72E-57	610	271
ENSG00000212724.3	*KRTAP2-3*	39.59	1.99E-57	32	1275
ENSG00000123689.6	*G0S2*	-2.83	2.15E-57	2348	829
ENSG00000198910.14	*L1CAM*	-16.17	2.75E-57	330	20
ENSG00000100473.18	*COCH*	-12.34	2.78E-57	147	12
ENSG00000169515.8	*CCDC8*	-6.03	5.85E-57	159	26
ENSG00000105851.11	*PIK3CG*	45.43	7.19E-57	3	155
ENSG00000141458.13	*NPC1*	-2.23	7.53E-57	2070	929
ENSG00000156711.17	*MAPK13*	-4.09	8.12E-57	1455	356
ENSG00000104356.11	*POP1*	2.06	9.44E-57	675	1390
ENSG00000132359.15	*RAP1GAP2*	3.89	1.44E-56	196	762
ENSG00000088280.19	*ASAP3*	-7.98	1.85E-56	182	23
ENSG00000121797.10	*CCRL2*	-2.87	2.13E-56	447	156
ENSG00000152683.14	*SLC30A6*	-2.12	2.61E-56	699	329
ENSG00000152455.16	*SUV39H2*	-2.22	6.26E-56	745	335
ENSG00000170961.7	*HAS2*	2.94	7.02E-56	450	1322
ENSG00000105655.19	*ISYNA1*	-5.25	7.36E-56	277	53
ENSG00000120690.16	*ELF1*	-2.19	9.24E-56	624	285
ENSG00000138074.15	*SLC5A6*	-2.87	9.32E-56	736	256
ENSG00000236104.3	*ZBTB22*	-2.15	1.11E-55	510	238
ENSG00000126953.8	*TIMM8A*	2.43	1.31E-55	344	836
ENSG00000143369.15	*ECM1*	-2.15	1.38E-55	729	338
ENSG00000164687.11	*FABP5*	2.06	1.58E-55	1287	2651
ENSG00000165474.8	*GJB2*	-3.05	2.43E-55	324	106
ENSG00000173960.14	*UBXN2A*	-2.02	7.87E-55	544	270
ENSG00000137409.19	*MTCH1*	-2.32	8.94E-55	2569	1109
ENSG00000143416.21	*SELENBP1*	-7.46	1.40E-54	159	21
ENSG00000143320.9	*CRABP2*	-5.03	2.15E-54	206	41
ENSG00000135750.15	*KCNK1*	3.48	2.71E-54	127	443
ENSG00000146278.11	*PNRC1*	2.39	2.80E-54	203	485
ENSG00000162407.9	*PLPP3*	2.54	5.70E-54	513	1303
ENSG00000122870.12	*BICC1*	-3.49	6.06E-54	211	61
ENSG00000088367.23	*EPB41L1*	-6.82	7.35E-54	323	47
ENSG00000091409.15	*ITGA6*	-3.82	8.17E-54	2635	690
ENSG00000124496.12	*TRERF1*	-2.43	1.16E-53	1228	505
ENSG00000184486.10	*POU3F2*	6.73	2.35E-53	37	251
ENSG00000115042.10	*FAHD2A*	-2.28	3.31E-53	352	155
ENSG00000094841.14	*UPRT*	3.30	3.68E-53	135	446
ENSG00000134330.19	*IAH1*	-2.12	5.95E-53	506	239
ENSG00000124181.14	*PLCG1*	-2.52	7.39E-53	2036	807

ENSG00000162337.12	*LRP5*	-2.21	7.81E-53	2982	1352
ENSG00000166396.13	*SERPINB7*	7.16	1.03E-52	26	184
ENSG00000198246.9	*SLC29A3*	-34.87	1.59E-52	132	4
ENSG00000141452.10	*RMC1*	-2.69	4.72E-52	531	198
ENSG00000100065.15	*CARD10*	-2.42	6.03E-52	672	278
ENSG00000120539.14	*MASTL*	-2.65	9.62E-52	1128	426
ENSG00000225383.8	*SFTA1P*	3.49	1.00E-51	264	923
ENSG00000213722.9	*DDAH2*	-2.78	1.82E-51	1032	372
ENSG00000150867.14	*PIP4K2A*	-2.62	1.94E-51	1607	612
ENSG00000164045.12	*CDC25A*	-2.24	1.95E-51	1443	643
ENSG00000221988.13	*PPT2*	-2.09	2.05E-51	708	339
ENSG00000101928.13	*MOSPD1*	2.39	2.20E-51	305	729
ENSG00000218739.10	*CEBPZOS*	-2.52	4.28E-51	507	201
ENSG00000130024.15	*PHF10*	-2.26	4.76E-51	1780	787
ENSG00000185909.15	*KLHDC8B*	-13.82	5.97E-51	152	11
ENSG00000183386.10	*FHL3*	-3.70	6.64E-51	323	87
ENSG00000163359.15	*COL6A3*	-20.77	7.03E-51	173	8
ENSG00000265763.4	*ZNF488*	-3.72	1.24E-50	185	50
ENSG00000091136.14	*LAMB1*	-2.17	1.94E-50	3509	1617
ENSG00000143126.8	*CELSR2*	-6.22	4.10E-50	278	45
ENSG00000083799.17	*CYLD*	2.24	4.30E-50	403	902
ENSG00000162614.18	*NEXN*	2.50	4.52E-50	681	1705
ENSG00000204272.13	*NBDY*	2.02	6.18E-50	382	772
ENSG00000080189.15	*SLC35C2*	-2.08	8.09E-50	875	421
ENSG00000126878.13	*AIF1L*	-42.54	1.65E-49	147	3
ENSG00000164379.7	*FOXQ1*	-3.60	2.17E-49	748	208
ENSG00000250697.2	*AC010343.3*	3.36	2.83E-49	129	435
ENSG00000155254.13	*MARVELD1*	-2.47	9.16E-49	691	279
ENSG00000103888.17	*CEMIP*	-61.19	1.65E-48	685	11
ENSG00000152464.15	*RPP38*	-2.35	1.71E-48	350	149
ENSG00000154330.13	*PGM5*	451.37	3.21E-48	2	723
ENSG00000110492.15	*MDK*	-13.47	4.71E-48	138	10
ENSG00000144642.22	*RBMS3*	2.81	5.67E-48	225	633
ENSG00000000003.15	*TSPAN6*	2.25	6.74E-48	408	919
ENSG00000167543.16	*TP53I13*	-2.15	1.24E-47	600	279
ENSG00000162511.8	*LAPTM5*	-4941.89	2.01E-47	1334	0
ENSG00000099256.19	*PRTFDC1*	-2.58	2.72E-47	368	143
ENSG00000151694.14	*ADAM17*	-2.53	2.99E-47	645	255
ENSG00000185585.20	*OLFML2A*	-43.86	4.44E-47	250	6
ENSG00000172465.14	*TCEAL1*	2.08	4.88E-47	284	592
ENSG00000159199.14	*ATP5MC1*	-2.22	6.07E-47	1669	753
ENSG00000120688.9	*WBP4*	-2.12	8.04E-47	431	204

ENSG00000067141.17	*NEO1*	10.17	9.62E-47	78	797
ENSG00000154678.18	*PDE1C*	13.33	1.28E-46	17	228
ENSG00000168386.18	*FILIP1L*	3.11	1.29E-46	112	350
ENSG00000171159.5	*C9orf16*	-2.58	2.15E-46	272	105
ENSG00000008311.15	*AASS*	-2.52	2.23E-46	756	301
ENSG00000072195.15	*SPEG*	-6.19	2.36E-46	173	28
ENSG00000168283.14	*BMI1*	-2.32	2.54E-46	2156	931
ENSG00000164062.13	*APEH*	-2.12	3.96E-46	1648	778
ENSG00000184117.12	*NIPSNAP1*	2.14	5.73E-46	270	576
ENSG00000123453.18	*SARDH*	-5.98	1.66E-45	147	25
ENSG00000023892.11	*DEF6*	-8.56	2.59E-45	375	44
ENSG00000053501.13	*USE1*	2.26	4.48E-45	157	355
ENSG00000148824.19	*MTG1*	-2.13	4.76E-45	480	225
ENSG00000147676.14	*MAL2*	-2.75	4.95E-45	587	213
ENSG00000129682.16	*FGF13*	3914.80	1.15E-44	0	684
ENSG00000206341.7	*HLA-H*	-2.93	1.32E-44	409	139
ENSG00000215808.4	*LINC01139*	5.30	1.33E-44	26	136
ENSG00000131725.14	*WDR44*	2.21	1.41E-44	495	1095
ENSG00000179242.16	*CDH4*	2.12	1.69E-44	1991	4222
ENSG00000204439.4	*C6orf47*	-2.02	1.96E-44	695	344
ENSG00000175556.17	*LONRF3*	2.79	2.06E-44	136	379
ENSG00000083642.19	*PDS5B*	-2.05	3.18E-44	800	391
ENSG00000173705.9	*SUSD5*	-4.86	5.75E-44	517	106
ENSG00000237187.9	*NR2F1-AS1*	2.47	6.54E-44	200	494
ENSG00000278535.5	*DHRS11*	-3.34	7.18E-44	304	91
ENSG00000177508.12	*IRX3*	-4.81	8.15E-44	238	50
ENSG00000100034.14	*PPM1F*	-2.10	8.76E-44	2334	1109
ENSG00000101417.12	*PXMP4*	-5.10	9.11E-44	206	40
ENSG00000271605.6	*MILR1*	-7.01	1.06E-43	161	23
ENSG00000125968.9	*ID1*	-3.01	1.58E-43	2085	692
ENSG00000167272.11	*POP5*	-2.45	1.77E-43	549	224
ENSG00000232774.8	*AL355916.1*	-7.99	2.73E-43	138	17
ENSG00000124151.19	*NCOA3*	-2.59	3.07E-43	786	303
ENSG00000183914.14	*DNAH2*	-5.61	3.61E-43	276	49
ENSG00000084112.15	*SSH1*	-2.58	3.87E-43	2450	948
ENSG00000170689.10	*HOXB9*	-2.72	5.69E-43	212	78
ENSG00000078142.13	*PIK3C3*	-2.63	6.75E-43	841	320
ENSG00000175470.20	*PPP2R2D*	-2.30	8.11E-43	774	336
ENSG00000107130.10	*NCS1*	-2.36	9.86E-43	1075	456
ENSG00000088836.14	*SLC4A11*	-4.99	1.11E-42	856	172
ENSG00000132470.14	*ITGB4*	-20.07	1.16E-42	2168	108
ENSG00000143845.15	*ETNK2*	-26.35	1.47E-42	141	5
ENSG00000221926.12	*TRIM16*	-2.11	1.52E-42	733	347

ENSG00000173801.17	*JUP*	-5.80	1.99E-42	259	45
ENSG00000008441.16	*NFIX*	-10.70	2.34E-42	636	59
ENSG00000076770.14	*MBNL3*	2.59	2.82E-42	169	437
ENSG00000184922.14	*FMNL1*	-2.51	2.86E-42	2108	840
ENSG00000132535.19	*DLG4*	-10.09	2.86E-42	240	24
ENSG00000214189.9	*ZNF788P*	-3.47	2.86E-42	196	56
ENSG00000249673.7	*NOP14-AS1*	2.28	3.37E-42	329	748
ENSG00000167393.18	*PPP2R3B*	-2.46	3.67E-42	341	139
ENSG00000118898.16	*PPL*	-9.80	4.38E-42	314	32
ENSG00000214078.12	*CPNE1*	-2.08	5.20E-42	1498	722
ENSG00000154734.15	*ADAMTS1*	3.48	7.86E-42	554	1930
ENSG00000241058.4	*NSUN6*	-2.34	8.80E-42	281	120
ENSG00000101452.15	*DHX35*	-2.19	1.26E-41	509	233
ENSG00000196535.16	*MYO18A*	-3.29	1.53E-41	1023	311
ENSG00000135723.14	*FHOD1*	-2.15	1.59E-41	728	339
ENSG00000111335.12	*OAS2*	-4.85	2.48E-41	191	39
ENSG00000027001.10	*MIPEP*	-2.71	2.64E-41	256	94
ENSG00000124191.18	*TOX2*	-2.37	2.65E-41	368	155
ENSG00000101843.19	*PSMD10*	2.25	3.51E-41	682	1537
ENSG00000125352.6	*RNF113A*	3.13	3.59E-41	244	766
ENSG00000141570.11	*CBX8*	-2.21	4.87E-41	347	157
ENSG00000099812.9	*MISP*	-4.23	6.85E-41	637	151
ENSG00000117152.13	*RGS4*	8.23	6.85E-41	35	286
ENSG00000166394.15	*CYB5R2*	13.04	7.86E-41	7	95
ENSG00000267405.1	*AC005180.1*	5.89	8.98E-41	18	105
ENSG00000012124.17	*CD22*	3.57	1.14E-40	121	433
ENSG00000283646.2	*LINC02009*	-4.28	1.34E-40	145	34
ENSG00000141655.17	*TNFRSF11A*	2.29	1.89E-40	290	664
ENSG00000171604.12	*CXXC5*	-7.21	2.46E-40	198	27
ENSG00000100599.16	*RIN3*	-2.12	2.70E-40	480	227
ENSG00000170485.17	*NPAS2*	-5.00	2.82E-40	1281	256
ENSG00000169871.13	*TRIM56*	-2.09	2.90E-40	1583	759
ENSG00000141068.14	*KSR1*	-16.49	3.19E-40	77	5
ENSG00000164307.13	*ERAP1*	-2.14	3.94E-40	1203	563
ENSG00000101363.12	*MANBAL*	-2.48	5.62E-40	477	193
ENSG00000255495.1	*AC145124.1*	5.63	6.35E-40	29	163
ENSG00000078967.13	*UBE2D4*	-2.48	6.54E-40	371	149
ENSG00000134463.15	*ECHDC3*	-2.09	7.21E-40	363	173
ENSG00000213160.10	*KLHL23*	-2.21	8.50E-40	688	311
ENSG00000006118.14	*TMEM132A*	-4.87	8.87E-40	378	78
ENSG00000020256.20	*ZFP64*	2.11	8.92E-40	195	411
ENSG00000157111.13	*TMEM171*	-4.05	9.27E-40	124	31
ENSG00000178401.16	*DNAJC22*	-10.43	1.53E-39	106	10

ENSG00000128016.7	*ZFP36*	2.22	1.77E-39	152	338
ENSG00000136352.17	*NKX2-1*	2310.96	1.87E-39	0	404
ENSG00000204438.11	*GPANK1*	-2.07	1.90E-39	459	221
ENSG00000158715.6	*SLC45A3*	-2.27	2.08E-39	401	177
ENSG00000188064.10	*WNT7B*	2.29	2.14E-39	833	1910
ENSG00000188636.4	*RTL6*	-2238.71	2.57E-39	843	0
ENSG00000127920.6	*GNG11*	-2.51	2.70E-39	443	176
ENSG00000186376.15	*ZNF75D*	2.58	2.79E-39	123	317
ENSG00000067606.17	*PRKCZ*	2.77	3.46E-39	148	409
ENSG00000137486.17	*ARRB1*	-35.36	3.73E-39	243	7
ENSG00000151388.11	*ADAMTS12*	-8.21	3.88E-39	541	66
ENSG00000213676.13	*ATF6B*	-2.38	4.49E-39	1687	709
ENSG00000228340.6	*MIR646HG*	2.96	5.37E-39	67	197
ENSG00000276045.3	*ORAI1*	-2.29	5.89E-39	796	347
ENSG00000144959.10	*NCEH1*	2.04	7.66E-39	3686	7517
ENSG00000102034.16	*ELF4*	2.15	8.59E-39	618	1329
ENSG00000087258.15	*GNAO1*	4.34	8.97E-39	74	323
ENSG00000155366.16	*RHOC*	2.03	1.03E-38	1278	2590
ENSG00000107331.17	*ABCA2*	-2.77	1.10E-38	544	196
ENSG00000084731.15	*KIF3C*	-3.78	1.29E-38	457	121
ENSG00000057704.13	*TMCC3*	-2.91	1.57E-38	352	121
ENSG00000136867.11	*SLC31A2*	-2.37	2.19E-38	304	128
ENSG00000167552.14	*TUBA1A*	2.66	2.46E-38	965	2562
ENSG00000166557.13	*TMED3*	2.05	6.12E-38	965	1979
ENSG00000106976.20	*DNM1*	-113.92	6.82E-38	185	2
ENSG00000204366.4	*ZBTB12*	-2.98	6.88E-38	257	86
ENSG00000165323.15	*FAT3*	33.56	9.32E-38	25	855
ENSG00000240065.8	*PSMB9*	-9.28	1.08E-37	204	22
ENSG00000105426.16	*PTPRS*	-3.57	1.12E-37	403	113
ENSG00000139970.17	*RTN1*	5.83	1.27E-37	15	90
ENSG00000198542.14	*ITGBL1*	-3.95	1.31E-37	147	37
ENSG00000148175.13	*STOM*	-6.93	1.42E-37	440	63
ENSG00000254635.6	*WAC-AS1*	-2.29	1.57E-37	353	154
ENSG00000139946.10	*PELI2*	4.85	1.68E-37	24	116
ENSG00000138095.19	*LRPPRC*	-3.38	2.18E-37	432	128
ENSG00000165259.14	*HDX*	16.35	2.88E-37	9	141
ENSG00000117122.14	*MFAP2*	-13.83	3.09E-37	165	12
ENSG00000179222.17	*MAGED1*	3.92	3.60E-37	143	561
ENSG00000102359.7	*SRPX2*	10.35	4.16E-37	30	314
ENSG00000164088.18	*PPM1M*	-2.42	4.43E-37	267	110
ENSG00000054277.14	*OPN3*	-5.48	5.58E-37	252	46
ENSG00000203930.12	*LINC00632*	37.53	6.92E-37	7	249

ENSG00000139725.8	*RHOF*	-2.01	1.06E-36	999	496
ENSG00000008869.12	*HEATR5B*	-2.23	1.08E-36	463	207
ENSG00000081803.16	*CADPS2*	-2.50	1.13E-36	273	109
ENSG00000160447.7	*PKN3*	-2.29	1.26E-36	674	294
ENSG00000184916.9	*JAG2*	-10.49	1.29E-36	191	18
ENSG00000120306.11	*CYSTM1*	2.47	1.46E-36	262	646
ENSG00000140450.9	*ARRDC4*	4.89	1.71E-36	56	272
ENSG00000276850.5	*AC245041.2*	-107.79	1.80E-36	138	1
ENSG00000106034.18	*CPED1*	2.48	1.97E-36	328	814
ENSG00000163412.13	*EIF4E3*	4.00	2.83E-36	40	162
ENSG00000136738.15	*STAM*	-2.07	3.05E-36	1056	510
ENSG00000175866.15	*BAIAP2*	-2.53	3.27E-36	986	390
ENSG00000130881.14	*LRP3*	-17.28	3.97E-36	181	10
ENSG00000164442.10	*CITED2*	2.26	4.32E-36	1733	3913
ENSG00000168032.10	*ENTPD3*	2.67	4.75E-36	73	195
ENSG00000166033.13	*HTRA1*	-4.76	5.28E-36	804	169
ENSG00000204525.16	*HLA-C*	-2.64	7.27E-36	670	254
ENSG00000187498.16	*COL4A1*	-2.62	7.74E-36	916	349
ENSG00000118777.12	*ABCG2*	-2.94	1.07E-35	321	109
ENSG00000168765.17	*GSTM4*	-2.76	1.12E-35	250	90
ENSG00000165424.7	*ZCCHC24*	-2.06	1.22E-35	681	330
ENSG00000168758.11	*SEMA4C*	-2.02	1.35E-35	611	302
ENSG00000108219.15	*TSPAN14*	-2.20	2.20E-35	589	267
ENSG00000143891.17	*GALM*	-3.73	3.30E-35	196	53
ENSG00000181031.16	*RPH3AL*	-2.36	3.34E-35	1037	439
ENSG00000165572.8	*KBTBD6*	-2.36	3.90E-35	350	148
ENSG00000149177.13	*PTPRJ*	-2.22	4.55E-35	1931	870
ENSG00000070961.15	*ATP2B1*	-2.09	7.10E-35	2072	991
ENSG00000125257.16	*ABCC4*	-2.01	7.42E-35	893	443
ENSG00000131269.19	*ABCB7*	2.26	8.66E-35	289	651
ENSG00000197860.10	*SGTB*	2.13	1.06E-34	285	607
ENSG00000162458.13	*FBLIM1*	-1479.67	1.22E-34	286	0
ENSG00000180884.10	*ZNF792*	-3.57	2.06E-34	182	51
ENSG00000128203.7	*ASPHD2*	-16.89	2.12E-34	80	5
ENSG00000133321.11	*PLAAT4*	-8.68	2.18E-34	203	23
ENSG00000121653.11	*MAPK8IP1*	-2.47	2.21E-34	286	116
ENSG00000095752.7	*IL11*	-20.88	2.41E-34	1809	87
ENSG00000087253.13	*LPCAT2*	-3.49	2.62E-34	253	73
ENSG00000136144.12	*RCBTB1*	-2.06	3.90E-34	520	252
ENSG00000114993.17	*RTKN*	-4.70	4.55E-34	162	34
ENSG00000196739.15	*COL27A1*	-14.40	4.67E-34	244	17
ENSG00000187098.15	*MITF*	2.30	5.96E-34	434	1000

ENSG00000134668.12	*SPOCD1*	2.93	5.96E-34	131	383
ENSG00000106733.21	*NMRK1*	3.96	7.95E-34	37	148
ENSG00000187957.8	*DNER*	4.36	9.04E-34	37	162
ENSG00000178922.16	*HYI*	-2.69	9.62E-34	1113	413
ENSG00000204348.10	*DXO*	-2.27	9.70E-34	276	121
ENSG00000140931.20	*CMTM3*	-2.76	1.20E-33	284	103
ENSG00000251273.4	*LINC02228*	3.48	1.61E-33	43	150
ENSG00000101017.14	*CD40*	-1257.59	2.08E-33	341	0
ENSG00000172159.16	*FRMD3*	3.71	2.28E-33	69	257
ENSG00000070366.14	*SMG6*	-2.11	2.89E-33	1333	633
ENSG00000231365.6	*WARS2-AS1*	2.41	3.53E-33	278	672
ENSG00000198624.13	*CCDC69*	-2.10	3.82E-33	623	297
ENSG00000112576.12	*CCND3*	-2.87	4.13E-33	446	155
ENSG00000181350.12	*LRRC75A*	-6.05	4.62E-33	91	15
ENSG00000215374.6	*FAM66B*	13.49	5.42E-33	8	109
ENSG00000104714.14	*ERICH1*	2.02	6.03E-33	213	430
ENSG00000196700.9	*ZNF512B*	-2.38	6.38E-33	894	376
ENSG00000167291.16	*TBC1D16*	-2.00	6.59E-33	924	461
ENSG00000099282.10	*TSPAN15*	-4.05	8.15E-33	277	69
ENSG00000143479.17	*DYRK3*	2.31	8.33E-33	145	335
ENSG00000163026.12	*WDCP*	-3.05	1.19E-32	340	111
ENSG00000111684.11	*LPCAT3*	-3.27	1.55E-32	404	123
ENSG00000212725.3	*KRTAP2-1*	49.96	1.94E-32	3	127
ENSG00000130303.13	*BST2*	-1287.79	2.05E-32	406	0
ENSG00000146122.17	*DAAM2*	16.39	2.15E-32	15	245
ENSG00000258659.6	*TRIM34*	4.13	3.48E-32	131	540
ENSG00000164068.16	*RNF123*	-2.18	3.89E-32	819	375
ENSG00000044524.11	*EPHA3*	47.66	5.49E-32	2	115
ENSG00000149212.12	*SESN3*	3.16	5.74E-32	96	302
ENSG00000198825.15	*INPP5F*	-2.21	7.64E-32	670	304
ENSG00000276672.1	*AL161891.1*	-2.68	8.47E-32	205	77
ENSG00000236824.2	*BCYRN1*	3.15	1.00E-31	1539	4843
ENSG00000124615.20	*MOCS1*	-2.00	1.05E-31	667	333
ENSG00000075413.18	*MARK3*	-2.80	1.83E-31	753	269
ENSG00000198908.12	*BHLHB9*	2.77	2.03E-31	99	275
ENSG00000213468.7	*FIRRE*	8.63	2.13E-31	10	87
ENSG00000186854.11	*TRABD2A*	2.52	2.40E-31	156	395
ENSG00000115616.3	*SLC9A2*	21.00	3.07E-31	3	73
ENSG00000178467.18	*P4HTM*	-2.24	3.14E-31	427	191
ENSG00000148057.16	*IDNK*	2.24	3.21E-31	91	204
ENSG00000145147.20	*SLIT2*	2.12	4.32E-31	739	1563

ENSG00000101844.18	*ATG4A*	2.27	4.97E-31	210	477
ENSG00000151623.15	*NR3C2*	2.66	5.68E-31	115	307
ENSG00000145040.4	*UCN2*	-5.40	6.73E-31	103	19
ENSG00000170577.8	*SIX2*	-6.93	6.91E-31	135	20
ENSG00000116819.8	*TFAP2E*	-18.52	7.79E-31	72	4
ENSG00000134508.12	*CABLES1*	-4.45	9.05E-31	231	52
ENSG00000149968.12	*MMP3*	99.77	9.69E-31	2	179
ENSG00000103490.14	*PYCARD*	-19.49	1.11E-30	72	4
ENSG00000102078.16	*SLC25A14*	2.70	1.37E-30	87	234
ENSG00000180448.10	*ARHGAP45*	-5.15	1.41E-30	295	57
ENSG00000205336.12	*ADGRG1*	-2.51	1.48E-30	485	193
ENSG00000106789.13	*CORO2A*	-2.44	1.51E-30	499	204
ENSG00000148671.14	*ADIRF*	-10.01	1.61E-30	248	25
ENSG00000036448.10	*MYOM2*	4.82	1.67E-30	18	88
ENSG00000152128.13	*TMEM163*	-374.11	2.16E-30	264	1
ENSG00000149639.15	*SOGA1*	-2.49	2.42E-30	1866	750
ENSG00000089094.19	*KDM2B*	-2.08	2.57E-30	958	460
ENSG00000038427.16	*VCAN*	43.62	2.85E-30	6	257
ENSG00000285294.1	*LINC00842*	-10.14	3.75E-30	67	7
ENSG00000090776.6	*EFNB1*	2.20	4.34E-30	363	799
ENSG00000182179.13	*UBA7*	-8.20	6.43E-30	111	14
ENSG00000181458.10	*TMEM45A*	2.50	7.13E-30	90	226
ENSG00000119630.14	*PGF*	-4.68	7.83E-30	98	21
ENSG00000278619.5	*MRM1*	-2.33	9.12E-30	184	79
ENSG00000196968.11	*FUT11*	-2.11	1.07E-29	349	166
ENSG00000168140.5	*VASN*	-5.43	1.21E-29	88	16
ENSG00000136717.15	*BIN1*	-2.74	1.40E-29	766	280
ENSG00000269190.6	*FBXO17*	-2.36	1.76E-29	436	185
ENSG00000161682.15	*FAM171A2*	-4.48	1.88E-29	109	24
ENSG00000164695.5	*CHMP4C*	2.07	2.03E-29	126	260
ENSG00000115919.15	*KYNU*	-3.80	2.23E-29	116	30
ENSG00000101040.19	*ZMYND8*	-2.42	2.43E-29	1415	584
ENSG00000184860.10	*SDR42E1*	2.01	3.19E-29	271	546
ENSG00000105711.12	*SCN1B*	-20.60	3.85E-29	72	3
ENSG00000160404.18	*TOR2A*	-2.56	4.06E-29	271	106
ENSG00000167105.8	*TMEM92*	-2.23	4.17E-29	344	154
ENSG00000203805.10	*PLPP4*	-2.11	4.43E-29	298	141
ENSG00000136859.10	*ANGPTL2*	-3.68	4.54E-29	313	85
ENSG00000121454.6	*LHX4*	-3.15	5.43E-29	128	41
ENSG00000163083.6	*INHBB*	-650.03	5.54E-29	342	1
ENSG00000204386.11	*NEU1*	-2.34	5.99E-29	604	259
ENSG00000225697.13	*SLC26A6*	-2.34	6.69E-29	387	166
ENSG00000148481.14	*MINDY3*	-2.09	8.00E-29	572	274

ENSG00000177374.13	*HIC1*	-9.73	9.19E-29	90	9
ENSG00000066084.13	*DIP2B*	-2.18	9.27E-29	1118	513
ENSG00000077238.14	*IL4R*	-2.00	1.13E-28	1036	517
ENSG00000122861.16	*PLAU*	-2.26	1.23E-28	6239	2766
ENSG00000240225.10	*ZNF542P*	-761.43	1.23E-28	147	0
ENSG00000106066.15	*CPVL*	-2.09	1.53E-28	382	183
ENSG00000151892.14	*GFRA1*	187.33	1.57E-28	1	149
ENSG00000186470.14	*BTN3A2*	-5.22	1.69E-28	229	44
ENSG00000204564.12	*C6orf136*	-2.15	1.89E-28	446	208
ENSG00000229415.9	*SFTA3*	748.62	2.62E-28	0	131
ENSG00000169084.15	*DHRSX*	-2.10	2.81E-28	373	178
ENSG00000286132.1	*AC022415.2*	-3.07	3.27E-28	156	51
ENSG00000170190.16	*SLC16A5*	-5.25	3.47E-28	100	19
ENSG00000180543.5	*TSPYL5*	2.41	3.48E-28	119	286
ENSG00000176845.13	*METRNL*	-5.75	3.75E-28	94	16
ENSG00000197415.12	*VEPH1*	2.48	4.64E-28	122	303
ENSG00000160588.10	*MPZL3*	5.08	4.68E-28	25	127
ENSG00000115339.14	*GALNT3*	-2.19	4.98E-28	1282	584
ENSG00000068079.7	*IFI35*	-7.21	5.59E-28	176	24
ENSG00000172830.13	*SSH3*	-4.50	5.59E-28	174	39
ENSG00000164220.7	*F2RL2*	5.74	7.22E-28	13	73
ENSG00000168497.5	*CAVIN2*	4.51	7.81E-28	941	4249
ENSG00000133026.12	*MYH10*	-2.02	8.02E-28	1891	937
ENSG00000139410.15	*SDSL*	-2.35	9.98E-28	312	132
ENSG00000084444.14	*FAM234B*	-2.38	9.99E-28	202	85
ENSG00000142279.13	*WTIP*	-4.12	2.31E-27	530	129
ENSG00000204228.4	*HSD17B8*	-20.44	2.64E-27	64	3
ENSG00000130304.17	*SLC27A1*	-2.70	2.79E-27	168	62
ENSG00000197122.11	*SRC*	-35.50	3.44E-27	169	5
ENSG00000213366.13	*GSTM2*	-11.27	3.59E-27	58	5
ENSG00000166974.13	*MAPRE2*	-2.51	7.97E-27	647	258
ENSG00000175591.11	*P2RY2*	-3.28	9.55E-27	300	92
ENSG00000169129.15	*AFAP1L2*	-3.25	1.09E-26	785	242
ENSG00000119335.16	*SET*	-13.78	1.14E-26	144	10
ENSG00000105894.12	*PTN*	-604.45	1.18E-26	117	0
ENSG00000242732.4	*RTL5*	2.23	1.29E-26	109	244
ENSG00000186814.14	*ZSCAN30*	-2.38	1.42E-26	356	149
ENSG00000175390.14	*EIF3F*	2.61	1.71E-26	156	406
ENSG00000147206.17	*NXF3*	262.11	1.71E-26	1	156
ENSG00000146678.10	*IGFBP1*	-2.40	2.34E-26	922	384
ENSG00000136840.19	*ST6GALNAC4*	-2.18	2.44E-26	422	193
ENSG00000104964.14	*TLE5*	-2.10	2.73E-26	1349	643
ENSG00000182621.18	*PLCB1*	4.39	2.84E-26	78	341

ENSG00000173894.11	*CBX2*	-2.43	3.29E-26	503	207
ENSG00000184515.11	*BEX5*	546.76	3.37E-26	0	134
ENSG00000111319.13	*SCNN1A*	-6.42	3.59E-26	104	16
ENSG00000204070.10	*SYS1*	-2.41	3.59E-26	860	356
ENSG00000274180.1	*NATD1*	-4.95	4.08E-26	75	15
ENSG00000185436.12	*IFNLR1*	-16.03	4.34E-26	64	4
ENSG00000170412.18	*GPRC5C*	-581.97	4.42E-26	112	0
ENSG00000187243.16	*MAGED4B*	11.81	5.13E-26	25	291
ENSG00000101882.10	*NKAP*	2.07	5.70E-26	276	572
ENSG00000124104.19	*SNX21*	-2.85	6.54E-26	369	129
ENSG00000062282.15	*DGAT2*	2.20	6.94E-26	164	362
ENSG00000055813.6	*CCDC85A*	44.92	6.96E-26	1	64
ENSG00000133138.20	*TBC1D8B*	3.66	7.21E-26	74	271
ENSG00000101680.15	*LAMA1*	15.37	7.24E-26	9	134
ENSG00000176225.14	*RTTN*	-2.01	9.11E-26	368	183
ENSG00000196975.16	*ANXA4*	2.07	1.14E-25	411	851
ENSG00000235904.3	*RBMS3-AS3*	3.26	1.39E-25	35	116
ENSG00000149591.17	*TAGLN*	3.17	1.63E-25	289	917
ENSG00000150051.14	*MKX*	-2.77	2.00E-25	122	44
ENSG00000154065.17	*ANKRD29*	-3.01	2.04E-25	184	61
ENSG00000129595.13	*EPB41L4A*	4.69	2.50E-25	34	160
ENSG00000183496.6	*MEX3B*	4.12	2.66E-25	39	162
ENSG00000180758.12	*GPR157*	-3.56	3.03E-25	232	65
ENSG00000167118.10	*URM1*	-2.32	3.13E-25	630	271
ENSG00000125347.14	*IRF1*	-2.61	3.32E-25	475	182
ENSG00000136758.18	*YME1L1*	-2.51	3.72E-25	1375	548
ENSG00000127863.15	*TNFRSF19*	-2.35	4.12E-25	161	69
ENSG00000108175.17	*ZMIZ1*	-2.23	5.23E-25	1994	893
ENSG00000100979.15	*PLTP*	-27.99	5.33E-25	64	2
ENSG00000165929.13	*TC2N*	6.35	6.79E-25	16	98
ENSG00000048740.18	*CELF2*	2.21	8.79E-25	458	1013
ENSG00000162520.15	*SYNC*	-9.42	9.32E-25	89	9
ENSG00000223749.10	*MIR503HG*	3.32	9.36E-25	58	191
ENSG00000142173.15	*COL6A2*	-53.53	9.82E-25	87	2
ENSG00000124593.16	*AL365205.1*	-2.23	9.95E-25	250	112
ENSG00000151693.11	*ASAP2*	-2.11	1.00E-24	1258	595
ENSG00000167705.12	*RILP*	-2.58	1.25E-24	208	81
ENSG00000015133.19	*CCDC88C*	-2.11	1.35E-24	687	326
ENSG00000106538.10	*RARRES2*	-31.10	1.40E-24	73	2
ENSG00000125967.16	*NECAB3*	-4.58	1.55E-24	261	57
ENSG00000120149.9	*MSX2*	6.41	1.66E-24	9	56
ENSG00000124570.20	*SERPINB6*	-2.06	1.75E-24	959	465
ENSG00000114631.11	*PODXL2*	-4.64	1.88E-24	200	43

ENSG00000166689.16	*PLEKHA7*	-5.38	1.93E-24	538	100
ENSG00000105619.13	*TFPT*	-29.67	1.99E-24	68	2
ENSG00000174705.13	*SH3PXD2B*	-3.44	2.31E-24	173	50
ENSG00000198626.17	*RYR2*	29.15	2.86E-24	2	70
ENSG00000171017.11	*LRRC8E*	-2.60	2.89E-24	279	107
ENSG00000196172.9	*ZNF681*	-40.80	3.37E-24	75	2
ENSG00000081051.8	*AFP*	10.09	4.51E-24	5	53
ENSG00000196335.13	*STK31*	5.34	4.58E-24	15	82
ENSG00000179083.6	*FAM133A*	-38.23	5.30E-24	60	2
ENSG00000188483.8	*IER5L*	-3.01	5.63E-24	332	110
ENSG00000169016.17	*E2F6*	-2.12	6.61E-24	387	182
ENSG00000124813.23	*RUNX2*	-2.24	6.87E-24	579	258
ENSG00000184709.7	*LRRC26*	-7.30	7.97E-24	64	9
ENSG00000028137.19	*TNFRSF1B*	-466.42	8.55E-24	126	0
ENSG00000167600.14	*CYP2S1*	-10.87	8.81E-24	67	6
ENSG00000179627.10	*ZBTB42*	-8.53	1.05E-23	90	10
ENSG00000157064.11	*NMNAT2*	2.39	1.29E-23	279	666
ENSG00000172059.11	*KLF11*	-2.65	1.60E-23	230	87
ENSG00000118503.15	*TNFAIP3*	4.25	1.78E-23	97	411
ENSG00000228594.4	*FNDC10*	-4.39	1.82E-23	87	20
ENSG00000213780.11	*GTF2H4*	-2.18	2.16E-23	693	318
ENSG00000115963.13	*RND3*	2.15	2.69E-23	816	1753
ENSG00000170381.14	*SEMA3E*	7.29	3.73E-23	71	515
ENSG00000172819.17	*RARG*	-2.55	4.58E-23	739	290
ENSG00000106211.9	*HSPB1*	-2.51	4.76E-23	2591	1031
ENSG00000135828.11	*RNASEL*	4.74	5.58E-23	15	72
ENSG00000269226.7	*TMSB15B*	3.45	5.86E-23	29	102
ENSG00000049323.16	*LTBP1*	-2.17	6.40E-23	684	315
ENSG00000173041.12	*ZNF680*	-2.52	6.40E-23	202	80
ENSG00000225684.4	*FAM225B*	-2.60	7.16E-23	458	176
ENSG00000166780.11	*BMERB1*	-8.51	7.70E-23	142	17
ENSG00000124664.11	*SPDEF*	-3.14	7.73E-23	623	198
ENSG00000170917.14	*NUDT6*	2.44	8.40E-23	109	267
ENSG00000131196.17	*NFATC1*	-6.18	9.32E-23	92	15
ENSG00000090376.11	*IRAK3*	-3.03	1.03E-22	115	38
ENSG00000168077.14	*SCARA3*	2.49	1.04E-22	429	1066
ENSG00000130635.15	*COL5A1*	-259.13	1.04E-22	61	0
ENSG00000074410.14	*CA12*	-4.20	1.07E-22	216	51
ENSG00000109929.10	*SC5D*	2.13	1.17E-22	501	1070
ENSG00000185761.11	*ADAMTSL5*	2.02	1.21E-22	172	347
ENSG00000147231.14	*RADX*	3.75	1.29E-22	64	240
ENSG00000204590.12	*GNL1*	-2.47	1.49E-22	322	130
ENSG00000165288.11	*BRWD3*	2.11	1.58E-22	243	512

ENSG00000153214.11	*TMEM87B*	-2.28	1.64E-22	1527	669
ENSG00000142347.19	*MYO1F*	-55.38	1.65E-22	70	1
ENSG00000213417.3	*KRTAP2-4*	33.68	1.65E-22	2	70
ENSG00000166147.13	*FBN1*	2.31	1.66E-22	291	673
ENSG00000119778.15	*ATAD2B*	-3.52	2.03E-22	175	50
ENSG00000163513.18	*TGFBR2*	-2.59	2.20E-22	1179	456
ENSG00000142235.10	*LMTK3*	-45.21	2.35E-22	67	1
ENSG00000135452.10	*TSPAN31*	-2.18	2.46E-22	226	103
ENSG00000234745.11	*HLA-B*	-2.54	2.49E-22	2795	1100
ENSG00000132563.16	*REEP2*	-4.87	2.90E-22	87	18
ENSG00000149260.18	*CAPN5*	-2.59	3.20E-22	297	114
ENSG00000181773.7	*GPR3*	-3.90	5.60E-22	112	29
ENSG00000172766.19	*NAA16*	-2.65	6.35E-22	303	114
ENSG00000198824.7	*CHAMP1*	-2.04	7.17E-22	684	336
ENSG00000133101.10	*CCNA1*	-2.80	8.54E-22	253	91
ENSG00000101460.13	*MAP1LC3A*	-8.31	8.67E-22	49	6
ENSG00000171408.14	*PDE7B*	-4.57	9.37E-22	76	17
ENSG00000184254.17	*ALDH1A3*	-9.14	1.20E-21	128	14
ENSG00000055332.18	*EIF2AK2*	-2.02	1.32E-21	598	297
ENSG00000163362.11	*INAVA*	-47.81	1.34E-21	67	1
ENSG00000185875.13	*THNSL1*	-2.05	1.41E-21	235	115
ENSG00000112561.18	*TFEB*	-13.29	1.48E-21	76	6
ENSG00000197696.10	*NMB*	-11.62	1.49E-21	53	5
ENSG00000179630.11	*LACC1*	-2.85	1.50E-21	149	52
ENSG00000119599.17	*DCAF4*	2.17	1.51E-21	227	492
ENSG00000101230.6	*ISM1*	2.09	1.63E-21	142	297
ENSG00000173432.12	*SAA1*	-61.83	1.88E-21	74	1
ENSG00000183828.15	*NUDT14*	-2.01	2.02E-21	227	113
ENSG00000106003.13	*LFNG*	-2.83	2.41E-21	331	117
ENSG00000173267.14	*SNCG*	-7.35	2.45E-21	62	8
ENSG00000156345.17	*CDK20*	7.42	2.66E-21	11	79
ENSG00000152242.11	*C18orf25*	-2.50	3.08E-21	677	271
ENSG00000139044.12	*B4GALNT3*	-17.67	3.18E-21	63	4
ENSG00000119787.14	*ATL2*	-2.04	3.38E-21	982	481
ENSG00000166415.15	*WDR72*	12.10	3.41E-21	5	66
ENSG00000176244.7	*ACBD7*	-3.09	4.16E-21	161	52
ENSG00000060656.20	*PTPRU*	-8.48	4.28E-21	133	16
ENSG00000160886.13	*LY6K*	2.44	4.36E-21	63	154
ENSG00000131095.13	*GFAP*	-51.06	4.37E-21	55	1
ENSG00000090554.13	*FLT3LG*	-6.54	4.73E-21	54	8
ENSG00000100345.21	*MYH9*	2.40	5.05E-21	208	500
ENSG00000185432.12	*METTL7A*	-5.07	5.94E-21	137	27
ENSG00000168237.18	*GLYCTK*	-2.38	6.01E-21	165	69

ENSG00000257594.4	*GALNT4*	-2.06	6.22E-21	314	153
ENSG00000115808.12	*STRN*	-2.04	6.59E-21	662	325
ENSG00000226328.7	*NUP50-DT*	2.06	6.93E-21	83	172
ENSG00000144152.13	*FBLN7*	-37.06	8.57E-21	59	2
ENSG00000089486.17	*CDIP1*	-4.75	8.80E-21	473	100
ENSG00000139971.15	*ARMH4*	3.05	9.30E-21	77	236
ENSG00000104903.5	*LYL1*	-4.73	9.46E-21	56	12
ENSG00000108840.15	*HDAC5*	-2.20	9.60E-21	236	107
ENSG00000172201.12	*ID4*	4.10	1.08E-20	58	239
ENSG00000183580.10	*FBXL7*	300.57	1.25E-20	0	75
ENSG00000179841.8	*AKAP5*	-4.64	1.41E-20	91	20
ENSG00000171103.11	*TRMT61B*	-2.28	1.83E-20	152	67
ENSG00000244306.11	*DUXAP10*	-347.17	2.08E-20	67	0
ENSG00000099139.13	*PCSK5*	11.47	2.26E-20	6	66
ENSG00000148180.19	*GSN*	-5.59	2.36E-20	296	53
ENSG00000136153.20	*LMO7*	-2.03	2.46E-20	2620	1291
ENSG00000117069.15	*ST6GALNAC5*	9.38	2.48E-20	16	148
ENSG00000160326.14	*SLC2A6*	-2.12	2.85E-20	291	137
ENSG00000178150.10	*ZNF114*	-2.89	2.92E-20	823	284
ENSG00000161513.12	*FDXR*	-2.53	2.93E-20	129	51
ENSG00000079263.19	*SP140*	-2.80	3.30E-20	128	46
ENSG00000237807.4	*AC022034.1*	-2.23	3.34E-20	483	216
ENSG00000185112.6	*FAM43A*	-4.76	3.48E-20	302	64
ENSG00000254979.5	*AP000781.2*	6.99	4.11E-20	7	51
ENSG00000166831.9	*RBPMS2*	-43.25	4.36E-20	56	1
ENSG00000169116.11	*PARM1*	3.00	4.76E-20	69	207
ENSG00000129103.18	*SUMF2*	-2.11	4.91E-20	999	474
ENSG00000115041.13	*KCNIP3*	-5.59	5.51E-20	91	16
ENSG00000102595.20	*UGGT2*	-2.22	5.82E-20	296	134
ENSG00000173926.6	*MARCHF3*	-2.25	7.45E-20	303	135
ENSG00000198963.11	*RORB*	4.06	7.47E-20	19	77
ENSG00000134569.10	*LRP4*	-14.71	7.60E-20	102	7
ENSG00000010810.17	*FYN*	2.04	8.00E-20	658	1345
ENSG00000114812.13	*VIPR1*	-100.83	8.16E-20	84	1
ENSG00000114315.4	*HES1*	-2.23	9.00E-20	241	108
ENSG00000214049.8	*UCA1*	-241.36	9.49E-20	106	0
ENSG00000154930.15	*ACSS1*	-2.99	1.07E-19	161	54
ENSG00000144485.11	*HES6*	-3.08	1.08E-19	124	40
ENSG00000264230.9	*ANXA8L1*	-15.06	1.13E-19	63	4
ENSG00000135596.18	*MICAL1*	2.19	1.25E-19	273	598
ENSG00000157303.11	*SUSD3*	-112.12	1.50E-19	83	1
ENSG00000108679.13	*LGALS3BP*	-2.28	1.81E-19	4895	2143
ENSG00000176595.4	*KBTBD11*	-3.17	1.86E-19	139	44

ENSG00000102996.5	*MMP15*	-3.99	2.04E-19	79	20
ENSG00000107882.11	*SUFU*	-6.44	2.24E-19	63	10
ENSG00000215845.11	*TSTD1*	-233.15	2.72E-19	45	0
ENSG00000159314.11	*ARHGAP27*	-2.37	2.96E-19	427	180
ENSG00000166741.7	*NNMT*	-3.50	4.17E-19	168	48
ENSG00000068724.17	*TTC7A*	-2.41	4.31E-19	401	167
ENSG00000082397.17	*EPB41L3*	889.89	4.38E-19	0	371
ENSG00000146197.9	*SCUBE3*	-28.63	4.95E-19	45	2
ENSG00000171222.10	*SCAND1*	-2.91	5.16E-19	141	49
ENSG00000225756.1	*DBH-AS1*	-6.81	5.59E-19	44	6
ENSG00000051825.15	*MPHOSPH9*	-2.35	5.76E-19	1068	454
ENSG00000099864.18	*PALM*	-229.18	6.04E-19	64	0
ENSG00000147246.10	*HTR2C*	230.70	6.43E-19	0	40
ENSG00000144868.13	*TMEM108*	263.11	6.47E-19	0	64
ENSG00000170439.7	*METTL7B*	15.71	7.01E-19	3	42
ENSG00000124177.15	*CHD6*	-2.23	7.80E-19	840	377
ENSG00000198478.8	*SH3BGRL2*	2.52	7.87E-19	66	167
ENSG00000074527.12	*NTN4*	2.03	9.53E-19	768	1560
ENSG00000206538.9	*VGLL3*	3.70	9.64E-19	51	189
ENSG00000170801.10	*HTRA3*	-221.26	9.90E-19	59	0
ENSG00000156453.13	*PCDH1*	-12.41	1.01E-18	50	4
ENSG00000184985.16	*SORCS2*	-156.78	1.05E-18	99	1
ENSG00000204019.5	*CT83*	2.57	1.17E-18	49	126
ENSG00000150967.18	*ABCB9*	-4.10	1.20E-18	217	53
ENSG00000241472.7	*PTPRG-AS1*	3.88	1.21E-18	75	293
ENSG00000265190.6	*ANXA8*	-15.67	1.35E-18	54	3
ENSG00000164048.14	*ZNF589*	-2.63	1.45E-18	165	63
ENSG00000271147.8	*ARMCX5-GPRASP2*	3.42	1.58E-18	35	121
ENSG00000144026.12	*ZNF514*	-2.26	1.79E-18	367	162
ENSG00000240184.7	*PCDHGC3*	-3.76	1.79E-18	202	54
ENSG00000197249.13	*SERPINA1*	-285.25	1.81E-18	55	0
ENSG00000187922.14	*LCN10*	-242.14	2.12E-18	47	0
ENSG00000244045.13	*TMEM199*	-2.08	2.21E-18	497	239
ENSG00000115226.10	*FNDC4*	-38.95	2.31E-18	48	1
ENSG00000135299.17	*ANKRD6*	2.46	2.33E-18	56	137
ENSG00000135373.12	*EHF*	-88.88	2.38E-18	49	1
ENSG00000107614.22	*TRDMT1*	-2.87	2.43E-18	269	94
ENSG00000100478.15	*AP4S1*	2.07	2.64E-18	97	200
ENSG00000163017.14	*ACTG2*	50.98	2.65E-18	1	48
ENSG00000136999.5	*CCN3*	2.10	2.75E-18	421	885
ENSG00000197381.16	*ADARB1*	-2.21	2.77E-18	340	154
ENSG00000019549.13	*SNAI2*	2.06	2.88E-18	224	462

ENSG00000136100.14	*VPS36*	-2.02	2.94E-18	615	305
ENSG00000167972.14	*ABCA3*	2.20	3.12E-18	225	495
ENSG00000140379.8	*BCL2A1*	237.08	3.99E-18	0	41
ENSG00000197183.14	*NOL4L*	-12.58	4.04E-18	104	8
ENSG00000124429.18	*POF1B*	211.71	4.08E-18	0	37
ENSG00000231527.7	*FAM27C*	2.81	4.26E-18	46	129
ENSG00000173349.6	*SFT2D3*	-2.39	4.27E-18	108	45
ENSG00000181982.18	*CCDC149*	2.56	4.30E-18	138	354
ENSG00000147650.11	*LRP12*	-3.04	4.67E-18	913	300
ENSG00000198053.11	*SIRPA*	-6.19	5.23E-18	58	9
ENSG00000092929.11	*UNC13D*	-2.72	5.76E-18	284	104
ENSG00000182272.12	*B4GALNT4*	-26.42	6.37E-18	61	2
ENSG00000185499.16	*MUC1*	-6.26	6.57E-18	50	8
ENSG00000184602.6	*SNN*	-2.77	6.92E-18	146	53
ENSG00000182983.15	*ZNF662*	3.48	8.21E-18	21	73
ENSG00000074219.13	*TEAD2*	-2.79	8.69E-18	343	123
ENSG00000010704.18	*HFE*	-4.59	1.08E-17	101	22
ENSG00000110321.17	*EIF4G2*	2.06	1.21E-17	753	1551
ENSG00000196814.15	*MVB12B*	-3.11	1.33E-17	117	38
ENSG00000170786.12	*SDR16C5*	7.17	1.35E-17	9	68
ENSG00000175087.10	*PDIK1L*	-2.62	1.50E-17	248	95
ENSG00000189120.5	*SP6*	-3.84	1.69E-17	104	27
ENSG00000251281.1	*AC034223.2*	4.63	1.71E-17	12	54
ENSG00000076351.13	*SLC46A1*	-3.07	1.89E-17	425	139
ENSG00000160867.15	*FGFR4*	-12.71	1.96E-17	53	4
ENSG00000074964.17	*ARHGEF10L*	-11.92	2.18E-17	71	6
ENSG00000182809.10	*CRIP2*	-16.30	2.28E-17	71	4
ENSG00000213523.10	*SRA1*	2.06	2.30E-17	226	465
ENSG00000176658.17	*MYO1D*	15.00	2.59E-17	10	148
ENSG00000132530.17	*XAF1*	-11.17	2.68E-17	42	4
ENSG00000215146.5	*BX322639.1*	-3.35	2.77E-17	100	30
ENSG00000011677.13	*GABRA3*	185.21	2.79E-17	0	32
ENSG00000196754.12	*S100A2*	-2.08	2.80E-17	575	276
ENSG00000120832.10	*MTERF2*	-2.45	2.86E-17	130	53
ENSG00000115109.14	*EPB41L5*	-2.42	2.93E-17	267	110
ENSG00000175315.3	*CST6*	-5.86	3.01E-17	100	17
ENSG00000169429.11	*CXCL8*	2.10	3.41E-17	121	254
ENSG00000160190.14	*SLC37A1*	-5.25	3.67E-17	80	15
ENSG00000204435.13	*CSNK2B*	-2.01	4.30E-17	345	172
ENSG00000268119.6	*AC010615.2*	-89.88	4.33E-17	61	1
ENSG00000003509.16	*NDUFAF7*	-2.41	4.78E-17	180	74
ENSG00000171448.9	*ZBTB26*	-2.59	5.01E-17	149	58
ENSG00000129219.14	*PLD2*	-2.19	5.20E-17	329	150

ENSG00000130720.13	*FIBCD1*	-5.01	5.52E-17	58	12
ENSG00000121753.12	*ADGRB2*	-25.25	6.14E-17	45	2
ENSG00000204261.9	*PSMB8-AS1*	-6.09	6.19E-17	47	8
ENSG00000102710.20	*SUPT20H*	-2.09	6.38E-17	771	369
ENSG00000119772.16	*DNMT3A*	-3.93	8.25E-17	171	44
ENSG00000206195.11	*DUXAP8*	-213.81	8.27E-17	42	0
ENSG00000104783.14	*KCNN4*	-2.02	1.00E-16	620	306
ENSG00000069869.16	*NEDD4*	3.60	1.09E-16	233	838
ENSG00000198399.14	*ITSN2*	-2.01	1.13E-16	602	299
ENSG00000082512.15	*TRAF5*	-2.05	1.14E-16	371	181
ENSG00000196917.6	*HCAR1*	-6.62	1.14E-16	50	8
ENSG00000115902.11	*SLC1A4*	-2.04	1.21E-16	180	88
ENSG00000186517.14	*ARHGAP30*	4.51	1.31E-16	12	54
ENSG00000145246.14	*ATP10D*	-2.43	1.49E-16	922	380
ENSG00000137413.16	*TAF8*	-2.51	1.49E-16	450	179
ENSG00000163909.8	*HEYL*	7.76	1.61E-16	5	40
ENSG00000213412.3	*HNRNPA1P33*	-12.37	1.97E-16	39	3
ENSG00000136152.15	*COG3*	-2.56	2.63E-16	459	180
ENSG00000198932.13	*GPRASP1*	4.02	2.80E-16	12	50
ENSG00000154917.11	*RAB6B*	23.64	2.84E-16	5	120
ENSG00000170498.9	*KISS1*	2.80	2.86E-16	304	853
ENSG00000197457.10	*STMN3*	-2.18	2.91E-16	336	154
ENSG00000205362.11	*MT1A*	-156.02	2.97E-16	30	0
ENSG00000148344.11	*PTGES*	-3.21	2.97E-16	424	132
ENSG00000177679.16	*SRRM3*	-126.00	3.13E-16	67	1
ENSG00000151715.8	*TMEM45B*	-35.50	3.18E-16	41	1
ENSG00000173275.13	*ZNF449*	2.51	3.30E-16	70	174
ENSG00000088387.19	*DOCK9*	-2.66	3.43E-16	382	144
ENSG00000138030.13	*KHK*	-2.41	3.74E-16	167	69
ENSG00000083290.20	*ULK2*	-15.46	3.88E-16	189	12
ENSG00000069424.15	*KCNAB2*	2.16	3.89E-16	163	353
ENSG00000078900.15	*TP73*	-93.99	4.02E-16	65	1
ENSG00000185885.16	*IFITM1*	-86.92	4.15E-16	61	1
ENSG00000223784.2	*LINP1*	2.27	4.34E-16	162	368
ENSG00000135454.14	*B4GALNT1*	-5.08	4.41E-16	71	14
ENSG00000116183.11	*PAPPA2*	3.72	4.48E-16	25	93
ENSG00000179588.9	*ZFPM1*	-3.91	4.97E-16	104	27
ENSG00000116132.12	*PRRX1*	-186.74	5.12E-16	47	0
ENSG00000136044.12	*APPL2*	-2.16	5.22E-16	648	300
ENSG00000181444.13	*ZNF467*	-6.50	5.38E-16	53	8
ENSG00000135929.9	*CYP27A1*	-3.53	5.56E-16	69	19
ENSG00000105497.8	*ZNF175*	-3.13	5.56E-16	466	149
ENSG00000178685.14	*PARP10*	-4.23	5.84E-16	294	69

ENSG00000068650.18	*ATP11A*	-2.64	5.86E-16	577	218
ENSG00000152229.18	*PSTPIP2*	-10.71	6.19E-16	50	5
ENSG00000173193.15	*PARP14*	-3.13	6.59E-16	460	147
ENSG00000164181.14	*ELOVL7*	2.58	6.65E-16	102	263
ENSG00000163214.21	*DHX57*	-2.04	7.09E-16	391	192
ENSG00000146966.13	*DENND2A*	-44.73	7.87E-16	47	1
ENSG00000175906.5	*ARL4D*	-2.17	8.50E-16	247	114
ENSG00000165025.15	*SYK*	98.49	8.66E-16	1	54
ENSG00000163795.14	*ZNF513*	-4.11	8.79E-16	61	15
ENSG00000151150.22	*ANK3*	-8.12	8.90E-16	97	12
ENSG00000117013.17	*KCNQ4*	-159.58	8.93E-16	31	0
ENSG00000167889.12	*MGAT5B*	-2.32	9.41E-16	190	82
ENSG00000101104.12	*PABPC1L*	-2.56	9.50E-16	241	94
ENSG00000180287.16	*PLD5*	2.27	9.51E-16	81	184
ENSG00000133069.17	*TMCC2*	2.15	1.14E-15	121	259
ENSG00000105514.8	*RAB3D*	-2.96	1.36E-15	74	25
ENSG00000187764.11	*SEMA4D*	-6.03	1.46E-15	99	16
ENSG00000165376.10	*CLDN2*	-14.63	1.50E-15	46	3
ENSG00000186462.9	*NAP1L2*	146.75	1.53E-15	0	69
ENSG00000151692.15	*RNF144A*	-218.52	1.57E-15	42	0
ENSG00000259091.1	*LINC00517*	155.21	1.76E-15	0	27
ENSG00000163694.15	*RBM47*	-3.34	2.03E-15	144	43
ENSG00000170369.4	*CST2*	-154.13	2.04E-15	41	0
ENSG00000273760.1	*AC245041.1*	-37.64	2.11E-15	39	1
ENSG00000081189.15	*MEF2C*	-8.35	2.30E-15	132	16
ENSG00000162981.14	*LRATD1*	3.93	2.35E-15	21	84
ENSG00000026950.17	*BTN3A1*	-3.41	2.37E-15	205	60
ENSG00000134321.12	*RSAD2*	-152.54	2.44E-15	29	0
ENSG00000137880.6	*GCHFR*	-10.41	2.46E-15	34	3
ENSG00000113212.7	*PCDHB7*	11.19	2.57E-15	3	32
ENSG00000233493.4	*TMEM238*	-2.84	2.77E-15	73	26
ENSG00000160094.15	*ZNF362*	-2.08	3.10E-15	220	105
ENSG00000101974.14	*ATP11C*	3.43	3.37E-15	208	714
ENSG00000173581.7	*CCDC106*	-2.33	3.49E-15	216	93
ENSG00000163568.15	*AIM2*	2.48	3.64E-15	42	104
ENSG00000139793.18	*MBNL2*	-3.03	3.77E-15	211	70
ENSG00000157514.16	*TSC22D3*	2.40	3.94E-15	97	233
ENSG00000205426.10	*KRT81*	2.07	4.02E-15	2521	5210
ENSG00000172817.4	*CYP7B1*	181.25	4.07E-15	0	32
ENSG00000183439.9	*TRIM61*	-176.02	4.27E-15	34	0
ENSG00000176155.19	*CCDC57*	-2.49	4.34E-15	347	139
ENSG00000147100.11	*SLC16A2*	3.25	4.34E-15	26	85
ENSG00000120662.16	*MTRF1*	-2.56	4.34E-15	95	37

ENSG00000121743.4	*GJA3*	-2.15	4.52E-15	192	90
ENSG00000078403.17	*MLLT10*	-2.44	4.73E-15	572	235
ENSG00000143333.7	*RGS16*	70.08	4.77E-15	1	44
ENSG00000198417.7	*MT1F*	-26.20	5.25E-15	31	1
ENSG00000215039.7	*CD27-AS1*	-2.67	5.55E-15	109	41
ENSG00000100344.11	*PNPLA3*	-6.15	5.84E-15	40	6
ENSG00000171462.15	*DLK2*	-3.18	6.16E-15	92	29
ENSG00000269958.1	*AL049840.5*	-2.36	6.59E-15	116	49
ENSG00000099337.5	*KCNK6*	-5.75	7.82E-15	151	26
ENSG00000107551.21	*RASSF4*	-2.73	9.14E-15	194	71
ENSG00000259953.2	*AL138756.1*	-2.64	1.00E-14	77	29
ENSG00000183876.9	*ARSI*	-108.51	1.03E-14	56	1
ENSG00000197467.14	*COL13A1*	-2.13	1.22E-14	972	456
ENSG00000136848.17	*DAB2IP*	-11.58	1.27E-14	574	50
ENSG00000196843.16	*ARID5A*	-2.29	1.32E-14	113	49
ENSG00000090339.9	*ICAM1*	-4.72	1.34E-14	128	27
ENSG00000164283.13	*ESM1*	120.73	1.35E-14	0	33
ENSG00000165716.11	*DIPK1B*	-132.94	1.39E-14	26	0
ENSG00000151468.11	*CCDC3*	-2.05	1.51E-14	151	74
ENSG00000070182.21	*SPTB*	10.06	1.55E-14	4	36
ENSG00000132749.11	*TESMIN*	2.10	1.63E-14	88	185
ENSG00000180616.9	*SSTR2*	-98.13	1.64E-14	51	1
ENSG00000204060.7	*FOXO6*	-10.31	1.66E-14	32	3
ENSG00000203950.6	*RTL8A*	2.86	1.90E-14	115	329
ENSG00000147394.18	*ZNF185*	2.06	2.05E-14	1399	2884
ENSG00000259495.3	*AC016705.2*	7.73	2.11E-14	6	48
ENSG00000102934.10	*PLLP*	-14.67	2.13E-14	51	3
ENSG00000157693.15	*TMEM268*	-2.61	2.18E-14	157	60
ENSG00000106665.15	*CLIP2*	-2.34	2.22E-14	568	243
ENSG00000174307.7	*PHLDA3*	-3.44	2.30E-14	236	69
ENSG00000142494.13	*SLC47A1*	-21.69	2.33E-14	35	2
ENSG00000164877.19	*MICALL2*	-2.25	2.43E-14	191	85
ENSG00000163751.4	*CPA3*	59.77	2.51E-14	1	33
ENSG00000143353.12	*LYPLAL1*	2.42	2.68E-14	170	411
ENSG00000101187.16	*SLCO4A1*	-14.35	2.86E-14	380	26
ENSG00000212978.6	*AC016747.1*	2.29	2.87E-14	72	165
ENSG00000064692.19	*SNCAIP*	2.60	3.12E-14	93	242
ENSG00000163898.10	*LIPH*	-3.46	3.14E-14	109	31
ENSG00000164898.13	*FMC1*	-2.21	3.29E-14	166	75
ENSG00000273812.3	*BX640514.2*	-19.38	3.43E-14	27	1
ENSG00000280120.1	*AC073857.1*	-3.09	3.72E-14	59	19
ENSG00000257529.5	*RPL36A-HNRNPH2*	3.10	3.77E-14	188	583

ENSG00000187134.14	*AKR1C1*	-4.83	3.78E-14	77	16
ENSG00000109511.12	*ANXA10*	-7.03	3.94E-14	33	5
ENSG00000131018.24	*SYNE1*	2.57	3.99E-14	545	1404
ENSG00000177409.12	*SAMD9L*	-3.46	4.03E-14	367	106
ENSG00000178531.6	*CTXN1*	-2.41	4.16E-14	324	134
ENSG00000160233.8	*LRRC3*	-115.53	4.23E-14	22	0
ENSG00000178814.17	*OPLAH*	-3.64	4.31E-14	55	15
ENSG00000153071.15	*DAB2*	2.09	4.37E-14	498	1040
ENSG00000163376.11	*KBTBD8*	112.01	4.55E-14	0	49
ENSG00000189050.16	*RNFT1*	-2.28	4.59E-14	147	64
ENSG00000102763.18	*VWA8*	-2.25	5.01E-14	336	149
ENSG00000103024.7	*NME3*	-2.41	5.06E-14	145	60
ENSG00000057657.17	*PRDM1*	4.33	5.14E-14	13	58
ENSG00000197632.9	*SERPINB2*	3.44	5.40E-14	16	57
ENSG00000269940.1	*AL049840.4*	-2.43	5.78E-14	78	32
ENSG00000231290.6	*APCDD1L-DT*	-27.79	5.81E-14	30	1
ENSG00000112902.12	*SEMA5A*	8.04	6.47E-14	8	67
ENSG00000165730.16	*STOX1*	-9.84	6.60E-14	33	3
ENSG00000237505.8	*PKN2-AS1*	22.52	6.86E-14	1	25
ENSG00000108846.16	*ABCC3*	-4.45	6.96E-14	278	62
ENSG00000211772.11	*TRBC2*	-109.10	7.40E-14	41	0
ENSG00000102109.9	*PCSK1N*	-107.26	9.09E-14	29	0
ENSG00000154914.17	*USP43*	-2.49	1.00E-13	103	42
ENSG00000205181.7	*LINC00654*	2.45	1.00E-13	79	195
ENSG00000135363.12	*LMO2*	4.14	1.05E-13	10	43
ENSG00000157833.13	*GAREM2*	-27.31	1.06E-13	33	1
ENSG00000185513.16	*L3MBTL1*	-6.13	1.07E-13	73	12
ENSG00000110888.17	*CAPRIN2*	-2.21	1.19E-13	740	335
ENSG00000156959.9	*LHFPL4*	4.21	1.27E-13	43	182
ENSG00000164850.15	*GPER1*	-2.99	1.39E-13	71	24
ENSG00000145349.17	*CAMK2D*	2.25	1.42E-13	355	799
ENSG00000214575.9	*CPEB1*	157.82	1.47E-13	0	28
ENSG00000136928.7	*GABBR2*	11.05	1.47E-13	2	27
ENSG00000179799.9	*OR7E22P*	6.58	1.52E-13	5	35
ENSG00000153012.12	*LGI2*	17.66	1.62E-13	2	28
ENSG00000179085.7	*DPM3*	-3.06	1.67E-13	72	24
ENSG00000134242.16	*PTPN22*	2.68	1.85E-13	27	72
ENSG00000111801.16	*BTN3A3*	-4.13	1.86E-13	131	32
ENSG00000069667.16	*RORA*	13.26	1.96E-13	6	81
ENSG00000165949.12	*IFI27*	-37.12	2.00E-13	74	2
ENSG00000163803.13	*PLB1*	-4.79	2.14E-13	78	16
ENSG00000143786.8	*CNIH3*	-2.09	2.22E-13	199	95
ENSG00000148832.16	*PAOX*	-6.30	2.25E-13	54	9

ENSG00000139292.13	*LGR5*	-8.62	2.33E-13	44	5
ENSG00000137709.10	*POU2F3*	23.90	2.42E-13	1	32
ENSG00000230836.1	*LINC01293*	7.86	2.44E-13	5	40
ENSG00000141447.18	*OSBPL1A*	-2.08	2.46E-13	354	170
ENSG00000164078.13	*MST1R*	-2.61	2.47E-13	257	98
ENSG00000151474.23	*FRMD4A*	-2.21	2.60E-13	767	348
ENSG00000162892.16	*IL24*	-9.16	2.73E-13	36	4
ENSG00000213462.5	*ERV3-1*	-11.99	2.75E-13	34	3
ENSG00000087510.7	*TFAP2C*	-121.04	2.86E-13	23	0
ENSG00000227372.12	*TP73-AS1*	-3.52	2.88E-13	398	113
ENSG00000178498.16	*DTX3*	-2.03	3.14E-13	295	145
ENSG00000149972.11	*CNTN5*	54.82	3.47E-13	1	28
ENSG00000128610.12	*FEZF1*	2.04	3.62E-13	64	131
ENSG00000110446.11	*SLC15A3*	-22.92	3.68E-13	43	2
ENSG00000064300.9	*NGFR*	-119.73	3.75E-13	23	0
ENSG00000129675.16	*ARHGEF6*	4.15	3.77E-13	14	58
ENSG00000169372.13	*CRADD*	-2.16	3.77E-13	138	64
ENSG00000269973.1	*AC010969.2*	-2.22	4.22E-13	96	43
ENSG00000186480.13	*INSIG1*	2.42	4.27E-13	527	1277
ENSG00000144834.14	*TAGLN3*	4.03	4.58E-13	11	46
ENSG00000284024.2	*HSPA14*	-2.13	4.85E-13	169	79
ENSG00000197536.11	*C5orf56*	-3.78	5.71E-13	43	11
ENSG00000133135.14	*RNF128*	-3.18	5.83E-13	55	17
ENSG00000135477.11	*KRT87P*	2.57	5.84E-13	54	139
ENSG00000232677.8	*LINC00665*	-6.92	5.85E-13	86	12
ENSG00000153064.12	*BANK1*	2.12	5.95E-13	95	202
ENSG00000141524.15	*TMC6*	-6.73	6.06E-13	102	15
ENSG00000213689.14	*TREX1*	-2.50	6.61E-13	120	48
ENSG00000136114.17	*THSD1*	-5.82	6.75E-13	45	8
ENSG00000154889.17	*MPPE1*	2.84	6.85E-13	31	88
ENSG00000005810.18	*MYCBP2*	-2.63	7.00E-13	469	178
ENSG00000237943.7	*PRKCQ-AS1*	5.33	7.65E-13	14	77
ENSG00000127946.17	*HIP1*	-2.56	7.83E-13	315	123
ENSG00000080493.17	*SLC4A4*	2.68	7.93E-13	73	196
ENSG00000161642.17	*ZNF385A*	-7.47	8.22E-13	173	23
ENSG00000100711.13	*ZFYVE21*	-2.76	8.69E-13	146	53
ENSG00000133142.17	*TCEAL4*	2.31	8.80E-13	309	713
ENSG00000169306.10	*IL1RAPL1*	-2.38	8.98E-13	130	55
ENSG00000103528.17	*SYT17*	3.54	9.04E-13	33	116
ENSG00000230795.3	*HLA-K*	-2.43	1.01E-12	81	33
ENSG00000152377.14	*SPOCK1*	6.23	1.03E-12	23	144
ENSG00000158106.14	*RHPN1*	-3.32	1.07E-12	123	37
ENSG00000183688.4	*RFLNB*	-96.98	1.33E-12	26	0

ENSG00000235174.1	*RPL39P3*	2.80	1.50E-12	28	79
ENSG00000174939.11	*ASPHD1*	-2.07	1.55E-12	224	108
ENSG00000166444.19	*ST5*	-2.24	1.70E-12	353	158
ENSG00000166432.15	*ZMAT1*	5.09	1.78E-12	15	74
ENSG00000111679.17	*PTPN6*	-19.70	1.85E-12	30	2
ENSG00000267080.6	*ASB16-AS1*	-2.30	2.03E-12	112	49
ENSG00000241749.4	*RPSAP52*	2.28	2.06E-12	37	84
ENSG00000125170.11	*DOK4*	-76.94	2.12E-12	69	1
ENSG00000250132.6	*AC004803.1*	-5.01	2.21E-12	33	7
ENSG00000197261.11	*C6orf141*	2.64	2.43E-12	49	129
ENSG00000164841.5	*TMEM74*	-2.82	2.56E-12	66	23
ENSG00000056998.20	*GYG2*	-121.81	2.64E-12	24	0
ENSG00000006747.15	*SCIN*	-11.42	2.82E-12	32	3
ENSG00000182632.15	*CCNYL2*	-123.36	2.89E-12	24	0
ENSG00000078589.13	*P2RY10*	126.39	3.38E-12	0	22
ENSG00000123843.13	*C4BPB*	-2.08	3.48E-12	672	323
ENSG00000075240.17	*GRAMD4*	-2.39	3.66E-12	269	113
ENSG00000084676.15	*NCOA1*	-2.88	3.69E-12	250	87
ENSG00000176438.12	*SYNE3*	-2.14	3.76E-12	249	116
ENSG00000161544.10	*CYGB*	-86.18	4.17E-12	27	0
ENSG00000159674.12	*SPON2*	-9.54	4.28E-12	28	3
ENSG00000255310.2	*AF131215.5*	2.46	4.41E-12	34	84
ENSG00000204634.12	*TBC1D8*	-4.67	4.46E-12	115	25
ENSG00000185215.9	*TNFAIP2*	-7.31	4.77E-12	88	12
ENSG00000124006.15	*OBSL1*	-3.42	5.26E-12	559	163
ENSG00000030304.14	*MUSK*	-10.40	5.40E-12	38	4
ENSG00000135469.13	*COQ10A*	-2.60	5.41E-12	147	57
ENSG00000167703.14	*SLC43A2*	-2.08	5.41E-12	116	56
ENSG00000261824.7	*LINC00662*	2.03	5.61E-12	158	320
ENSG00000248771.5	*SMIM31*	8.39	5.79E-12	4	35
ENSG00000149573.9	*MPZL2*	7.30	5.89E-12	10	76
ENSG00000260917.1	*AL158212.3*	-2.16	6.33E-12	100	46
ENSG00000172794.20	*RAB37*	-25.92	6.98E-12	28	1
ENSG00000271013.1	*LRRC37A9P*	6.79	7.06E-12	4	30
ENSG00000152457.18	*DCLRE1C*	-2.08	7.44E-12	368	176
ENSG00000277734.8	*TRAC*	2.73	8.37E-12	22	60
ENSG00000101986.12	*ABCD1*	-2.06	8.44E-12	264	128
ENSG00000171840.12	*NINJ2*	-3.65	8.49E-12	55	15
ENSG00000176428.6	*VPS37D*	-6.59	9.45E-12	26	4
ENSG00000286519.1	*AC009236.1*	-30.74	1.00E-11	27	1
ENSG00000227695.6	*DNMBP-AS1*	-12.98	1.02E-11	24	2
ENSG00000258464.2	*AL160237.1*	11.98	1.02E-11	2	22
ENSG00000103942.13	*HOMER2*	2.02	1.06E-11	263	530

ENSG00000164530.15	*PI16*	-77.11	1.10E-11	36	0
ENSG00000233251.8	*AC007743.1*	76.84	1.13E-11	0	20
ENSG00000263465.4	*SRSF8*	2.05	1.18E-11	58	118
ENSG00000281091.3	*AL117327.1*	4.25	1.19E-11	11	46
ENSG00000166387.13	*PPFIBP2*	4.21	1.50E-11	17	74
ENSG00000170954.11	*ZNF415*	-2.14	1.65E-11	137	64
ENSG00000115598.10	*IL1RL2*	2.71	1.82E-11	19	52
ENSG00000272121.1	*AC006058.3*	-2.60	2.06E-11	67	26
ENSG00000203721.7	*LINC00862*	4.50	2.11E-11	9	42
ENSG00000179862.7	*CITED4*	-8.18	2.17E-11	23	3
ENSG00000107738.20	*VSIR*	-3.81	2.17E-11	115	30
ENSG00000126010.6	*GRPR*	3.74	2.24E-11	9	34
ENSG00000154760.14	*SLFN13*	-2.35	2.25E-11	269	115
ENSG00000123342.16	*MMP19*	-3.02	2.26E-11	57	19
ENSG00000237548.1	*TTLL11-IT1*	3.74	2.30E-11	10	37
ENSG00000183760.11	*ACP7*	-5.35	2.32E-11	30	6
ENSG00000164136.17	*IL15*	-2.90	2.33E-11	56	19
ENSG00000162804.14	*SNED1*	-53.07	2.34E-11	27	1
ENSG00000173110.8	*HSPA6*	3.31	2.37E-11	18	61
ENSG00000257219.6	*LNCOG*	3.52	2.41E-11	12	41
ENSG00000198573.7	*SPANXC*	5.84	2.42E-11	5	30
ENSG00000180739.14	*S1PR5*	-14.43	2.44E-11	23	2
ENSG00000251593.1	*MSNP1*	2.23	2.51E-11	39	86
ENSG00000197191.6	*CYSRT1*	-5.90	2.59E-11	33	6
ENSG00000165511.6	*C10orf25*	2.36	3.15E-11	33	78
ENSG00000163701.19	*IL17RE*	-2.85	3.36E-11	103	36
ENSG00000134324.11	*LPIN1*	-2.79	3.37E-11	582	208
ENSG00000169242.12	*EFNA1*	-3.75	3.43E-11	38	10
ENSG00000181418.8	*DDN*	-4.78	3.66E-11	35	7
ENSG00000107968.10	*MAP3K8*	-2.98	3.90E-11	67	23
ENSG00000120278.16	*PLEKHG1*	90.93	3.98E-11	0	20
ENSG00000267121.6	*AC008105.3*	-3.23	4.08E-11	69	21
ENSG00000270504.1	*AL391422.4*	-2.43	4.16E-11	91	37
ENSG00000106125.14	*MINDY4*	-2.63	4.27E-11	79	30
ENSG00000102048.16	*ASB9*	2.06	4.54E-11	79	162
ENSG00000197442.10	*MAP3K5*	2.56	4.60E-11	137	352
ENSG00000018610.14	*CXorf56*	3.93	4.90E-11	46	182
ENSG00000240489.1	*SETP14*	-2.47	4.92E-11	133	54
ENSG00000107242.19	*PIP5K1B*	22.26	5.00E-11	1	23
ENSG00000226137.5	*BAIAP2-DT*	-2.18	5.31E-11	128	59
ENSG00000282851.2	*BISPR*	-15.60	5.41E-11	28	2
ENSG00000142765.18	*SYTL1*	-4.49	5.87E-11	50	11
ENSG00000135549.15	*PKIB*	2.53	6.03E-11	63	159

ENSG00000198203.10	*SULT1C2*	16.63	6.90E-11	3	50
ENSG00000189350.12	*TOGARAM2*	-10.14	7.05E-11	42	4
ENSG00000234444.10	*ZNF736*	-2.43	7.56E-11	249	103
ENSG00000234773.7	*AC012618.3*	-3.62	8.20E-11	40	11
ENSG00000133466.14	*C1QTNF6*	-2.36	8.75E-11	74	31
ENSG00000269918.1	*AF131215.6*	2.86	8.89E-11	18	51
ENSG00000114646.10	*CSPG5*	-2.04	9.10E-11	249	122
ENSG00000079215.14	*SLC1A3*	-5.08	9.20E-11	38	7
ENSG00000204580.13	*DDR1*	-12.62	9.27E-11	304	24
ENSG00000160469.17	*BRSK1*	-4.45	9.59E-11	75	17
ENSG00000029534.20	*ANK1*	-3.41	9.64E-11	192	56
ENSG00000115415.18	*STAT1*	-2.22	9.86E-11	235	105
ENSG00000153292.16	*ADGRF1*	-6.94	1.09E-10	87	13
ENSG00000260077.1	*AC104794.3*	-6.11	1.11E-10	26	4
ENSG00000166348.18	*USP54*	-4.53	1.15E-10	242	54
ENSG00000225377.6	*NRSN2-AS1*	2.10	1.32E-10	54	113
ENSG00000124225.16	*PMEPA1*	-2.85	1.34E-10	982	345
ENSG00000137745.12	*MMP13*	11.91	1.58E-10	2	25
ENSG00000187607.16	*ZNF286A*	-2.24	1.63E-10	429	191
ENSG00000142920.17	*AZIN2*	-2.43	1.70E-10	171	70
ENSG00000101276.17	*SLC52A3*	117.06	1.70E-10	0	20
ENSG00000165215.6	*CLDN3*	-3.47	1.76E-10	38	11
ENSG00000138083.5	*SIX3*	-19.85	1.80E-10	24	1
ENSG00000136014.12	*USP44*	-2.35	1.98E-10	78	33
ENSG00000006210.7	*CX3CL1*	-106.56	2.06E-10	21	0
ENSG00000138675.16	*FGF5*	2.79	2.40E-10	330	923
ENSG00000171346.16	*KRT15*	2.61	2.41E-10	51	132
ENSG00000105371.10	*ICAM4*	-50.42	2.48E-10	27	1
ENSG00000115207.13	*GTF3C2*	-2.50	2.48E-10	85	34
ENSG00000176170.13	*SPHK1*	-2.19	2.66E-10	236	108
ENSG00000136327.7	*NKX2-8*	4.70	2.75E-10	6	27
ENSG00000116525.14	*TRIM62*	-2.22	2.76E-10	141	64
ENSG00000163093.12	*BBS5*	-2.06	2.83E-10	129	63
ENSG00000012171.20	*SEMA3B*	-3.08	2.95E-10	365	119
ENSG00000101888.11	*NXT2*	3.62	3.03E-10	10	38
ENSG00000085552.17	*IGSF9*	11.57	3.08E-10	2	28
ENSG00000054219.11	*LY75*	-47.00	3.18E-10	23	0
ENSG00000231528.3	*FAM225A*	-2.38	3.20E-10	611	257
ENSG00000105767.3	*CADM4*	-2.98	3.38E-10	44	15
ENSG00000156265.15	*MAP3K7CL*	2.04	3.48E-10	43	88
ENSG00000221821.4	*C6orf226*	-2.12	3.49E-10	103	49
ENSG00000081665.14	*ZNF506*	-2.16	3.59E-10	210	97
ENSG00000180787.6	*ZFP3*	-4.45	3.73E-10	26	6

ENSG00000130707.18	*ASS1*	-3.80	4.03E-10	59	15
ENSG00000141627.13	*DYM*	-2.15	4.27E-10	330	153
ENSG00000113578.18	*FGF1*	2.62	4.33E-10	108	283
ENSG00000114923.17	*SLC4A3*	-5.42	4.71E-10	27	5
ENSG00000125971.16	*DYNLRB1*	-2.02	5.05E-10	115	57
ENSG00000173890.17	*GPR160*	2.47	5.46E-10	63	155
ENSG00000181284.3	*TMEM102*	-2.51	5.88E-10	52	21
ENSG00000158373.8	*HIST1H2BD*	-3.27	5.94E-10	75	23
ENSG00000115525.18	*ST3GAL5*	-2.28	6.70E-10	97	42
ENSG00000156510.13	*HKDC1*	-3.50	7.27E-10	85	24
ENSG00000171295.13	*ZNF440*	-2.13	8.17E-10	237	112
ENSG00000196367.13	*TRRAP*	-2.00	8.41E-10	1749	872
ENSG00000182054.9	*IDH2*	-2.65	8.69E-10	138	52
ENSG00000107902.14	*LHPP*	-7.08	9.61E-10	48	7
ENSG00000163798.13	*SLC4A1AP*	-2.60	9.72E-10	283	109
ENSG00000125845.7	*BMP2*	2.08	1.03E-09	41	86
ENSG00000179300.4	*RTL3*	4.44	1.07E-09	7	30
ENSG00000196406.4	*SPANXD*	24.26	1.15E-09	1	19
ENSG00000117143.13	*UAP1*	4.57	1.22E-09	17	79
ENSG00000071073.13	*MGAT4A*	-3.77	1.25E-09	127	34
ENSG00000164743.5	*C8orf48*	2.04	1.26E-09	39	79
ENSG00000163082.10	*SGPP2*	3.95	1.35E-09	9	34
ENSG00000163710.9	*PCOLCE2*	-2.82	1.36E-09	74	26
ENSG00000062524.16	*LTK*	-3.71	1.38E-09	72	19
ENSG00000285304.1	*Z83844.3*	-184.31	1.41E-09	35	0
ENSG00000226835.3	*ARHGAP29-AS1*	9.35	1.44E-09	2	22
ENSG00000248323.7	*LUCAT1*	-2.59	1.51E-09	115	44
ENSG00000286964.1	*AL136169.1*	3.64	1.53E-09	8	28
ENSG00000266208.1	*AC080112.1*	-3.39	1.70E-09	65	19
ENSG00000286523.1	*AL022151.1*	58.38	1.72E-09	0	20
ENSG00000005243.10	*COPZ2*	-17.68	1.73E-09	24	1
ENSG00000107821.14	*KAZALD1*	-2.05	1.75E-09	111	54
ENSG00000169247.12	*SH3TC2*	-2.53	1.77E-09	403	160
ENSG00000286177.1	*AC011462.5*	-2.43	1.80E-09	54	22
ENSG00000123607.15	*TTC21B*	-2.29	1.86E-09	250	109
ENSG00000149403.12	*GRIK4*	-27.59	1.90E-09	28	1
ENSG00000128271.22	*ADORA2A*	-45.72	1.97E-09	43	1
ENSG00000170006.12	*TMEM154*	2.92	2.08E-09	100	293
ENSG00000272419.6	*LINC01145*	2.12	2.22E-09	117	247
ENSG00000105559.12	*PLEKHA4*	-6.91	2.23E-09	97	14
ENSG00000178026.13	*LRRC75B*	-10.37	2.34E-09	20	2
ENSG00000271614.1	*ATP2B1-AS1*	-3.59	2.39E-09	34	9

ENSG00000232759.1	*AC002480.1*	-4.08	2.39E-09	36	9
ENSG00000183891.6	*TTC32*	-2.51	2.51E-09	65	26
ENSG00000227295.2	*ELL2P1*	2.51	2.62E-09	17	41
ENSG00000169239.13	*CA5B*	-2.51	2.76E-09	170	68
ENSG00000214274.9	*ANG*	2.71	2.81E-09	18	48
ENSG00000120324.9	*PCDHB10*	2.82	2.82E-09	19	53
ENSG00000282057.1	*AC092807.3*	2.11	3.15E-09	72	152
ENSG00000244198.7	*AC004889.1*	-3.48	3.18E-09	101	29
ENSG00000213626.13	*LBH*	-2.01	3.44E-09	143	71
ENSG00000255052.5	*FAM66D*	3.44	3.62E-09	11	38
ENSG00000171914.16	*TLN2*	2.35	3.63E-09	211	497
ENSG00000270977.2	*AC015849.5*	6.48	3.67E-09	7	43
ENSG00000175711.8	*B3GNTL1*	-2.01	3.76E-09	190	94
ENSG00000143194.13	*MAEL*	3.79	3.78E-09	10	36
ENSG00000259439.2	*LINC01833*	-30.00	3.99E-09	20	1
ENSG00000287014.1	*AC087883.2*	6.91	4.13E-09	3	22
ENSG00000227482.1	*AL157702.2*	6.21	4.38E-09	4	22
ENSG00000169302.16	*STK32A*	8.70	4.90E-09	4	38
ENSG00000102760.13	*RGCC*	-3.28	5.14E-09	53	16
ENSG00000124635.8	*HIST1H2BJ*	-8.03	5.23E-09	21	3
ENSG00000196876.17	*SCN8A*	54.64	5.37E-09	0	24
ENSG00000114779.19	*ABHD14B*	-4.51	5.89E-09	192	43
ENSG00000204282.4	*TNRC6C-AS1*	-10.37	7.65E-09	51	5
ENSG00000126858.18	*RHOT1*	-2.03	7.74E-09	310	153
ENSG00000130702.15	*LAMA5*	-4.70	7.84E-09	2901	618
ENSG00000175175.6	*PPM1E*	-2.80	8.13E-09	36	13
ENSG00000109103.11	*UNC119*	-3.48	8.87E-09	138	40
ENSG00000198521.11	*ZNF43*	-2.56	8.87E-09	165	64
ENSG00000184986.11	*TMEM121*	-10.32	8.90E-09	20	2
ENSG00000050438.17	*SLC4A8*	2.62	9.41E-09	62	163
ENSG00000254837.2	*AP001372.2*	2.38	9.43E-09	36	85
ENSG00000065328.16	*MCM10*	-2.02	9.50E-09	913	453
ENSG00000113108.19	*APBB3*	2.30	9.69E-09	63	144
ENSG00000101265.16	*RASSF2*	-5.11	9.81E-09	31	6
ENSG00000155363.18	*MOV10*	-2.67	1.04E-08	183	69
ENSG00000103196.12	*CRISPLD2*	-2.03	1.07E-08	93	46
ENSG00000069020.18	*MAST4*	2.48	1.08E-08	94	234
ENSG00000140398.14	*NEIL1*	-7.67	1.09E-08	43	6
ENSG00000105963.15	*ADAP1*	-2.36	1.11E-08	69	29
ENSG00000068615.18	*REEP1*	2.60	1.11E-08	28	73
ENSG00000232803.1	*SLCO4A1-AS1*	-5.95	1.20E-08	54	9
ENSG00000204792.2	*LINC01291*	6.06	1.24E-08	4	25
ENSG00000169629.12	*RGPD8*	-2.85	1.31E-08	253	89

ENSG00000110693.18	*SOX6*	4.54	1.38E-08	11	49
ENSG00000254300.1	*LINC01111*	5.66	1.41E-08	4	23
ENSG00000272622.2	*AC010735.2*	2.22	1.41E-08	44	97
ENSG00000169126.16	*ARMC4*	-2.47	1.45E-08	135	55
ENSG00000165359.15	*INTS6L*	6.86	1.51E-08	31	215
ENSG00000253669.4	*GASAL1*	-3.21	1.57E-08	36	11
ENSG00000125848.10	*FLRT3*	9.54	1.63E-08	3	29
ENSG00000120738.8	*EGR1*	2.26	1.63E-08	39	89
ENSG00000125384.7	*PTGER2*	-7.48	1.67E-08	25	3
ENSG00000114270.17	*COL7A1*	-6.80	1.71E-08	142	21
ENSG00000138411.13	*HECW2*	2.04	1.81E-08	102	207
ENSG00000171872.5	*KLF17*	5.54	1.85E-08	5	30
ENSG00000170523.3	*KRT83*	2.44	1.94E-08	36	88
ENSG00000155066.16	*PROM2*	-14.03	1.99E-08	20	1
ENSG00000213560.4	*AC103591.1*	2.12	2.12E-08	36	75
ENSG00000140009.18	*ESR2*	2.70	2.12E-08	15	41
ENSG00000167785.9	*ZNF558*	-16.53	2.14E-08	193	12
ENSG00000183607.10	*GKN2*	11.78	2.15E-08	2	22
ENSG00000165675.16	*ENOX2*	2.77	2.33E-08	45	125
ENSG00000165879.9	*FRAT1*	-3.45	2.41E-08	30	9
ENSG00000174721.10	*FGFBP3*	-2.04	2.50E-08	72	35
ENSG00000143970.17	*ASXL2*	-2.09	2.63E-08	200	96
ENSG00000115295.20	*CLIP4*	-3.05	3.00E-08	281	92
ENSG00000171132.14	*PRKCE*	-2.34	3.07E-08	500	214
ENSG00000124313.16	*IQSEC2*	-2.11	3.10E-08	393	186
ENSG00000169169.14	*CPT1C*	-5.69	3.12E-08	101	18
ENSG00000196659.10	*TTC30B*	-2.13	3.19E-08	59	27
ENSG00000157680.15	*DGKI*	4.65	3.33E-08	6	26
ENSG00000230074.2	*AL162231.2*	2.02	3.35E-08	29	58
ENSG00000215068.8	*AC025171.2*	-3.15	3.52E-08	28	9
ENSG00000253710.4	*ALG11*	-2.15	3.56E-08	431	201
ENSG00000143473.13	*KCNH1*	3.53	3.65E-08	15	53
ENSG00000230615.7	*AL139220.2*	3.10	3.70E-08	21	65
ENSG00000248871.1	*TNFSF12-TNFSF13*	-112.80	3.70E-08	22	0
ENSG00000076716.9	*GPC4*	41.30	3.80E-08	0	20
ENSG00000187244.11	*BCAM*	-2.53	3.94E-08	172	68
ENSG00000180573.9	*HIST1H2AC*	-3.01	3.96E-08	149	49
ENSG00000277778.2	*PGM5P2*	2.64	4.22E-08	54	143
ENSG00000110042.8	*DTX4*	7.29	4.26E-08	5	36
ENSG00000116299.17	*KIAA1324*	-7.85	4.40E-08	46	6
ENSG00000124882.4	*EREG*	2.05	4.58E-08	316	647
ENSG00000130158.14	*DOCK6*	-2.57	4.66E-08	125	49

ENSG00000146950.13	*SHROOM2*	-2.47	4.74E-08	326	132
ENSG00000162733.19	*DDR2*	2.91	5.28E-08	22	65
ENSG00000204287.14	*HLA-DRA*	-3.50	6.00E-08	73	21
ENSG00000134716.11	*CYP2J2*	2.07	6.44E-08	59	123
ENSG00000174233.11	*ADCY6*	-6.07	6.84E-08	82	13
ENSG00000149418.11	*ST14*	-5.63	6.86E-08	20	4
ENSG00000146411.6	*SLC2A12*	-2.02	6.88E-08	63	31
ENSG00000277147.6	*LINC00869*	2.35	6.97E-08	44	104
ENSG00000115760.14	*BIRC6*	-2.42	7.02E-08	452	187
ENSG00000107159.13	*CA9*	7.87	7.14E-08	4	30
ENSG00000215105.4	*TTC3P1*	2.30	7.32E-08	29	66
ENSG00000284948.1	*AC107959.4*	2.51	7.86E-08	19	46
ENSG00000184988.8	*TMEM106A*	-2.57	7.91E-08	53	21
ENSG00000156411.9	*ATP5MPL*	-2.75	7.98E-08	84	30
ENSG00000079691.18	*CARMIL1*	-2.05	8.21E-08	241	118
ENSG00000169220.18	*RGS14*	-12.89	8.27E-08	45	4
ENSG00000145934.16	*TENM2*	87.01	8.52E-08	0	30
ENSG00000107816.17	*LZTS2*	-2.67	8.62E-08	313	117
ENSG00000185187.13	*SIGIRR*	-3.38	9.02E-08	103	30
ENSG00000172638.13	*EFEMP2*	-4.11	9.13E-08	30	7
ENSG00000259230.1	*LINC02323*	-4.76	9.22E-08	18	4
ENSG00000171992.13	*SYNPO*	-2.13	9.75E-08	413	194
ENSG00000204176.14	*SYT15*	-4.30	9.77E-08	71	16
ENSG00000205464.12	*ATP6AP1L*	2.27	1.00E-07	28	63
ENSG00000274026.2	*FAM27E3*	2.16	1.03E-07	28	60
ENSG00000145358.6	*DDIT4L*	2.83	1.05E-07	18	52
ENSG00000122033.14	*MTIF3*	-2.20	1.07E-07	128	58
ENSG00000215086.2	*NPM1P24*	2.34	1.09E-07	33	78
ENSG00000164663.14	*USP49*	-3.67	1.10E-07	53	14
ENSG00000162772.17	*ATF3*	2.08	1.14E-07	82	170
ENSG00000285796.1	*AL162458.1*	-3.36	1.16E-07	44	13
ENSG00000130940.15	*CASZ1*	-3.11	1.24E-07	131	42
ENSG00000274070.2	*CASTOR2*	-2.11	1.26E-07	104	50
ENSG00000287431.1	*AC027601.6*	-3.06	1.32E-07	44	14
ENSG00000121741.16	*ZMYM2*	-2.21	1.36E-07	403	182
ENSG00000196104.11	*SPOCK3*	-4.64	1.40E-07	28	6
ENSG00000127252.7	*PLAAT1*	2.44	1.46E-07	25	62
ENSG00000163517.15	*HDAC11*	-2.26	1.48E-07	139	62
ENSG00000227496.3	*AC099066.2*	3.57	1.50E-07	8	28
ENSG00000174327.7	*SLC16A13*	-3.16	1.76E-07	25	8
ENSG00000121361.5	*KCNJ8*	2.35	1.79E-07	28	65
ENSG00000277534.1	*AC007996.1*	-2.48	1.86E-07	53	22
ENSG00000134317.18	*GRHL1*	-4.86	1.87E-07	21	4

ENSG00000113494.17	*PRLR*	2.62	1.94E-07	43	112
ENSG00000100031.19	*GGT1*	-7.27	1.98E-07	36	5
ENSG00000073060.16	*SCARB1*	-8.16	2.08E-07	368	45
ENSG00000217801.10	*AL390719.1*	-3.30	2.09E-07	60	18
ENSG00000197020.11	*ZNF100*	-2.04	2.18E-07	222	109
ENSG00000132639.12	*SNAP25*	4.37	2.44E-07	13	55
ENSG00000152926.15	*ZNF117*	-8.24	2.58E-07	23	3
ENSG00000265688.2	*MAFG-DT*	-2.02	2.61E-07	93	46
ENSG00000205755.12	*CRLF2*	-3.39	2.62E-07	24	7
ENSG00000110330.8	*BIRC2*	2.02	2.66E-07	190	384
ENSG00000245648.2	*AC022075.1*	-5.40	2.68E-07	19	3
ENSG00000234405.2	*Z69733.1*	2.87	2.74E-07	14	40
ENSG00000159335.16	*PTMS*	-2.30	2.84E-07	417	182
ENSG00000243629.2	*LINC00880*	2.58	2.91E-07	14	36
ENSG00000130775.16	*THEMIS2*	-2.56	3.26E-07	88	35
ENSG00000164619.10	*BMPER*	2.37	3.34E-07	39	93
ENSG00000141441.16	*GAREM1*	-3.54	3.35E-07	76	21
ENSG00000168994.13	*PXDC1*	-4.08	3.35E-07	52	13
ENSG00000103021.9	*CCDC113*	4.14	3.43E-07	8	33
ENSG00000160255.18	*ITGB2*	2.27	3.55E-07	118	269
ENSG00000107282.8	*APBA1*	16.12	3.73E-07	3	47
ENSG00000134987.11	*WDR36*	-2.66	3.74E-07	59	22
ENSG00000233461.6	*AL445524.1*	2.02	3.77E-07	92	185
ENSG00000011332.19	*DPF1*	-5.27	3.88E-07	88	17
ENSG00000083544.14	*TDRD3*	-2.89	4.01E-07	158	55
ENSG00000166352.16	*C11orf74*	3.04	4.04E-07	51	155
ENSG00000131480.9	*AOC2*	-2.06	4.11E-07	58	28
ENSG00000164855.16	*TMEM184A*	-2.09	4.47E-07	112	54
ENSG00000103534.17	*TMC5*	-3.99	4.51E-07	48	12
ENSG00000004399.12	*PLXND1*	-6.45	4.52E-07	94	15
ENSG00000141696.13	*P3H4*	-4.27	4.53E-07	113	26
ENSG00000164761.9	*TNFRSF11B*	-2.84	4.65E-07	39	14
ENSG00000119514.7	*GALNT12*	-2.94	4.77E-07	51	17
ENSG00000185650.9	*ZFP36L1*	2.71	4.82E-07	45	123
ENSG00000122035.6	*RASL11A*	-7.93	5.00E-07	20	2
ENSG00000269609.6	*RPARP-AS1*	-4.02	5.27E-07	58	14
ENSG00000272462.3	*U91328.1*	-2.47	5.34E-07	52	21
ENSG00000173930.9	*SLCO4C1*	3.19	5.77E-07	8	26
ENSG00000153237.18	*CCDC148*	4.19	5.88E-07	10	42
ENSG00000080561.13	*MID2*	2.30	6.17E-07	22	51
ENSG00000166833.21	*NAV2*	3.04	6.23E-07	551	1677
ENSG00000157657.14	*ZNF618*	-2.76	6.49E-07	257	93
ENSG00000248015.7	*AC005329.1*	-2.38	6.96E-07	52	22

ENSG00000184164.14	*CRELD2*	2.90	7.33E-07	20	58
ENSG00000163393.13	*SLC22A15*	2.11	7.56E-07	81	172
ENSG00000186280.7	*KDM4D*	2.30	7.59E-07	16	38
ENSG00000226007.3	*BX005266.2*	-2.98	8.14E-07	30	10
ENSG00000204740.11	*MALRD1*	-4.41	8.61E-07	25	6
ENSG00000264278.1	*ZNF236-DT*	-3.65	9.99E-07	23	6
ENSG00000153896.18	*ZNF599*	-4.61	1.02E-06	20	4
ENSG00000126759.13	*CFP*	-2.81	1.02E-06	217	77
ENSG00000137434.11	*C6orf52*	-2.30	1.03E-06	72	31
ENSG00000105520.10	*PLPPR2*	-2.38	1.08E-06	286	120
ENSG00000061337.15	*LZTS1*	-3.28	1.08E-06	24	7
ENSG00000048540.15	*LMO3*	8.41	1.15E-06	3	25
ENSG00000253676.1	*TAGLN2P1*	2.38	1.19E-06	14	33
ENSG00000279821.1	*AC145098.2*	2.19	1.35E-06	21	46
ENSG00000181513.14	*ACBD4*	-2.43	1.36E-06	62	25
ENSG00000138101.18	*DTNB*	-2.85	1.43E-06	66	23
ENSG00000079841.18	*RIMS1*	3.14	1.49E-06	20	63
ENSG00000245571.7	*FAM111A-DT*	2.15	1.51E-06	27	58
ENSG00000171219.9	*CDC42BPG*	-3.42	1.52E-06	37	11
ENSG00000231566.2	*LINC02595*	-2.36	1.64E-06	38	16
ENSG00000127720.8	*METTL25*	-2.46	1.66E-06	65	26
ENSG00000112812.16	*PRSS16*	4.53	1.68E-06	6	26
ENSG00000153404.14	*PLEKHG4B*	-7.18	1.81E-06	51	7
ENSG00000212694.8	*LINC01089*	-2.87	1.83E-06	39	14
ENSG00000179403.12	*VWA1*	-2.38	1.84E-06	161	68
ENSG00000154589.7	*LY96*	2.95	2.04E-06	18	52
ENSG00000154832.14	*CXXC1*	-2.12	2.10E-06	129	61
ENSG00000159403.18	*C1R*	-3.28	2.11E-06	37	11
ENSG00000182580.3	*EPHB3*	-4.66	2.12E-06	27	6
ENSG00000156218.13	*ADAMTSL3*	15.90	2.15E-06	2	31
ENSG00000136715.18	*SAP130*	-2.19	2.16E-06	569	260
ENSG00000006025.12	*OSBPL7*	-2.30	2.17E-06	94	41
ENSG00000198689.11	*SLC9A6*	2.61	2.18E-06	45	118
ENSG00000153933.10	*DGKE*	-2.45	2.22E-06	48	20
ENSG00000213290.4	*PGK1P2*	2.95	2.27E-06	10	30
ENSG00000073756.12	*PTGS2*	16.73	2.32E-06	18	300
ENSG00000132182.12	*NUP210*	-5.14	2.39E-06	1421	276
ENSG00000147251.15	*DOCK11*	3.33	2.45E-06	55	184
ENSG00000110811.20	*P3H3*	-5.35	2.54E-06	65	12
ENSG00000184226.15	*PCDH9*	-2.03	2.57E-06	84	41
ENSG00000165240.20	*ATP7A*	3.22	2.58E-06	46	149
ENSG00000105877.18	*DNAH11*	2.25	2.66E-06	55	123
ENSG00000099822.3	*HCN2*	-2.47	2.69E-06	33	13

ENSG00000245146.7	*MALINC1*	2.50	2.85E-06	24	60
ENSG00000152689.18	*RASGRP3*	-3.65	2.92E-06	69	19
ENSG00000136002.19	*ARHGEF4*	-5.32	2.99E-06	24	4
ENSG00000105376.5	*ICAM5*	-2.52	3.22E-06	51	20
ENSG00000167964.13	*RAB26*	-4.12	3.24E-06	17	4
ENSG00000169856.9	*ONECUT1*	7.73	3.45E-06	2	19
ENSG00000187024.14	*PTRH1*	-4.19	3.54E-06	62	15
ENSG00000253948.2	*VPS13B-DT*	-3.77	3.57E-06	19	5
ENSG00000167106.12	*FAM102A*	-2.05	3.70E-06	838	409
ENSG00000259171.1	*AL163636.2*	2.99	3.93E-06	23	68
ENSG00000247151.7	*CSTF3-DT*	2.49	3.94E-06	17	43
ENSG00000272410.5	*AC022384.1*	2.43	3.99E-06	98	238
ENSG00000100503.23	*NIN*	-2.04	4.15E-06	527	259
ENSG00000230043.1	*TMSB4XP6*	2.92	4.18E-06	17	51
ENSG00000271335.6	*AL117336.2*	-2.74	4.41E-06	24	9
ENSG00000266088.6	*AC004585.1*	3.70	4.65E-06	5	17
ENSG00000063169.10	*BICRA*	4.81	4.65E-06	12	59
ENSG00000204642.14	*HLA-F*	-2.93	4.72E-06	28	9
ENSG00000188820.13	*CALHM6*	3.05	4.87E-06	9	29
ENSG00000136531.16	*SCN2A*	5.30	4.91E-06	6	32
ENSG00000167363.14	*FN3K*	-2.36	4.91E-06	44	19
ENSG00000143919.15	*CAMKMT*	-2.14	5.00E-06	71	33
ENSG00000108387.15	*SEPTIN4*	-7.33	5.29E-06	19	3
ENSG00000069812.11	*HES2*	-4.68	5.35E-06	98	21
ENSG00000170271.11	*FAXDC2*	3.27	5.35E-06	14	45
ENSG00000109107.14	*ALDOC*	-2.19	5.39E-06	40	18
ENSG00000130475.14	*FCHO1*	-3.48	5.48E-06	35	10
ENSG00000187229.3	*AC100800.1*	3.22	5.52E-06	6	20
ENSG00000203999.9	*LINC01270*	-6.62	5.60E-06	27	4
ENSG00000179455.9	*MKRN3*	5.14	5.75E-06	6	33
ENSG00000137834.15	*SMAD6*	-3.00	5.90E-06	66	22
ENSG00000174899.11	*SLC66A1L*	4.61	6.20E-06	5	22
ENSG00000279118.1	*AC093535.2*	3.14	6.36E-06	13	40
ENSG00000171951.5	*SCG2*	-2.55	6.38E-06	37	14
ENSG00000095637.22	*SORBS1*	4.08	6.39E-06	5	21
ENSG00000147036.11	*LANCL3*	9.63	6.44E-06	6	54
ENSG00000241404.7	*EGFL8*	-2.01	6.61E-06	103	51
ENSG00000154654.15	*NCAM2*	-4.07	6.73E-06	33	8
ENSG00000109743.11	*BST1*	2.25	6.90E-06	20	45
ENSG00000160145.15	*KALRN*	7.20	6.99E-06	4	32
ENSG00000186523.14	*FAM86B1*	2.47	7.11E-06	45	111
ENSG00000263606.1	*AP000919.1*	2.30	7.20E-06	14	33
ENSG00000235084.3	*CHCHD2P6*	-2.16	7.32E-06	35	16

ENSG00000011638.10	*TMEM159*	2.21	7.59E-06	113	250
ENSG00000214530.9	*STARD10*	-2.12	7.79E-06	159	75
ENSG00000175782.10	*SLC35E3*	-2.79	7.90E-06	79	28
ENSG00000166578.10	*IQCD*	-2.43	8.40E-06	29	12
ENSG00000235750.10	*KIAA0040*	20.12	8.46E-06	1	28
ENSG00000019186.10	*CYP24A1*	-3.75	8.60E-06	34	9
ENSG00000112541.15	*PDE10A*	-2.58	8.69E-06	273	106
ENSG00000183072.10	*NKX2-5*	-4.99	8.71E-06	17	3
ENSG00000138336.9	*TET1*	-2.64	9.00E-06	27	10
ENSG00000143502.15	*SUSD4*	3.18	9.00E-06	19	61
ENSG00000243811.10	*APOBEC3D*	-9.42	9.03E-06	18	2
ENSG00000253522.6	*MIR3142HG*	2.01	9.04E-06	24	48
ENSG00000088881.20	*EBF4*	-3.74	9.15E-06	46	12
ENSG00000178773.15	*CPNE7*	-2.96	9.15E-06	71	24
ENSG00000054690.14	*PLEKHH1*	-2.51	9.57E-06	94	38
ENSG00000198816.7	*ZNF358*	-2.07	9.59E-06	387	187
ENSG00000135439.11	*AGAP2*	8.53	9.66E-06	5	39
ENSG00000260265.1	*LINC02562*	2.65	9.69E-06	12	33
ENSG00000277701.5	*AC159540.2*	2.87	9.74E-06	15	44
ENSG00000170161.7	*AL512625.1*	-2.12	9.75E-06	81	38
ENSG00000196639.6	*HRH1*	2.22	9.96E-06	69	154
ENSG00000065413.20	*ANKRD44*	-2.25	1.01E-05	307	136
ENSG00000226287.8	*TMEM191A*	5.99	1.01E-05	4	22
ENSG00000251669.5	*FAM86EP*	2.24	1.02E-05	34	76
ENSG00000124216.4	*SNAI1*	-4.12	1.04E-05	17	4
ENSG00000153982.11	*GDPD1*	-3.76	1.06E-05	31	8
ENSG00000151849.15	*CENPJ*	-2.17	1.06E-05	113	52
ENSG00000134574.11	*DDB2*	-2.68	1.07E-05	139	52
ENSG00000204758.8	*AC008429.1*	2.54	1.08E-05	17	44
ENSG00000086730.17	*LAT2*	-2.30	1.20E-05	59	26
ENSG00000064547.14	*LPAR2*	-2.03	1.20E-05	88	43
ENSG00000198774.5	*RASSF9*	-2.70	1.22E-05	30	11
ENSG00000091129.20	*NRCAM*	-4.80	1.25E-05	71	15
ENSG00000040608.14	*RTN4R*	2.10	1.30E-05	19	41
ENSG00000136244.12	*IL6*	-3.12	1.31E-05	41	13
ENSG00000151773.13	*CCDC122*	-2.19	1.36E-05	54	24
ENSG00000119686.10	*FLVCR2*	-2.43	1.37E-05	63	26
ENSG00000269416.6	*LINC01224*	-2.21	1.41E-05	123	56
ENSG00000189056.14	*RELN*	3.56	1.43E-05	28	98
ENSG00000273291.5	*AC092042.3*	2.46	1.47E-05	15	37
ENSG00000143740.14	*SNAP47*	-2.61	1.47E-05	46	18
ENSG00000204371.11	*EHMT2*	-2.07	1.57E-05	584	283
ENSG00000153246.13	*PLA2R1*	-2.81	1.65E-05	66	23

ENSG00000231607.12	*DLEU2*	-4.19	1.67E-05	22	5
ENSG00000144821.10	*MYH15*	2.19	1.71E-05	21	47
ENSG00000163864.17	*NMNAT3*	5.18	1.75E-05	5	24
ENSG00000257732.1	*AC089983.1*	-3.32	1.91E-05	19	6
ENSG00000129422.14	*MTUS1*	-2.74	1.93E-05	115	42
ENSG00000101255.11	*TRIB3*	2.48	2.08E-05	13	33
ENSG00000081059.20	*TCF7*	-2.13	2.08E-05	74	35
ENSG00000156966.7	*B3GNT7*	-2.94	2.09E-05	120	41
ENSG00000164308.16	*ERAP2*	-2.99	2.18E-05	30	10
ENSG00000197008.9	*ZNF138*	-2.06	2.19E-05	85	41
ENSG00000095397.14	*WHRN*	-2.20	2.19E-05	48	22
ENSG00000114541.15	*FRMD4B*	-2.35	2.20E-05	55	24
ENSG00000163993.7	*S100P*	-3.35	2.20E-05	17	5
ENSG00000138798.13	*EGF*	2.29	2.20E-05	53	122
ENSG00000241288.8	*LINC02614*	3.53	2.37E-05	5	19
ENSG00000112319.19	*EYA4*	-2.24	2.42E-05	109	48
ENSG00000166126.10	*AMN*	-5.58	2.43E-05	18	3
ENSG00000142961.14	*MOB3C*	-2.24	2.46E-05	38	17
ENSG00000167721.10	*TSR1*	-2.28	2.53E-05	93	41
ENSG00000010361.14	*FUZ*	-2.22	2.53E-05	42	19
ENSG00000139973.16	*SYT16*	5.22	2.55E-05	16	81
ENSG00000095303.17	*PTGS1*	-4.65	2.58E-05	26	6
ENSG00000059378.12	*PARP12*	-3.19	2.59E-05	72	23
ENSG00000187534.6	*PRR13P5*	2.55	2.66E-05	20	51
ENSG00000177839.7	*PCDHB9*	3.98	2.77E-05	15	61
ENSG00000285887.1	*AL009176.1*	3.54	2.92E-05	8	28
ENSG00000018236.15	*CNTN1*	3.13	2.95E-05	8	27
ENSG00000267787.7	*AC027097.2*	-3.75	3.36E-05	18	5
ENSG00000230316.7	*FEZF1-AS1*	2.50	3.39E-05	30	75
ENSG00000283486.2	*FAM95C*	4.13	3.46E-05	15	61
ENSG00000146856.14	*AGBL3*	-2.27	3.47E-05	55	24
ENSG00000090975.12	*PITPNM2*	-2.47	3.47E-05	149	60
ENSG00000169213.7	*RAB3B*	3.72	3.48E-05	9	32
ENSG00000270157.1	*AC004918.4*	-2.80	3.51E-05	19	7
ENSG00000124549.14	*BTN2A3P*	-2.14	3.65E-05	94	44
ENSG00000113721.14	*PDGFRB*	-10.80	3.88E-05	28	3
ENSG00000204390.10	*HSPA1L*	-2.52	3.89E-05	26	10
ENSG00000287569.1	*AL078587.2*	-3.72	3.94E-05	17	5
ENSG00000223551.1	*TMSB4XP4*	2.44	3.97E-05	18	43
ENSG00000214435.8	*AS3MT*	-14.35	4.01E-05	101	7
ENSG00000228223.3	*HCG11*	-2.84	4.03E-05	58	20
ENSG00000219626.9	*FAM228B*	-2.76	4.31E-05	41	15
ENSG00000260589.1	*STAM-AS1*	-3.05	4.51E-05	18	6

ENSG00000119866.22	*BCL11A*	5.70	4.58E-05	3	19
ENSG00000164161.10	*HHIP*	2.28	4.63E-05	86	195
ENSG00000167880.7	*EVPL*	-3.36	4.81E-05	191	57
ENSG00000169026.12	*SLC49A3*	-2.68	4.84E-05	48	18
ENSG00000272841.1	*AL139393.3*	2.19	4.88E-05	16	35
ENSG00000184613.10	*NELL2*	4.05	4.89E-05	15	60
ENSG00000099998.17	*GGT5*	-2.38	4.91E-05	221	93
ENSG00000153944.11	*MSI2*	2.31	4.92E-05	86	199
ENSG00000139178.11	*C1RL*	-2.64	5.32E-05	44	17
ENSG00000160325.14	*CACFD1*	-8.21	5.64E-05	25	3
ENSG00000228742.11	*LINC02577*	-2.19	5.70E-05	55	25
ENSG00000281344.1	*HELLPAR*	-2.42	6.02E-05	29	12
ENSG00000224934.5	*AL391684.1*	-2.60	6.14E-05	24	9
ENSG00000256028.2	*AC026362.1*	-2.46	6.25E-05	90	37
ENSG00000262580.5	*AC087741.1*	-2.50	6.39E-05	31	12
ENSG00000149646.12	*CNBD2*	-2.20	6.82E-05	28	13
ENSG00000168772.11	*CXXC4*	-2.99	6.87E-05	23	8
ENSG00000254505.10	*CHMP4A*	2.19	6.94E-05	37	82
ENSG00000136040.9	*PLXNC1*	-2.04	7.01E-05	52	25
ENSG00000138769.11	*CDKL2*	2.48	7.11E-05	9	23
ENSG00000085465.13	*OVGP1*	2.60	7.12E-05	9	23
ENSG00000150627.15	*WDR17*	22.15	7.19E-05	1	19
ENSG00000116663.11	*FBXO6*	-2.48	7.25E-05	31	13
ENSG00000257524.6	*AL157935.2*	-2.63	7.33E-05	66	25
ENSG00000008277.14	*ADAM22*	-2.42	7.43E-05	106	44
ENSG00000184481.17	*FOXO4*	-2.57	7.47E-05	32	12
ENSG00000287091.1	*AC009961.4*	-3.03	7.62E-05	21	7
ENSG00000239697.11	*TNFSF12*	-10.04	8.35E-05	134	13
ENSG00000078699.21	*CBFA2T2*	-3.33	8.35E-05	84	25
ENSG00000225972.1	*MTND1P23*	-2.88	8.40E-05	25	9
ENSG00000120328.6	*PCDHB12*	-2.66	8.53E-05	23	9
ENSG00000166321.14	*NUDT13*	-2.07	8.73E-05	44	21
ENSG00000272374.1	*Z97832.2*	-2.67	8.99E-05	21	8
ENSG00000168056.16	*LTBP3*	-3.74	9.13E-05	106	28
ENSG00000188825.14	*LINC00910*	-2.47	9.76E-05	34	14
ENSG00000257591.6	*ZNF625*	-2.83	9.89E-05	38	13
ENSG00000139211.6	*AMIGO2*	-2.11	1.00E-04	502	238
ENSG00000128872.10	*TMOD2*	2.09	1.02E-04	87	182
ENSG00000143819.12	*EPHX1*	-2.21	1.05E-04	39	18
ENSG00000246465.1	*AC138904.1*	3.51	1.08E-04	5	18
ENSG00000130653.16	*PNPLA7*	4.39	1.08E-04	4	17
ENSG00000278916.1	*CEP83-DT*	-2.95	1.09E-04	19	6
ENSG00000234616.8	*JRK*	-5.14	1.10E-04	20	4

ENSG00000124479.11	*NDP*	-3.95	1.10E-04	16	4
ENSG00000222033.1	*LINC01124*	-2.00	1.11E-04	39	20
ENSG00000231752.6	*EMBP1*	2.06	1.14E-04	17	35
ENSG00000273888.1	*FRMD6-AS1*	-2.34	1.15E-04	25	11
ENSG00000261441.1	*AC124068.2*	3.65	1.19E-04	4	16
ENSG00000135205.15	*CCDC146*	-2.75	1.20E-04	37	14
ENSG00000137203.12	*TFAP2A*	-2.86	1.22E-04	59	21
ENSG00000254860.6	*TMEM9B-AS1*	5.60	1.23E-04	4	23
ENSG00000165568.18	*AKR1E2*	2.03	1.28E-04	26	53
ENSG00000225265.2	*TAF1A-AS1*	2.48	1.33E-04	17	42
ENSG00000243406.6	*MRPS31P5*	-2.15	1.34E-04	70	33
ENSG00000188848.16	*BEND4*	-2.80	1.36E-04	20	7
ENSG00000096060.14	*FKBP5*	-5.28	1.42E-04	97	18
ENSG00000073670.14	*ADAM11*	-3.90	1.43E-04	21	5
ENSG00000168071.22	*CCDC88B*	-2.44	1.44E-04	29	12
ENSG00000104419.14	*NDRG1*	2.60	1.53E-04	48	123
ENSG00000197013.10	*ZNF429*	-5.00	1.55E-04	21	4
ENSG00000174808.12	*BTC*	2.14	1.57E-04	34	72
ENSG00000257497.2	*AC121761.1*	-2.73	1.58E-04	17	6
ENSG00000261094.2	*AC007066.2*	-2.13	1.68E-04	30	14
ENSG00000144048.10	*DUSP11*	6.72	1.68E-04	4	25
ENSG00000234771.3	*SLC25A25-AS1*	-2.03	1.69E-04	34	17
ENSG00000247373.3	*TMED2-DT*	-2.64	1.69E-04	17	6
ENSG00000183495.13	*EP400*	-2.18	1.69E-04	145	67
ENSG00000115112.8	*TFCP2L1*	-10.01	1.71E-04	21	2
ENSG00000254413.8	*CHKB-CPT1B*	2.21	1.72E-04	30	67
ENSG00000173546.7	*CSPG4*	-5.55	1.75E-04	216	39
ENSG00000112139.16	*MDGA1*	-2.45	1.80E-04	60	25
ENSG00000256210.3	*AC005255.1*	2.26	1.85E-04	14	32
ENSG00000250264.1	*AL669918.1*	-2.53	1.92E-04	108	43
ENSG00000122420.10	*PTGFR*	2.35	1.94E-04	14	32
ENSG00000272870.3	*AC097534.2*	3.00	2.08E-04	17	52
ENSG00000168016.14	*TRANK1*	-2.91	2.11E-04	237	81
ENSG00000213104.3	*NPM1P46*	2.21	2.12E-04	12	27
ENSG00000124588.20	*NQO2*	-3.66	2.12E-04	63	17
ENSG00000131187.9	*F12*	-2.11	2.22E-04	67	32
ENSG00000072133.11	*RPS6KA6*	3.77	2.28E-04	4	17
ENSG00000234424.2	*AL353743.4*	2.94	2.29E-04	6	17
ENSG00000185272.14	*RBM11*	3.07	2.31E-04	5	15
ENSG00000120899.18	*PTK2B*	-2.45	2.34E-04	26	10
ENSG00000240288.8	*GHRLOS*	2.32	2.44E-04	11	26
ENSG00000153283.13	*CD96*	-6.43	2.44E-04	27	4

ENSG00000197808.12	*ZNF461*	-2.39	2.45E-04	76	32
ENSG00000100055.21	*CYTH4*	-6.35	2.45E-04	17	3
ENSG00000126351.12	*THRA*	-3.30	2.48E-04	45	14
ENSG00000158050.5	*DUSP2*	-3.00	2.54E-04	22	7
ENSG00000171658.8	*NMRAL2P*	-2.65	2.64E-04	22	8
ENSG00000234608.8	*MAPKAPK5-AS1*	-2.27	2.65E-04	89	39
ENSG00000223745.8	*CCDC18-AS1*	2.31	2.76E-04	32	74
ENSG00000158406.4	*HIST1H4H*	-2.84	2.82E-04	32	11
ENSG00000184887.13	*BTBD6*	-2.30	2.86E-04	221	96
ENSG00000136960.12	*ENPP2*	7.81	2.87E-04	3	23
ENSG00000110031.12	*LPXN*	2.71	2.94E-04	44	119
ENSG00000081386.12	*ZNF510*	-2.02	3.00E-04	140	69
ENSG00000141349.8	*G6PC3*	-2.23	3.06E-04	41	18
ENSG00000167716.18	*WDR81*	-2.60	3.06E-04	98	38
ENSG00000178096.9	*BOLA1*	-3.01	3.09E-04	27	9
ENSG00000173825.7	*TIGD3*	-2.71	3.16E-04	19	7
ENSG00000267368.1	*UPK3BL1*	-2.89	3.19E-04	96	33
ENSG00000088179.9	*PTPN4*	-2.25	3.24E-04	231	103
ENSG00000259726.1	*CSPG4P11*	2.19	3.28E-04	14	30
ENSG00000233184.7	*AC093157.1*	2.15	3.30E-04	26	55
ENSG00000150477.15	*KIAA1328*	-2.26	3.35E-04	61	27
ENSG00000080947.15	*CROCCP3*	-3.55	3.46E-04	44	12
ENSG00000235927.4	*NEXN-AS1*	2.47	3.50E-04	8	20
ENSG00000100092.23	*SH3BP1*	-11.41	3.57E-04	20	2
ENSG00000278175.4	*GLIDR*	-3.59	3.71E-04	55	15
ENSG00000150722.10	*PPP1R1C*	2.48	3.77E-04	12	30
ENSG00000279765.3	*AC013394.1*	5.23	3.78E-04	4	21
ENSG00000179046.8	*TRIML2*	2.18	3.87E-04	21	45
ENSG00000117016.10	*RIMS3*	-3.57	4.03E-04	42	12
ENSG00000250565.7	*ATP6V1E2*	-2.02	4.13E-04	64	31
ENSG00000258289.8	*CHURC1*	3.35	4.32E-04	5	16
ENSG00000145029.13	*NICN1*	-2.09	4.39E-04	72	34
ENSG00000125962.14	*ARMCX5*	2.47	4.59E-04	40	98
ENSG00000146776.14	*ATXN7L1*	-2.25	4.89E-04	41	18
ENSG00000287712.1	*AC005865.2*	2.32	5.61E-04	14	32
ENSG00000163596.16	*ICA1L*	-3.03	5.61E-04	44	15
ENSG00000106610.15	*STAG3L4*	-2.02	5.63E-04	106	52
ENSG00000166341.8	*DCHS1*	2.90	5.76E-04	6	17
ENSG00000187952.9	*HS6ST1P1*	-2.65	5.92E-04	25	10
ENSG00000112852.7	*PCDHB2*	9.32	6.02E-04	2	20
ENSG00000184500.15	*PROS1*	2.14	6.10E-04	84	180
ENSG00000250305.9	*TRMT9B*	2.87	6.13E-04	7	19

ENSG00000183018.9	*SPNS2*	-2.42	6.33E-04	122	50
ENSG00000183638.6	*RP1L1*	-2.43	6.34E-04	17	7
ENSG00000169598.15	*DFFB*	-2.66	6.41E-04	68	25
ENSG00000092621.12	*PHGDH*	-4.57	6.59E-04	94	20
ENSG00000089505.17	*CMTM1*	2.01	6.62E-04	13	27
ENSG00000244171.4	*PBX2P1*	-2.43	6.62E-04	18	7
ENSG00000237149.5	*ZNF503-AS2*	-2.13	6.79E-04	20	10
ENSG00000151117.9	*TMEM86A*	3.68	6.96E-04	5	18
ENSG00000133619.17	*KRBA1*	-4.44	6.99E-04	24	5
ENSG00000213096.10	*ZNF254*	-2.70	7.01E-04	47	17
ENSG00000151611.16	*MMAA*	2.46	7.71E-04	19	46
ENSG00000259305.6	*ZHX1-C8orf76*	-2.36	7.81E-04	32	14
ENSG00000163283.7	*ALPP*	-3.59	8.18E-04	20	6
ENSG00000077942.19	*FBLN1*	-3.53	8.22E-04	32	9
ENSG00000129521.14	*EGLN3*	-7.02	8.25E-04	35	5
ENSG00000144229.12	*THSD7B*	10.74	8.26E-04	2	19
ENSG00000187554.14	*TLR5*	3.27	8.48E-04	13	42
ENSG00000142623.11	*PADI1*	2.27	8.94E-04	15	34
ENSG00000276116.2	*FUT8-AS1*	2.04	9.15E-04	24	49
ENSG00000131650.14	*KREMEN2*	-3.53	9.17E-04	20	6
ENSG00000185090.14	*MANEAL*	2.08	9.30E-04	87	180
ENSG00000196220.16	*SRGAP3*	7.72	9.80E-04	3	21
ENSG00000135063.19	*FAM189A2*	4.56	9.87E-04	4	19
ENSG00000112769.20	*LAMA4*	-2.86	1.02E-03	59	21
ENSG00000003987.14	*MTMR7*	-2.83	1.02E-03	32	11
ENSG00000121207.12	*LRAT*	2.72	1.05E-03	8	21
ENSG00000176383.9	*B3GNT4*	-3.84	1.05E-03	23	6
ENSG00000198223.16	*CSF2RA*	-2.89	1.06E-03	155	53
ENSG00000250506.7	*CDK3*	-2.57	1.07E-03	21	8
ENSG00000183793.14	*NPIPA5*	4.04	1.08E-03	9	35
ENSG00000001617.12	*SEMA3F*	-2.02	1.10E-03	185	92
ENSG00000158457.6	*TSPAN33*	-2.55	1.11E-03	27	11
ENSG00000138395.16	*CDK15*	2.16	1.12E-03	20	43
ENSG00000205578.6	*POM121B*	-3.13	1.12E-03	19	6
ENSG00000115318.12	*LOXL3*	-2.80	1.14E-03	35	13
ENSG00000234072.1	*AC074117.1*	-2.26	1.19E-03	48	21
ENSG00000249459.10	*ZNF286B*	-2.05	1.22E-03	38	18
ENSG00000155962.13	*CLIC2*	2.39	1.24E-03	18	43
ENSG00000186806.5	*VSIG10L*	-2.10	1.26E-03	19	9
ENSG00000169174.10	*PCSK9*	-2.49	1.27E-03	203	82
ENSG00000243753.5	*HLA-L*	-2.47	1.27E-03	17	7
ENSG00000269001.2	*AC092070.2*	-2.22	1.34E-03	82	37
ENSG00000040531.14	*CTNS*	-2.84	1.35E-03	26	9

ENSG00000167107.12	*ACSF2*	-3.23	1.36E-03	21	6
ENSG00000118707.10	*TGIF2*	-4.45	1.44E-03	73	17
ENSG00000179168.15	*GGN*	-2.79	1.47E-03	18	6
ENSG00000160991.16	*ORAI2*	-2.89	1.53E-03	437	151
ENSG00000233006.8	*MIR3936HG*	-2.47	1.53E-03	18	7
ENSG00000227540.1	*AC016394.1*	-2.26	1.55E-03	22	10
ENSG00000138735.16	*PDE5A*	2.10	1.55E-03	29	61
ENSG00000106013.15	*ANKRD7*	2.65	1.62E-03	7	19
ENSG00000157873.17	*TNFRSF14*	-4.73	1.64E-03	31	7
ENSG00000152527.14	*PLEKHH2*	-2.55	1.65E-03	60	24
ENSG00000246985.8	*SOCS2-AS1*	-2.32	1.68E-03	24	10
ENSG00000280138.1	*AC027290.2*	-2.50	1.73E-03	27	11
ENSG00000247679.3	*AC139795.2*	2.25	1.76E-03	11	24
ENSG00000099194.6	*SCD*	-2.34	1.78E-03	2494	1066
ENSG00000255031.5	*AP002807.1*	-2.06	1.80E-03	28	13
ENSG00000137225.13	*CAPN11*	-2.30	1.80E-03	23	10
ENSG00000149256.16	*TENM4*	12.04	1.81E-03	2	28
ENSG00000250041.3	*AC069360.1*	2.23	1.83E-03	13	29
ENSG00000127533.4	*F2RL3*	-2.56	1.88E-03	16	6
ENSG00000272501.1	*AL662844.4*	-2.47	1.89E-03	20	8
ENSG00000157734.14	*SNX22*	-2.17	1.89E-03	21	10
ENSG00000061918.13	*GUCY1B1*	124.79	1.91E-03	0	22
ENSG00000080031.10	*PTPRH*	-4.22	1.92E-03	17	4
ENSG00000156026.14	*MCU*	-3.10	1.97E-03	56	18
ENSG00000182389.19	*CACNB4*	-2.04	2.01E-03	103	51
ENSG00000138002.15	*IFT172*	-2.39	2.05E-03	109	46
ENSG00000241489.8	*AC244197.3*	2.58	2.07E-03	29	75
ENSG00000232611.1	*AL683813.1*	2.48	2.07E-03	6	15
ENSG00000164093.17	*PITX2*	2.28	2.11E-03	14	32
ENSG00000204959.4	*ARHGEF34P*	-2.32	2.16E-03	40	17
ENSG00000225269.3	*LINC00705*	-2.08	2.24E-03	33	16
ENSG00000285509.1	*AP000646.1*	2.58	2.25E-03	6	16
ENSG00000254536.2	*AL360181.3*	-4.02	2.28E-03	21	5
ENSG00000082014.16	*SMARCD3*	-3.33	2.44E-03	42	13
ENSG00000213085.10	*CFAP45*	-2.00	2.51E-03	23	11
ENSG00000143028.9	*SYPL2*	-2.05	2.53E-03	18	9
ENSG00000254838.5	*GVINP1*	2.07	2.55E-03	10	21
ENSG00000143375.15	*CGN*	-2.28	2.57E-03	65	29
ENSG00000185614.6	*INKA1*	-2.00	2.58E-03	22	11
ENSG00000162241.12	*SLC25A45*	3.67	2.61E-03	10	38
ENSG00000148848.14	*ADAM12*	-3.01	2.67E-03	26	9
ENSG00000106123.12	*EPHB6*	-3.56	2.77E-03	24	7
ENSG00000196358.11	*NTNG2*	-2.29	2.82E-03	33	14

ENSG00000163032.12	*VSNL1*	-3.12	2.87E-03	21	7
ENSG00000205639.11	*MFSD2B*	-2.28	2.90E-03	18	8
ENSG00000115825.10	*PRKD3*	-2.15	2.93E-03	282	131
ENSG00000143429.10	*LSP1P4*	2.99	2.97E-03	16	47
ENSG00000165821.12	*SALL2*	-2.79	2.99E-03	17	6
ENSG00000224086.6	*AC245452.1*	2.03	2.99E-03	14	29
ENSG00000229214.2	*LINC00242*	2.43	3.03E-03	7	16
ENSG00000145982.12	*FARS2*	-2.21	3.05E-03	33	15
ENSG00000165029.16	*ABCA1*	-2.08	3.33E-03	220	106
ENSG00000101489.20	*CELF4*	-3.46	3.40E-03	33	10
ENSG00000125375.15	*DMAC2L*	-2.03	3.44E-03	58	29
ENSG00000231187.3	*AL356056.2*	-2.20	3.45E-03	23	10
ENSG00000287024.1	*AL022162.1*	2.55	3.47E-03	6	16
ENSG00000158315.11	*RHBDL2*	-2.33	3.48E-03	39	17
ENSG00000168394.11	*TAP1*	-2.54	3.53E-03	155	61
ENSG00000237840.6	*FAM21FP*	-2.23	3.63E-03	14	6
ENSG00000140563.15	*MCTP2*	2.01	3.67E-03	33	66
ENSG00000234465.11	*PINLYP*	2.04	3.81E-03	16	33
ENSG00000259583.3	*AC015712.2*	-2.10	3.98E-03	24	11
ENSG00000152223.15	*EPG5*	-2.95	4.11E-03	679	230
ENSG00000147606.9	*SLC26A7*	2.22	4.21E-03	16	36
ENSG00000164867.11	*NOS3*	-3.10	4.26E-03	17	5
ENSG00000143554.14	*SLC27A3*	-3.30	4.44E-03	30	9
ENSG00000258818.4	*RNASE4*	4.11	4.44E-03	10	41
ENSG00000215417.13	*MIR17HG*	-2.06	4.46E-03	28	13
ENSG00000128596.17	*CCDC136*	-2.50	4.74E-03	38	15
ENSG00000263843.1	*AC022211.2*	-2.20	4.76E-03	18	8
ENSG00000147133.15	*TAF1*	-2.68	5.17E-03	18	7
ENSG00000178623.12	*GPR35*	2.37	5.18E-03	9	21
ENSG00000102081.14	*FMR1*	2.45	5.18E-03	169	413
ENSG00000083750.12	*RRAGB*	2.68	5.23E-03	11	28
ENSG00000115266.11	*APC2*	-2.35	5.28E-03	34	14
ENSG00000205517.12	*RGL3*	-3.53	5.40E-03	16	5
ENSG00000116191.17	*RALGPS2*	10.19	5.40E-03	3	35
ENSG00000196268.11	*ZNF493*	-2.76	5.53E-03	22	8
ENSG00000099958.14	*DERL3*	-2.36	5.54E-03	15	6
ENSG00000283341.2	*AC068205.2*	2.42	5.57E-03	15	36
ENSG00000135905.19	*DOCK10*	3.79	5.64E-03	55	209
ENSG00000259146.4	*AC005476.2*	-2.10	5.67E-03	19	9
ENSG00000240747.7	*KRBOX1*	3.00	5.92E-03	17	52
ENSG00000231711.2	*LINC00899*	-2.30	6.00E-03	32	14
ENSG00000249279.6	*LINC02057*	2.31	6.01E-03	10	24
ENSG00000126561.16	*STAT5A*	-4.53	6.05E-03	56	12

ENSG00000232160.7	*RAP2C-AS1*	2.39	6.11E-03	8	19
ENSG00000204632.11	*HLA-G*	-3.63	6.14E-03	17	5
ENSG00000198892.6	*SHISA4*	-3.86	6.16E-03	38	10
ENSG00000141738.14	*GRB7*	-2.71	6.20E-03	17	6
ENSG00000125247.15	*TMTC4*	-3.74	6.22E-03	175	47
ENSG00000205309.14	*NT5M*	-2.47	6.37E-03	15	6
ENSG00000164342.12	*TLR3*	-3.32	6.41E-03	21	6
ENSG00000181634.8	*TNFSF15*	2.29	6.43E-03	10	23
ENSG00000130762.15	*ARHGEF16*	-2.13	6.52E-03	16	7
ENSG00000241280.1	*AC106712.1*	2.39	6.52E-03	16	38
ENSG00000273162.1	*AL133215.2*	-2.01	6.54E-03	24	12
ENSG00000155761.14	*SPAG17*	5.81	6.55E-03	3	18
ENSG00000197375.12	*SLC22A5*	-4.02	6.66E-03	85	21
ENSG00000188322.7	*SBK1*	2.66	6.83E-03	6	16
ENSG00000154529.14	*CNTNAP3B*	2.07	6.95E-03	26	53
ENSG00000108932.12	*SLC16A6*	-2.48	6.98E-03	15	6
ENSG00000135392.16	*DNAJC14*	-2.20	7.01E-03	88	40
ENSG00000124920.13	*MYRF*	-4.95	7.08E-03	43	9
ENSG00000179583.19	*CIITA*	-2.96	7.10E-03	40	14
ENSG00000073350.13	*LLGL2*	-2.06	7.11E-03	76	37
ENSG00000255152.8	*MSH5-SAPCD1*	-3.67	7.23E-03	26	7
ENSG00000188404.10	*SELL*	2.15	7.78E-03	13	28
ENSG00000197283.17	*SYNGAP1*	-3.13	7.81E-03	69	22
ENSG00000167131.17	*CCDC103*	-2.78	7.93E-03	31	11
ENSG00000249863.2	*AC021106.1*	2.20	8.21E-03	7	15
ENSG00000128422.17	*KRT17*	3.24	8.26E-03	5	16
ENSG00000220323.4	*HIST2H2BD*	-2.41	8.35E-03	64	26
ENSG00000164920.9	*OSR2*	-3.26	8.41E-03	61	19
ENSG00000204305.14	*AGER*	-2.10	8.51E-03	16	8
ENSG00000147408.14	*CSGALNACT1*	-3.19	8.75E-03	53	17
ENSG00000285042.1	*AC099499.2*	2.08	8.76E-03	7	14
ENSG00000128604.20	*IRF5*	-4.08	8.77E-03	21	5
ENSG00000186787.8	*SPIN2B*	-2.65	8.91E-03	128	48
ENSG00000272916.5	*AC022400.5*	-2.05	8.92E-03	26	13
ENSG00000135838.13	*NPL*	4.56	8.96E-03	4	19
ENSG00000132334.16	*PTPRE*	-5.23	9.11E-03	18	3
ENSG00000143995.20	*MEIS1*	2.39	9.42E-03	15	36
ENSG00000108984.15	*MAP2K6*	-2.65	9.47E-03	24	9
ENSG00000177034.16	*MTX3*	2.42	9.73E-03	51	125
ENSG00000106526.10	*ACTR3C*	-3.54	1.00E-02	28	8
ENSG00000141854.9	*MISP3*	-2.17	1.03E-02	24	11
ENSG00000099992.15	*TBC1D10A*	-3.27	1.04E-02	26	8

ENSG00000178821.13	*TMEM52*	-2.11	1.05E-02	19	9
ENSG00000231120.3	*BTF3P10*	2.28	1.06E-02	7	16
ENSG00000111331.13	*OAS3*	-5.47	1.08E-02	119	22
ENSG00000003989.17	*SLC7A2*	-24.47	1.10E-02	41	2
ENSG00000136237.19	*RAPGEF5*	-2.04	1.10E-02	41	20
ENSG00000146054.18	*TRIM7*	-2.84	1.12E-02	15	5
ENSG00000125089.17	*SH3TC1*	-3.72	1.12E-02	17	4
ENSG00000139687.15	*RB1*	-3.68	1.16E-02	55	15
ENSG00000228612.2	*HK2P1*	2.17	1.17E-02	6	14
ENSG00000137103.20	*TMEM8B*	-2.53	1.17E-02	17	7
ENSG00000161551.14	*ZNF577*	-2.25	1.19E-02	33	15
ENSG00000188013.6	*MEIS3P2*	-2.24	1.20E-02	15	7
ENSG00000244486.8	*SCARF2*	-4.87	1.20E-02	25	5
ENSG00000157927.17	*RADIL*	-2.34	1.21E-02	31	13
ENSG00000225345.3	*SNX18P3*	2.24	1.23E-02	9	20
ENSG00000107249.23	*GLIS3*	-2.74	1.26E-02	54	20
ENSG00000081923.14	*ATP8B1*	3.04	1.27E-02	7	22
ENSG00000167528.12	*ZNF641*	2.12	1.28E-02	51	108
ENSG00000138669.9	*PRKG2*	2.13	1.33E-02	17	36
ENSG00000137841.12	*PLCB2*	-2.06	1.36E-02	14	7
ENSG00000243696.5	*AC006254.1*	-2.02	1.38E-02	19	10
ENSG00000188234.13	*AGAP4*	-2.54	1.42E-02	15	6
ENSG00000287710.1	*AC067852.5*	-2.05	1.43E-02	15	7
ENSG00000242259.8	*C22orf39*	-3.04	1.44E-02	29	10
ENSG00000118971.8	*CCND2*	27.39	1.44E-02	10	283
ENSG00000157077.14	*ZFYVE9*	7.12	1.47E-02	9	65
ENSG00000177853.14	*ZNF518A*	-2.51	1.48E-02	18	7
ENSG00000124762.13	*CDKN1A*	-2.46	1.51E-02	63	25
ENSG00000256167.1	*ATF4P4*	2.01	1.54E-02	12	24
ENSG00000237753.2	*AC079922.2*	-2.06	1.56E-02	17	8
ENSG00000243137.8	*PSG4*	-2.58	1.59E-02	18	7
ENSG00000188223.9	*AD000671.1*	2.96	1.59E-02	5	16
ENSG00000204622.11	*HLA-J*	-2.00	1.61E-02	20	10
ENSG00000170549.4	*IRX1*	-3.42	1.64E-02	30	9
ENSG00000171608.16	*PIK3CD*	-4.02	1.68E-02	17	4
ENSG00000273763.2	*AC007318.2*	6.45	1.69E-02	3	21
ENSG00000073849.15	*ST6GAL1*	3.40	1.78E-02	11	37
ENSG00000143847.15	*PPFIA4*	2.21	1.78E-02	13	29
ENSG00000223802.7	*CERS1*	-3.21	1.79E-02	17	5
ENSG00000158427.15	*TMSB15B*	2.20	1.81E-02	58	127
ENSG00000106078.19	*COBL*	-2.71	1.82E-02	55	20
ENSG00000053747.16	*LAMA3*	-3.36	1.87E-02	164	49
ENSG00000286015.1	*CR589904.2*	2.18	1.87E-02	6	14

ENSG00000173320.12	*STOX2*	2.32	1.90E-02	26	60
ENSG00000187068.3	*C3orf70*	2.14	1.90E-02	10	20
ENSG00000262001.1	*DLGAP1-AS2*	-2.18	1.91E-02	14	6
ENSG00000230373.8	*GOLGA6L5P*	2.22	2.00E-02	15	34
ENSG00000227449.8	*FGF7P6*	2.26	2.06E-02	10	24
ENSG00000261971.8	*MMP25-AS1*	-3.10	2.07E-02	19	6
ENSG00000196517.11	*SLC6A9*	-2.31	2.08E-02	39	17
ENSG00000196993.8	*NPIPB9*	2.24	2.10E-02	8	17
ENSG00000261253.2	*AC137932.2*	-2.15	2.12E-02	14	7
ENSG00000125772.13	*GPCPD1*	2.30	2.13E-02	29	66
ENSG00000250303.4	*LINC02762*	2.70	2.21E-02	8	21
ENSG00000136367.14	*ZFHX2*	-2.12	2.23E-02	40	19
ENSG00000224577.3	*LINC01117*	2.12	2.25E-02	9	19
ENSG00000178301.4	*AQP11*	-2.06	2.26E-02	17	8
ENSG00000180071.20	*ANKRD18A*	2.08	2.27E-02	13	28
ENSG00000232346.1	*Z74021.1*	2.08	2.31E-02	8	17
ENSG00000196550.10	*FAM72A*	2.10	2.31E-02	29	61
ENSG00000229619.4	*MBNL1-AS1*	2.07	2.32E-02	16	33
ENSG00000002079.14	*MYH16*	-2.32	2.32E-02	31	13
ENSG00000277117.5	*FP565260.3*	-2.01	2.33E-02	26	13
ENSG00000261377.5	*PDCD6IPP2*	2.09	2.33E-02	10	21
ENSG00000276141.4	*WHAMMP3*	2.01	2.51E-02	23	47
ENSG00000187091.13	*PLCD1*	-2.60	2.51E-02	28	11
ENSG00000101311.15	*FERMT1*	2.30	2.58E-02	100	229
ENSG00000160051.11	*IQCC*	-2.21	2.78E-02	44	20
ENSG00000071575.11	*TRIB2*	-4.77	2.83E-02	44	9
ENSG00000146674.15	*IGFBP3*	2.72	2.84E-02	110	298
ENSG00000163617.11	*CCDC191*	2.20	2.85E-02	8	18
ENSG00000287769.1	*AL353748.3*	2.07	2.87E-02	7	14
ENSG00000072071.16	*ADGRL1*	-2.01	2.91E-02	20	10
ENSG00000156869.13	*FRRS1*	2.14	2.93E-02	14	29
ENSG00000179913.11	*B3GNT3*	-2.28	2.93E-02	22	10
ENSG00000196440.11	*ARMCX4*	2.50	2.96E-02	6	15
ENSG00000095574.11	*IKZF5*	-2.12	3.01E-02	27	13
ENSG00000115970.18	*THADA*	-2.01	3.12E-02	83	41
ENSG00000169435.14	*RASSF6*	2.19	3.14E-02	8	17
ENSG00000162368.13	*CMPK1*	-2.47	3.23E-02	30	12
ENSG00000183486.13	*MX2*	2.07	3.35E-02	16	33
ENSG00000185339.9	*TCN2*	-3.21	3.37E-02	61	19
ENSG00000255663.1	*AP002373.1*	2.93	3.42E-02	14	40
ENSG00000106868.16	*SUSD1*	-2.64	3.45E-02	64	24
ENSG00000112144.15	*ICK*	-5.43	3.47E-02	135	25
ENSG00000183401.12	*CCDC159*	-2.10	3.55E-02	17	8

ENSG00000132793.11	*LPIN3*	-2.09	3.56E-02	18	9
ENSG00000178852.16	*EFCAB13*	-2.04	3.63E-02	23	11
ENSG00000254852.8	*NPIPA2*	2.35	3.79E-02	10	23
ENSG00000150893.11	*FREM2*	-2.38	3.86E-02	47	20
ENSG00000235501.6	*AC105942.1*	4.11	3.98E-02	5	19
ENSG00000163607.16	*GTPBP8*	2.23	4.20E-02	22	48
ENSG00000286905.1	*AC108488.2*	-2.08	4.29E-02	68	33
ENSG00000110344.9	*UBE4A*	-2.23	4.31E-02	122	55
ENSG00000109066.13	*TMEM104*	-3.81	4.36E-02	16	4
ENSG00000244026.6	*FAM86DP*	2.18	4.59E-02	7	16
ENSG00000101665.9	*SMAD7*	-3.57	4.64E-02	31	9
ENSG00000286239.1	*AC093884.1*	3.89	4.72E-02	6	24

Table A3. Genes that were differentially expressed in the PTGS2 overexpressing MDA-MB-231 cells relative to typical MDA-MB-231 cells.

Gene ID	Gene	Fold change	p_{adj}	Control; Mean transcript counts per million	RR; Mean transcript counts per million
ENSG00000162511.8	*LAPTM5*	5.33	2.13E-205	638	3399
ENSG00000170412.18	*GPRC5C*	12.99	5.47E-183	100	1305
ENSG00000101210.12	*EEF1A2*	5.95	1.80E-170	400	2378
ENSG00000117525.14	*F3*	-2.84	3.35E-124	8740	3075
ENSG00000160211.19	*G6PD*	3.03	1.80E-118	1184	3585
ENSG00000163083.6	*INHBB*	7.08	1.84E-99	142	1007
ENSG00000196611.5	*MMP1*	-23.99	5.70E-83	697	29
ENSG00000122862.5	*SRGN*	-3.98	1.31E-78	2368	595
ENSG00000141753.7	*IGFBP4*	3.75	5.77E-73	17977	67357
ENSG00000115648.14	*MLPH*	2.44	2.49E-67	1467	3577
ENSG00000102181.21	*CD99L2*	2.37	5.60E-64	1105	2614
ENSG00000088836.14	*SLC4A11*	3.11	6.05E-63	668	2079
ENSG00000153395.10	*LPCAT1*	2.35	5.16E-59	1923	4522
ENSG00000169299.14	*PGM2*	-2.88	8.41E-59	2354	818
ENSG00000132561.14	*MATN2*	-5.38	9.68E-58	1176	219
ENSG00000130303.13	*BST2*	11.85	2.71E-57	47	552
ENSG00000124664.11	*SPDEF*	4.27	2.50E-55	230	982
ENSG00000130702.15	*LAMA5*	2.40	2.58E-55	3565	8551
ENSG00000182871.16	*COL18A1*	2.27	5.42E-54	1073	2431
ENSG00000049759.18	*NEDD4L*	-2.37	2.11E-52	5169	2179
ENSG00000101187.16	*SLCO4A1*	4.48	3.11E-51	457	2046
ENSG00000142871.17	*CCN1*	-1.86	3.11E-51	15254	8203
ENSG00000075618.18	*FSCN1*	2.86	4.56E-51	577	1650

ENSG00000096696.14	*DSP*	-3.88	1.43E-50	1314	338
ENSG00000144136.11	*SLC20A1*	1.95	1.85E-50	7903	15425
ENSG00000109861.16	*CTSC*	-2.59	1.92E-50	4366	1683
ENSG00000196154.12	*S100A4*	4.89	4.09E-50	612	2992
ENSG00000077420.16	*APBB1IP*	-3.74	4.64E-50	898	240
ENSG00000164379.7	*FOXQ1*	3.29	8.72E-50	409	1343
ENSG00000106683.15	*LIMK1*	2.14	2.22E-49	1130	2421
ENSG00000144810.16	*COL8A1*	-3.05	1.15E-48	2700	884
ENSG00000198959.12	*TGM2*	-2.11	3.74E-47	3784	1793
ENSG00000175130.7	*MARCKSL1*	3.00	1.13E-46	1858	5579
ENSG00000117984.14	*CTSD*	2.52	2.36E-46	11117	27968
ENSG00000197956.10	*S100A6*	3.02	4.32E-46	9237	27911
ENSG00000120129.6	*DUSP1*	-2.78	7.51E-46	1138	410
ENSG00000148926.10	*ADM*	-2.46	2.26E-45	1385	562
ENSG00000142347.19	*MYO1F*	11.02	1.48E-44	32	350
ENSG00000151651.16	*ADAM8*	2.73	1.48E-44	1516	4135
ENSG00000106089.12	*STX1A*	2.79	1.85E-44	641	1791
ENSG00000139318.8	*DUSP6*	1.98	2.00E-44	2366	4676
ENSG00000152332.16	*UHMK1*	-2.15	1.97E-43	4582	2134
ENSG00000100994.12	*PYGB*	1.83	1.57E-42	7030	12894
ENSG00000152128.13	*TMEM163*	3.77	1.74E-42	195	736
ENSG00000174136.13	*RGMB*	-1.90	4.99E-42	3031	1598
ENSG00000188042.8	*ARL4C*	2.13	7.05E-42	1295	2762
ENSG00000203879.12	*GDI1*	1.95	1.24E-41	1956	3817
ENSG00000120875.9	*DUSP4*	1.65	5.60E-41	7270	11967
ENSG00000182752.10	*PAPPA*	4.75	1.16E-40	126	599
ENSG00000170961.7	*HAS2*	3.54	1.04E-38	164	580
ENSG00000132470.14	*ITGB4*	2.36	2.79E-38	1600	3770
ENSG00000196754.12	*S100A2*	5.47	4.57E-38	165	903
ENSG00000162337.12	*LRP5*	1.90	4.80E-38	3010	5707
ENSG00000085491.17	*SLC25A24*	-2.07	4.89E-38	2337	1129
ENSG00000186642.16	*PDE2A*	-3.19	1.00E-37	806	253
ENSG00000185567.7	*AHNAK2*	2.06	8.64E-37	2032	4191
ENSG00000106211.9	*HSPB1*	2.13	9.48E-37	1295	2757
ENSG00000001617.12	*SEMA3F*	-4.76	1.24E-36	680	143
ENSG00000157654.18	*PALM2-AKAP2*	-2.34	2.13E-36	9323	3989
ENSG00000142627.13	*EPHA2*	1.59	1.13E-35	6843	10908
ENSG00000115756.13	*HPCAL1*	2.01	3.48E-35	1905	3823
ENSG00000114353.17	*GNAI2*	1.74	4.00E-35	5763	10009
ENSG00000176595.4	*KBTBD11*	-6.57	9.21E-35	355	54
ENSG00000151718.16	*WWC2*	-2.55	1.98E-34	1101	431
ENSG00000196924.17	*FLNA*	1.82	3.34E-34	28181	51167

ENSG00000085117.12	*CD82*	2.45	7.16E-34	682	1671
ENSG00000124615.20	*MOCS1*	2.42	1.56E-33	408	988
ENSG00000184216.14	*IRAK1*	1.86	1.27E-32	2857	5314
ENSG00000151388.11	*ADAMTS12*	-2.72	5.54E-32	691	254
ENSG00000153283.13	*CD96*	17.18	1.03E-31	19	334
ENSG00000089723.10	*OTUB2*	2.75	2.01E-31	261	717
ENSG00000156966.7	*B3GNT7*	-3.66	4.08E-31	615	168
ENSG00000155189.12	*AGPAT5*	-2.32	6.81E-31	1815	783
ENSG00000198682.13	*PAPSS2*	-1.90	1.89E-30	2573	1351
ENSG00000134686.18	*PHC2*	1.75	2.33E-30	2839	4972
ENSG00000116478.12	*HDAC1*	1.64	2.33E-30	2610	4269
ENSG00000050405.13	*LIMA1*	-2.65	3.58E-30	3383	1275
ENSG00000198753.12	*PLXNB3*	4.02	3.89E-30	177	711
ENSG00000198830.11	*HMGN2*	1.67	5.61E-30	7532	12579
ENSG00000177706.9	*FAM20C*	2.76	6.73E-30	349	965
ENSG00000057608.17	*GDI2*	-1.58	7.75E-30	5880	3718
ENSG00000048740.18	*CELF2*	-3.45	9.96E-30	855	248
ENSG00000157613.11	*CREB3L1*	2.52	1.73E-29	461	1160
ENSG00000058063.16	*ATP11B*	-2.09	2.58E-29	1265	605
ENSG00000232803.1	*SLCO4A1-AS1*	4.77	8.54E-29	83	397
ENSG00000169083.17	*AR*	409.80	1.13E-28	1	432
ENSG00000172380.6	*GNG12*	-1.66	1.34E-28	5630	3383
ENSG00000148120.16	*AOPEP*	3.03	1.65E-28	377	1144
ENSG00000106541.12	*AGR2*	3.45	1.78E-28	198	684
ENSG00000143322.21	*ABL2*	-3.26	2.04E-28	1714	526
ENSG00000109171.15	*SLAIN2*	-1.89	2.11E-28	1633	866
ENSG00000163110.15	*PDLIM5*	-1.95	1.43E-27	6002	3082
ENSG00000107937.19	*GTPBP4*	-2.11	1.45E-27	3416	1620
ENSG00000147403.16	*RPL10*	2.47	1.59E-27	8736	21585
ENSG00000070669.17	*ASNS*	1.99	3.13E-27	822	1637
ENSG00000204767.4	*INSYN2B*	-2.98	3.20E-27	1153	387
ENSG00000126773.13	*PCNX4*	-1.73	4.30E-27	5793	3354
ENSG00000088280.19	*ASAP3*	3.36	5.90E-27	114	382
ENSG00000104783.14	*KCNN4*	2.63	7.68E-27	343	903
ENSG00000100034.14	*PPM1F*	1.85	1.13E-26	2113	3901
ENSG00000184371.14	*CSF1*	1.64	1.36E-26	1786	2921
ENSG00000163931.16	*TKT*	1.60	1.37E-26	5343	8531
ENSG00000204219.11	*TCEA3*	3.34	1.44E-26	177	591
ENSG00000108551.5	*RASD1*	3.24	2.07E-26	167	542
ENSG00000100504.17	*PYGL*	-1.79	2.07E-26	5884	3292
ENSG00000067082.15	*KLF6*	-1.70	3.13E-26	2738	1615
ENSG00000101439.9	*CST3*	2.31	4.54E-26	2912	6733
ENSG00000197102.12	*DYNC1H1*	2.48	5.46E-26	4230	10493

ENSG00000127418.15	*FGFRL1*	1.87	6.95E-26	1251	2339
ENSG00000122068.13	*FYTTD1*	-2.29	9.55E-26	967	423
ENSG00000177119.16	*ANO6*	-2.69	1.09E-25	1195	445
ENSG00000106034.18	*CPED1*	-4.07	1.28E-25	412	101
ENSG00000065054.14	*SLC9A3R2*	1.94	1.33E-25	1902	3697
ENSG00000124766.7	*SOX4*	2.47	1.79E-25	314	776
ENSG00000119714.11	*GPR68*	5.09	2.07E-25	68	347
ENSG00000139926.15	*FRMD6*	-2.31	2.29E-25	2649	1147
ENSG00000132821.12	*VSTM2L*	3.01	2.71E-25	191	576
ENSG00000118596.12	*SLC16A7*	-3.15	2.93E-25	1029	327
ENSG00000104823.9	*ECH1*	2.06	3.15E-25	665	1369
ENSG00000042493.16	*CAPG*	2.24	4.08E-25	2398	5376
ENSG00000054277.14	*OPN3*	4.31	4.11E-25	76	328
ENSG00000170571.12	*EMB*	-2.50	4.95E-25	918	367
ENSG00000164056.11	*SPRY1*	2.09	5.02E-25	653	1366
ENSG00000163661.4	*PTX3*	-2.43	8.20E-25	1970	809
ENSG00000022840.16	*RNF10*	1.67	1.18E-24	3602	6010
ENSG00000185825.17	*BCAP31*	1.93	2.02E-24	2863	5532
ENSG00000104490.18	*NCALD*	-35.00	2.02E-24	162	5
ENSG00000117308.15	*GALE*	2.10	2.12E-24	1020	2143
ENSG00000171345.13	*KRT19*	1.91	2.19E-24	2665	5089
ENSG00000169174.10	*PCSK9*	3.22	4.23E-24	235	756
ENSG00000181031.16	*RPH3AL*	1.75	5.39E-24	1146	2005
ENSG00000083444.17	*PLOD1*	1.61	6.97E-24	1940	3131
ENSG00000186577.14	*SMIM29*	2.30	8.12E-24	403	925
ENSG00000139278.10	*GLIPR1*	-2.01	1.03E-23	1566	779
ENSG00000071242.12	*RPS6KA2*	2.96	1.58E-23	207	614
ENSG00000142669.15	*SH3BGRL3*	2.04	2.17E-23	3412	6975
ENSG00000114450.10	*GNB4*	-1.98	2.70E-23	1845	931
ENSG00000104728.16	*ARHGEF10*	-1.98	3.19E-23	2165	1096
ENSG00000004897.12	*CDC27*	-1.72	4.29E-23	3006	1748
ENSG00000126759.13	*CFP*	2.88	4.61E-23	202	584
ENSG00000152104.12	*PTPN14*	-1.66	5.37E-23	5552	3348
ENSG00000085662.14	*AKR1B1*	2.17	6.35E-23	1668	3619
ENSG00000146112.12	*PPP1R18*	1.66	1.59E-22	2254	3753
ENSG00000130005.13	*GAMT*	2.06	1.78E-22	828	1708
ENSG00000071553.17	*ATP6AP1*	1.82	2.11E-22	1136	2071
ENSG00000077549.18	*CAPZB*	1.67	2.40E-22	2462	4112
ENSG00000013588.8	*GPRC5A*	-4.47	2.50E-22	692	155
ENSG00000164889.14	*SLC4A2*	1.67	2.77E-22	3643	6077
ENSG00000102178.13	*UBL4A*	1.91	3.26E-22	820	1562
ENSG00000125520.14	*SLC2A4RG*	1.71	4.16E-22	1273	2173
ENSG00000154978.13	*VOPP1*	1.63	4.68E-22	1475	2405

ENSG00000164176.13	*EDIL3*	-1.95	5.55E-22	2026	1037
ENSG00000117318.9	*ID3*	2.77	5.83E-22	460	1273
ENSG00000198121.13	*LPAR1*	-1.87	5.83E-22	1960	1045
ENSG00000125484.12	*GTF3C4*	-1.84	6.68E-22	2067	1123
ENSG00000010404.18	*IDS*	1.62	8.22E-22	3492	5673
ENSG00000083312.17	*TNPO1*	-4.57	9.57E-22	433	95
ENSG00000065809.13	*FAM107B*	-1.76	1.05E-21	2897	1643
ENSG00000185551.15	*NR2F2*	-1.72	1.15E-21	3206	1858
ENSG00000233237.8	*LINC00472*	-4.16	1.37E-21	1057	254
ENSG00000205426.10	*KRT81*	2.06	1.43E-21	1713	3530
ENSG00000143157.11	*POGK*	-1.80	1.59E-21	1500	836
ENSG00000106003.13	*LFNG*	2.38	1.68E-21	247	586
ENSG00000136295.15	*TTYH3*	1.71	1.82E-21	1154	1976
ENSG00000064042.18	*LIMCH1*	-2.60	2.39E-21	2733	1053
ENSG00000120137.7	*PANK3*	-2.08	2.42E-21	2103	1013
ENSG00000125378.16	*BMP4*	1.72	2.76E-21	1233	2122
ENSG00000058085.15	*LAMC2*	1.80	3.26E-21	1061	1906
ENSG00000006468.14	*ETV1*	1.82	4.18E-21	1128	2049
ENSG00000168209.5	*DDIT4*	3.52	4.58E-21	403	1417
ENSG00000197467.14	*COL13A1*	1.92	4.68E-21	1313	2522
ENSG00000163428.4	*LRRC58*	-2.01	5.14E-21	1511	751
ENSG00000150938.10	*CRIM1*	-2.06	6.98E-21	9226	4481
ENSG00000112414.15	*ADGRG6*	-4.24	7.02E-21	1651	389
ENSG00000125968.9	*ID1*	2.79	7.61E-21	1276	3559
ENSG00000132356.11	*PRKAA1*	-6.83	9.73E-21	209	31
ENSG00000169439.12	*SDC2*	2.31	1.06E-20	423	978
ENSG00000034053.14	*APBA2*	-3.22	1.13E-20	369	115
ENSG00000151414.15	*NEK7*	-1.98	1.16E-20	3326	1680
ENSG00000134824.14	*FADS2*	1.55	1.34E-20	2892	4481
ENSG00000142784.16	*WDTC1*	1.82	1.38E-20	646	1172
ENSG00000142676.14	*RPL11*	1.60	1.46E-20	6192	9934
ENSG00000114331.15	*ACAP2*	-2.65	1.46E-20	1344	507
ENSG00000165732.13	*DDX21*	-2.08	1.59E-20	6892	3312
ENSG00000137409.19	*MTCH1*	1.86	1.73E-20	2973	5538
ENSG00000139354.11	*GAS2L3*	-2.03	1.90E-20	1117	551
ENSG00000029993.15	*HMGB3*	2.01	2.02E-20	1166	2342
ENSG00000117500.13	*TMED5*	-1.77	2.06E-20	2149	1217
ENSG00000143776.18	*CDC42BPA*	-2.31	2.46E-20	2473	1073
ENSG00000164741.15	*DLC1*	-1.67	3.17E-20	2616	1565
ENSG00000221968.9	*FADS3*	-2.15	3.26E-20	1524	710
ENSG00000117394.23	*SLC2A1*	1.64	3.89E-20	2374	3901
ENSG00000185112.6	*FAM43A*	2.84	4.97E-20	259	734
ENSG00000087448.11	*KLHL42*	-2.06	5.32E-20	997	484

ENSG00000168283.14	*BMI1*	-2.20	5.83E-20	2101	957
ENSG00000180758.12	*GPR157*	3.18	9.75E-20	141	449
ENSG00000067829.19	*IDH3G*	2.09	1.12E-19	446	933
ENSG00000136738.15	*STAM*	-2.24	1.14E-19	1161	517
ENSG00000135916.16	*ITM2C*	2.14	1.26E-19	858	1840
ENSG00000107438.9	*PDLIM1*	1.65	1.26E-19	1064	1761
ENSG00000065029.15	*ZNF76*	1.70	1.39E-19	789	1341
ENSG00000137161.17	*CNPY3*	2.04	1.41E-19	943	1920
ENSG00000127399.15	*LRRC61*	2.34	1.43E-19	228	534
ENSG00000057019.16	*DCBLD2*	-1.78	1.51E-19	7265	4074
ENSG00000166347.19	*CYB5A*	2.38	1.56E-19	227	539
ENSG00000108256.9	*NUFIP2*	-2.34	1.81E-19	2870	1224
ENSG00000204310.13	*AGPAT1*	1.70	1.83E-19	1739	2956
ENSG00000112473.18	*SLC39A7*	1.60	1.83E-19	2721	4349
ENSG00000111275.13	*ALDH2*	1.93	1.92E-19	683	1319
ENSG00000108582.12	*CPD*	-2.23	1.94E-19	2387	1072
ENSG00000188647.13	*PTAR1*	-2.58	2.49E-19	1298	504
ENSG00000127124.16	*HIVEP3*	2.46	2.66E-19	425	1046
ENSG00000106605.11	*BLVRA*	2.19	2.69E-19	376	822
ENSG00000185340.15	*GAS2L1*	1.90	2.83E-19	818	1554
ENSG00000148671.14	*ADIRF*	3.32	3.23E-19	101	337
ENSG00000149925.20	*ALDOA*	2.34	3.44E-19	3220	7542
ENSG00000160789.20	*LMNA*	1.86	3.73E-19	3037	5659
ENSG00000067167.8	*TRAM1*	-1.61	5.18E-19	2922	1813
ENSG00000161671.16	*EMC10*	2.28	5.32E-19	460	1050
ENSG00000181467.5	*RAP2B*	1.71	5.43E-19	1226	2101
ENSG00000158856.18	*DMTN*	-6.37	5.45E-19	252	40
ENSG00000124587.14	*PEX6*	1.87	5.46E-19	499	933
ENSG00000071859.15	*FAM50A*	1.81	5.68E-19	1182	2136
ENSG00000137962.13	*ARHGAP29*	-3.08	6.64E-19	5944	1932
ENSG00000064692.19	*SNCAIP*	-5.05	9.20E-19	282	56
ENSG00000108021.20	*TASOR2*	-7.11	1.06E-18	354	50
ENSG00000186350.12	*RXRA*	1.63	1.26E-18	982	1599
ENSG00000104356.11	*POP1*	-1.97	1.32E-18	961	489
ENSG00000060339.14	*CCAR1*	-1.92	1.34E-18	1808	943
ENSG00000163293.12	*NIPAL1*	-2.85	1.70E-18	364	128
ENSG00000073792.15	*IGF2BP2*	-2.13	1.70E-18	1817	854
ENSG00000168528.12	*SERINC2*	1.73	1.75E-18	728	1264
ENSG00000166250.12	*CLMP*	-2.17	1.87E-18	593	273
ENSG00000085719.13	*CPNE3*	-1.64	1.94E-18	2432	1487
ENSG00000036054.13	*TBC1D23*	-2.28	1.94E-18	864	380
ENSG00000166181.13	*API5*	-2.01	1.99E-18	2939	1461
ENSG00000077147.16	*TM9SF3*	-1.91	2.39E-18	4824	2530

ENSG00000121060.18	*TRIM25*	-1.56	2.62E-18	3495	2238
ENSG00000180879.14	*SSR4*	2.81	3.07E-18	757	2128
ENSG00000118898.16	*PPL*	2.56	3.07E-18	195	499
ENSG00000136754.17	*ABI1*	-1.89	3.26E-18	1010	534
ENSG00000172354.10	*GNB2*	1.94	3.41E-18	2311	4479
ENSG00000151233.11	*GXYLT1*	-2.08	3.43E-18	1222	588
ENSG00000184640.18	*SEPTIN9*	1.59	3.49E-18	3254	5160
ENSG00000213722.9	*DDAH2*	2.24	4.00E-18	492	1103
ENSG00000111371.16	*SLC38A1*	-1.98	4.43E-18	10285	5207
ENSG00000107338.10	*SHB*	1.65	5.34E-18	984	1628
ENSG00000148468.17	*FAM171A1*	-1.76	5.62E-18	1183	674
ENSG00000188064.10	*WNT7B*	1.86	5.93E-18	514	957
ENSG00000165775.18	*FUNDC2*	2.34	5.99E-18	391	914
ENSG00000156675.16	*RAB11FIP1*	-2.07	6.69E-18	653	315
ENSG00000159140.20	*SON*	-1.89	6.75E-18	2986	1582
ENSG00000134363.12	*FST*	-2.13	6.75E-18	2035	954
ENSG00000092969.12	*TGFB2*	-2.43	7.40E-18	1339	550
ENSG00000033178.13	*UBA6*	-3.10	8.71E-18	2110	680
ENSG00000136048.14	*DRAM1*	-2.36	8.86E-18	532	226
ENSG00000082898.17	*XPO1*	-2.67	9.27E-18	3297	1235
ENSG00000142657.21	*PGD*	1.56	1.02E-17	2876	4475
ENSG00000138771.16	*SHROOM3*	-2.24	1.07E-17	735	328
ENSG00000127824.14	*TUBA4A*	2.01	1.15E-17	888	1782
ENSG00000198756.12	*COLGALT2*	2.14	1.28E-17	478	1025
ENSG00000049192.15	*ADAMTS6*	-9.28	1.68E-17	242	26
ENSG00000074800.16	*ENO1*	1.64	1.89E-17	34307	56125
ENSG00000137312.15	*FLOT1*	1.65	2.38E-17	2810	4640
ENSG00000105851.11	*PIK3CG*	-115.14	2.72E-17	188	2
ENSG00000165233.18	*CARD19*	2.21	2.79E-17	678	1495
ENSG00000167644.12	*C19orf33*	2.29	3.25E-17	1039	2384
ENSG00000173599.15	*PC*	1.72	4.40E-17	829	1424
ENSG00000259974.3	*LINC00261*	2.05	5.99E-17	517	1057
ENSG00000170017.12	*ALCAM*	-2.02	6.55E-17	6412	3178
ENSG00000126903.16	*SLC10A3*	1.91	6.79E-17	485	925
ENSG00000135040.16	*NAA35*	-1.93	6.99E-17	950	493
ENSG00000138594.14	*TMOD3*	-1.75	8.09E-17	2069	1180
ENSG00000248905.9	*FMN1*	-2.34	8.88E-17	1648	703
ENSG00000124313.16	*IQSEC2*	2.46	8.96E-17	300	740
ENSG00000164163.11	*ABCE1*	-1.96	1.06E-16	2684	1366
ENSG00000165804.16	*ZNF219*	2.18	1.06E-16	274	597
ENSG00000150867.14	*PIP4K2A*	-1.90	1.09E-16	1665	876
ENSG00000007168.13	*PAFAH1B1*	-1.60	1.12E-16	4120	2571

ENSG00000103365.15	*GGA2*	-1.79	1.12E-16	1828	1023
ENSG00000109610.6	*SOD3*	3.14	1.32E-16	129	406
ENSG00000137831.15	*UACA*	-1.98	1.34E-16	925	467
ENSG00000174738.13	*NR1D2*	-1.76	1.42E-16	1874	1065
ENSG00000141385.9	*AFG3L2*	-8.63	1.55E-16	181	21
ENSG00000152558.15	*TMEM123*	-1.82	1.61E-16	6294	3453
ENSG00000173546.7	*CSPG4*	-3.16	1.61E-16	349	110
ENSG00000101057.16	*MYBL2*	1.54	1.71E-16	1328	2049
ENSG00000131016.17	*AKAP12*	-3.41	1.88E-16	1306	383
ENSG00000178467.18	*P4HTM*	2.29	2.14E-16	333	762
ENSG00000108854.16	*SMURF2*	-1.67	2.22E-16	4588	2753
ENSG00000166510.14	*CCDC68*	-3.83	2.33E-16	278	73
ENSG00000117399.14	*CDC20*	1.63	2.55E-16	3710	6045
ENSG00000102030.16	*NAA10*	1.95	2.60E-16	770	1498
ENSG00000134955.11	*SLC37A2*	3.41	2.86E-16	102	347
ENSG00000133121.21	*STARD13*	-3.06	3.55E-16	483	158
ENSG00000136167.14	*LCP1*	-6.18	3.61E-16	202	33
ENSG00000134900.12	*TPP2*	-2.13	3.68E-16	898	422
ENSG00000197170.10	*PSMD12*	-1.91	4.09E-16	2778	1451
ENSG00000134107.5	*BHLHE40*	1.83	4.34E-16	569	1038
ENSG00000165997.5	*ARL5B*	-2.34	4.71E-16	839	359
ENSG00000245532.9	*NEAT1*	-2.06	4.74E-16	2523	1224
ENSG00000124225.16	*PMEPA1*	2.46	4.85E-16	317	780
ENSG00000165105.10	*RASEF*	-28.24	4.94E-16	124	4
ENSG00000071082.11	*RPL31*	1.78	5.57E-16	5626	10007
ENSG00000233276.5	*GPX1*	2.08	6.94E-16	4843	10051
ENSG00000137331.12	*IER3*	1.76	9.00E-16	1902	3347
ENSG00000116685.16	*KIAA2013*	1.79	1.26E-15	932	1670
ENSG00000255346.10	*NOX5*	4.27	1.37E-15	44	186
ENSG00000132329.11	*RAMP1*	3.00	1.40E-15	140	420
ENSG00000163513.18	*TGFBR2*	2.36	1.42E-15	664	1567
ENSG00000228526.7	*MIR34AHG*	9.12	1.48E-15	12	106
ENSG00000102265.12	*TIMP1*	1.94	1.52E-15	2098	4069
ENSG00000164211.13	*STARD4*	-2.18	1.62E-15	965	443
ENSG00000136261.15	*BZW2*	1.53	1.99E-15	1069	1640
ENSG00000135940.7	*COX5B*	2.08	2.71E-15	904	1881
ENSG00000187079.17	*TEAD1*	-4.30	2.74E-15	1870	435
ENSG00000167996.16	*FTH1*	1.87	2.78E-15	3728	6983
ENSG00000157240.4	*FZD1*	1.85	2.91E-15	512	947
ENSG00000085998.14	*POMGNT1*	1.74	3.00E-15	932	1618
ENSG00000115884.11	*SDC1*	-1.63	3.08E-15	1632	1003
ENSG00000146701.12	*MDH2*	1.68	3.19E-15	2984	5017
ENSG00000011105.14	*TSPAN9*	1.86	3.35E-15	627	1170

ENSG00000106245.11	*BUD31*	1.80	3.65E-15	793	1424
ENSG00000152952.12	*PLOD2*	-3.21	3.85E-15	1466	456
ENSG00000136717.15	*BIN1*	2.14	4.79E-15	534	1144
ENSG00000073921.18	*PICALM*	-1.62	4.79E-15	3678	2274
ENSG00000163291.14	*PAQR3*	-1.99	5.41E-15	917	460
ENSG00000183840.7	*GPR39*	2.08	5.50E-15	258	536
ENSG00000068366.20	*ACSL4*	-2.09	5.92E-15	1925	923
ENSG00000070367.16	*EXOC5*	-2.46	5.98E-15	2101	854
ENSG00000117676.14	*RPS6KA1*	1.76	6.26E-15	540	948
ENSG00000073008.15	*PVR*	-1.52	6.37E-15	3037	2001
ENSG00000180182.11	*MED14*	-1.77	6.52E-15	1057	598
ENSG00000136111.14	*TBC1D4*	-1.82	6.95E-15	1363	748
ENSG00000146281.6	*PM20D2*	-1.95	7.19E-15	990	507
ENSG00000168090.10	*COPS6*	1.64	7.23E-15	2169	3552
ENSG00000262919.8	*CCNQ*	2.20	7.86E-15	247	545
ENSG00000110172.12	*CHORDC1*	-2.28	8.23E-15	1174	516
ENSG00000078269.15	*SYNJ2*	1.59	9.56E-15	1630	2597
ENSG00000106367.15	*AP1S1*	1.87	9.59E-15	1417	2655
ENSG00000113658.18	*SMAD5*	-2.08	9.59E-15	1717	825
ENSG00000127952.17	*STYXL1*	2.05	9.77E-15	500	1028
ENSG00000136720.7	*HS6ST1*	1.98	1.16E-14	307	607
ENSG00000171791.13	*BCL2*	-2.32	1.16E-14	518	224
ENSG00000154059.11	*IMPACT*	-2.82	1.22E-14	291	103
ENSG00000170525.21	*PFKFB3*	-1.61	1.23E-14	1726	1075
ENSG00000109756.9	*RAPGEF2*	-3.02	1.40E-14	450	149
ENSG00000254999.4	*BRK1*	1.66	1.44E-14	1676	2774
ENSG00000072274.13	*TFRC*	-2.53	1.48E-14	9811	3874
ENSG00000142687.18	*KIAA0319L*	1.76	1.61E-14	847	1490
ENSG00000241685.10	*ARPC1A*	1.73	1.66E-14	2381	4123
ENSG00000146678.10	*IGFBP1*	1.85	1.68E-14	644	1192
ENSG00000143756.12	*FBXO28*	-1.88	1.73E-14	1371	728
ENSG00000196262.14	*PPIA*	1.77	1.92E-14	16017	28401
ENSG00000163811.12	*WDR43*	-1.74	1.96E-14	1544	889
ENSG00000196411.10	*EPHB4*	1.70	2.01E-14	815	1385
ENSG00000141367.12	*CLTC*	4.54	2.04E-14	170	770
ENSG00000240303.8	*ACAD11*	-3.34	2.07E-14	265	79
ENSG00000160094.15	*ZNF362*	2.61	2.11E-14	155	405
ENSG00000157593.19	*SLC35B2*	1.84	2.14E-14	1549	2855
ENSG00000091622.16	*PITPNM3*	-1.71	2.16E-14	1242	728
ENSG00000008018.9	*PSMB1*	1.65	2.21E-14	1819	2994
ENSG00000179632.10	*MAF1*	1.75	2.28E-14	1972	3455
ENSG00000115073.8	*ACTR1B*	1.74	2.33E-14	925	1613
ENSG00000179242.16	*CDH4*	-1.52	2.35E-14	2647	1740

ENSG00000151465.14	*CDC123*	-1.55	2.65E-14	2264	1456
ENSG00000167258.14	*CDK12*	-2.48	2.86E-14	1177	474
ENSG00000101096.20	*NFATC2*	-1.84	2.88E-14	955	520
ENSG00000197971.15	*MBP*	1.71	2.96E-14	1154	1978
ENSG00000177697.19	*CD151*	1.73	3.04E-14	5086	8818
ENSG00000144567.11	*RETREG2*	1.75	3.17E-14	1103	1929
ENSG00000175832.13	*ETV4*	1.64	3.35E-14	928	1518
ENSG00000139734.19	*DIAPH3*	-1.80	3.51E-14	1744	970
ENSG00000152270.9	*PDE3B*	-3.11	3.53E-14	285	92
ENSG00000134243.12	*SORT1*	-1.56	3.60E-14	2488	1599
ENSG00000110841.14	*PPFIBP1*	-1.99	3.86E-14	1255	631
ENSG00000197448.14	*GSTK1*	1.87	4.02E-14	652	1220
ENSG00000127314.18	*RAP1B*	-1.66	4.89E-14	2575	1554
ENSG00000108064.11	*TFAM*	-1.81	4.94E-14	2439	1346
ENSG00000165424.7	*ZCCHC24*	1.82	5.00E-14	667	1212
ENSG00000137770.14	*CTDSPL2*	-2.74	5.41E-14	940	343
ENSG00000158828.8	*PINK1*	1.54	5.46E-14	980	1509
ENSG00000058804.12	*NDC1*	-1.53	5.54E-14	4139	2712
ENSG00000105048.17	*TNNT1*	1.90	6.03E-14	715	1355
ENSG00000126870.16	*WDR60*	1.96	6.15E-14	297	583
ENSG00000078403.17	*MLLT10*	-2.06	6.19E-14	591	286
ENSG00000125686.12	*MED1*	-1.72	6.22E-14	2491	1447
ENSG00000167767.14	*KRT80*	1.55	6.90E-14	2143	3319
ENSG00000108107.14	*RPL28*	1.67	6.95E-14	6029	10071
ENSG00000100097.12	*LGALS1*	1.90	7.22E-14	5854	11134
ENSG00000106066.15	*CPVL*	2.02	7.52E-14	256	516
ENSG00000184232.9	*OAF*	-1.67	7.52E-14	1296	775
ENSG00000103942.13	*HOMER2*	-2.86	9.25E-14	375	131
ENSG00000006747.15	*SCIN*	8.88	9.86E-14	10	85
ENSG00000066084.13	*DIP2B*	-1.72	1.04E-13	1280	746
ENSG00000204356.14	*NELFE*	1.72	1.06E-13	1335	2301
ENSG00000152455.16	*SUV39H2*	-2.50	1.07E-13	686	274
ENSG00000178343.5	*SHISA3*	2.07	1.08E-13	334	690
ENSG00000171488.15	*LRRC8C*	-1.63	1.10E-13	1625	994
ENSG00000133313.15	*CNDP2*	1.57	1.22E-13	1639	2566
ENSG00000165912.16	*PACSIN3*	1.85	1.24E-13	457	844
ENSG00000130770.18	*ATP5IF1*	1.96	1.26E-13	745	1457
ENSG00000090013.11	*BLVRB*	2.32	1.32E-13	253	585
ENSG00000114850.6	*SSR3*	-1.92	1.35E-13	710	370
ENSG00000156976.17	*EIF4A2*	-1.69	1.37E-13	8370	4941
ENSG00000189369.9	*GSPT2*	6.90	1.40E-13	16	109
ENSG00000141480.18	*ARRB2*	2.04	1.57E-13	222	452
ENSG00000138018.18	*SELENOI*	-1.89	1.84E-13	1306	690

ENSG00000117410.14	*ATP6V0B*	2.05	1.86E-13	1202	2468
ENSG00000120063.10	*GNA13*	-1.85	2.14E-13	1633	883
ENSG00000115107.20	*STEAP3*	1.54	2.28E-13	1529	2352
ENSG00000118640.11	*VAMP8*	2.07	2.50E-13	790	1637
ENSG00000175471.19	*MCTP1*	-2.22	2.74E-13	645	291
ENSG00000090432.7	*MUL1*	1.59	2.99E-13	733	1166
ENSG00000204387.14	*SNHG32*	1.94	3.07E-13	1259	2437
ENSG00000117419.16	*ERI3*	1.83	3.15E-13	629	1153
ENSG00000107897.19	*ACBD5*	-2.38	3.24E-13	868	365
ENSG00000170779.11	*CDCA4*	1.60	3.31E-13	1230	1969
ENSG00000130429.15	*ARPC1B*	1.59	3.36E-13	1916	3037
ENSG00000113580.15	*NR3C1*	-1.74	3.43E-13	2160	1242
ENSG00000260032.2	*NORAD*	-1.66	3.94E-13	5524	3319
ENSG00000184990.13	*SIVA1*	2.24	4.20E-13	705	1576
ENSG00000171703.17	*TCEA2*	2.14	4.25E-13	280	598
ENSG00000111144.10	*LTA4H*	1.54	4.32E-13	1451	2232
ENSG00000106635.8	*BCL7B*	1.76	4.32E-13	877	1547
ENSG00000145147.20	*SLIT2*	-2.64	4.42E-13	976	370
ENSG00000171621.14	*SPSB1*	1.72	4.55E-13	528	911
ENSG00000123453.18	*SARDH*	2.80	4.72E-13	114	321
ENSG00000160255.18	*ITGB2*	3.02	5.26E-13	78	235
ENSG00000161813.22	*LARP4*	-2.16	5.28E-13	2575	1193
ENSG00000178904.19	*DPY19L3*	-2.17	5.80E-13	1001	462
ENSG00000129680.16	*MAP7D3*	-2.04	5.81E-13	1046	513
ENSG00000072364.13	*AFF4*	-2.28	6.30E-13	3356	1475
ENSG00000060971.18	*ACAA1*	2.02	6.75E-13	480	970
ENSG00000173660.12	*UQCRH*	1.87	7.23E-13	1661	3102
ENSG00000116675.16	*DNAJC6*	-2.81	7.39E-13	361	129
ENSG00000107984.10	*DKK1*	-2.00	7.67E-13	9101	4557
ENSG00000073712.15	*FERMT2*	-1.56	7.71E-13	1799	1155
ENSG00000168758.11	*SEMA4C*	1.94	7.95E-13	477	923
ENSG00000169136.11	*ATF5*	1.62	8.13E-13	680	1104
ENSG00000108239.9	*TBC1D12*	-2.39	8.24E-13	338	142
ENSG00000156273.16	*BACH1*	-3.50	8.80E-13	664	190
ENSG00000124733.5	*MEA1*	1.79	9.33E-13	1876	3360
ENSG00000101265.16	*RASSF2*	-9.36	9.44E-13	93	10
ENSG00000166128.13	*RAB8B*	-1.95	1.17E-12	909	466
ENSG00000223784.2	*LINP1*	-3.27	1.34E-12	330	101
ENSG00000124120.11	*TTPAL*	-1.80	1.43E-12	989	551
ENSG00000197021.9	*CXorf40B*	1.93	1.45E-12	323	624
ENSG00000075711.21	*DLG1*	-2.02	1.56E-12	2398	1187
ENSG00000112541.15	*PDE10A*	-2.67	1.59E-12	376	141
ENSG00000164932.13	*CTHRC1*	11.60	1.62E-12	7	80

ENSG00000115685.15	*PPP1R7*	1.96	1.65E-12	536	1054
ENSG00000185728.17	*YTHDF3*	-1.83	1.67E-12	1054	577
ENSG00000154001.14	*PPP2R5E*	-1.58	1.69E-12	1985	1257
ENSG00000145833.16	*DDX46*	-1.96	1.76E-12	2856	1456
ENSG00000146648.18	*EGFR*	-2.01	1.78E-12	6800	3391
ENSG00000127838.14	*PNKD*	2.15	1.80E-12	431	926
ENSG00000118689.15	*FOXO3*	-1.82	1.80E-12	816	447
ENSG00000123384.14	*LRP1*	2.20	1.80E-12	336	739
ENSG00000166165.13	*CKB*	2.10	2.04E-12	1179	2479
ENSG00000008405.12	*CRY1*	-1.67	2.05E-12	1464	879
ENSG00000188643.11	*S100A16*	1.78	2.26E-12	3062	5439
ENSG00000005486.17	*RHBDD2*	1.71	2.34E-12	476	813
ENSG00000148484.18	*RSU1*	-1.55	2.38E-12	1522	983
ENSG00000011009.11	*LYPLA2*	1.59	2.86E-12	1000	1587
ENSG00000158552.13	*ZFAND2B*	2.36	2.92E-12	203	479
ENSG00000173530.6	*TNFRSF10D*	-1.59	2.92E-12	1027	645
ENSG00000089248.7	*ERP29*	1.65	2.93E-12	2274	3742
ENSG00000187498.16	*COL4A1*	-1.77	2.99E-12	1311	741
ENSG00000145536.15	*ADAMTS16*	-4.20	2.99E-12	310	74
ENSG00000010256.11	*UQCRC1*	1.67	3.21E-12	2995	4995
ENSG00000106009.16	*BRAT1*	1.76	3.34E-12	635	1120
ENSG00000102024.18	*PLS3*	-2.09	3.45E-12	2801	1340
ENSG00000231298.7	*MANCR*	-1.79	4.18E-12	829	462
ENSG00000087074.8	*PPP1R15A*	-1.54	4.32E-12	2790	1806
ENSG00000023608.5	*SNAPC1*	-1.62	4.55E-12	1450	894
ENSG00000175470.20	*PPP2R2D*	1.60	4.61E-12	618	987
ENSG00000164099.3	*PRSS12*	-2.74	4.66E-12	457	167
ENSG00000072840.13	*EVC*	-2.24	4.87E-12	1239	553
ENSG00000137171.15	*KLC4*	2.62	4.96E-12	103	271
ENSG00000197747.9	*S100A10*	1.56	4.98E-12	4069	6329
ENSG00000217128.12	*FNIP1*	-2.34	5.29E-12	909	389
ENSG00000247596.9	*TWF2*	1.69	5.61E-12	1260	2125
ENSG00000159167.12	*STC1*	-2.21	5.82E-12	341	155
ENSG00000108509.21	*CAMTA2*	1.91	5.98E-12	978	1871
ENSG00000178035.12	*IMPDH2*	1.68	7.04E-12	4038	6764
ENSG00000142937.12	*RPS8*	1.72	7.06E-12	8724	14986
ENSG00000161016.17	*RPL8*	1.79	7.56E-12	16264	29148
ENSG00000126062.4	*TMEM115*	1.56	8.18E-12	880	1370
ENSG00000134250.20	*NOTCH2*	-1.77	8.48E-12	6138	3464
ENSG00000056586.16	*RC3H2*	-1.78	9.44E-12	1723	968
ENSG00000187514.16	*PTMA*	2.05	9.60E-12	252	515
ENSG00000113441.16	*LNPEP*	-2.07	9.94E-12	1612	780
ENSG00000139292.13	*LGR5*	3.29	1.08E-11	53	174

ENSG00000167994.13	*RAB3IL1*	-4.15	1.18E-11	152	36
ENSG00000138363.15	*ATIC*	1.55	1.25E-11	2030	3137
ENSG00000083799.17	*CYLD*	-2.73	1.26E-11	366	134
ENSG00000213281.5	*NRAS*	-1.52	1.28E-11	2112	1391
ENSG00000133243.10	*BTBD2*	1.61	1.33E-11	799	1283
ENSG00000123240.17	*OPTN*	-1.75	1.35E-11	1228	702
ENSG00000177700.6	*POLR2L*	1.82	1.37E-11	2440	4451
ENSG00000108443.14	*RPS6KB1*	-1.74	1.42E-11	881	508
ENSG00000157150.5	*TIMP4*	4.02	1.43E-11	37	150
ENSG00000122515.15	*ZMIZ2*	1.56	1.51E-11	1153	1803
ENSG00000179241.13	*LDLRAD3*	-1.98	1.52E-11	631	318
ENSG00000117650.13	*NEK2*	-1.63	1.52E-11	1115	683
ENSG00000142634.13	*EFHD2*	1.66	1.53E-11	2197	3655
ENSG00000170498.9	*KISS1*	-4.82	1.53E-11	160	33
ENSG00000092010.15	*PSME1*	1.67	1.67E-11	1190	1983
ENSG00000070950.10	*RAD18*	-1.94	1.71E-11	1255	648
ENSG00000114978.18	*MOB1A*	-1.61	1.77E-11	2344	1457
ENSG00000128829.12	*EIF2AK4*	-1.57	1.78E-11	2168	1379
ENSG00000106049.9	*HIBADH*	1.72	1.81E-11	569	978
ENSG00000139428.12	*MMAB*	2.04	1.97E-11	299	610
ENSG00000197620.11	*CXorf40A*	2.43	1.98E-11	150	366
ENSG00000146540.15	*C7orf50*	1.92	2.00E-11	749	1436
ENSG00000234741.8	*GAS5*	-2.45	2.02E-11	355	145
ENSG00000151458.12	*ANKRD50*	-2.74	2.18E-11	1054	384
ENSG00000183508.5	*TENT5C*	2.28	2.18E-11	159	363
ENSG00000112514.16	*CUTA*	1.87	2.21E-11	1422	2661
ENSG00000150457.9	*LATS2*	-1.84	2.21E-11	889	482
ENSG00000103544.15	*VPS35L*	-2.37	2.21E-11	328	138
ENSG00000143126.8	*CELSR2*	-2.66	2.27E-11	367	138
ENSG00000004399.12	*PLXND1*	3.15	2.31E-11	86	270
ENSG00000092531.10	*SNAP23*	-1.68	2.32E-11	857	510
ENSG00000055208.19	*TAB2*	-1.71	2.39E-11	1440	842
ENSG00000167642.13	*SPINT2*	1.77	2.49E-11	3590	6363
ENSG00000165801.10	*ARHGEF40*	1.98	2.63E-11	368	730
ENSG00000242125.3	*SNHG3*	1.97	2.83E-11	471	925
ENSG00000138593.9	*SECISBP2L*	-2.09	2.85E-11	659	315
ENSG00000140859.16	*KIFC3*	1.60	2.91E-11	2570	4122
ENSG00000004059.11	*ARF5*	1.78	2.91E-11	822	1462
ENSG00000081189.15	*MEF2C*	4.77	2.97E-11	69	330
ENSG00000074219.13	*TEAD2*	2.43	2.97E-11	159	386
ENSG00000136699.19	*SMPD4*	1.71	3.04E-11	1004	1720
ENSG00000046604.13	*DSG2*	-1.91	3.10E-11	2213	1159
ENSG00000123219.13	*CENPK*	-1.91	3.13E-11	763	400

ENSG00000121892.15	*PDS5A*	-2.06	3.32E-11	3796	1842
ENSG00000113356.12	*POLR3G*	-1.83	3.43E-11	506	277
ENSG00000204580.13	*DDR1*	2.78	3.59E-11	168	468
ENSG00000141429.13	*GALNT1*	-4.65	3.65E-11	187	40
ENSG00000206527.10	*HACD2*	-1.64	3.84E-11	990	605
ENSG00000172260.15	*NEGR1*	-1.97	3.84E-11	455	231
ENSG00000114790.13	*ARHGEF26*	-1.69	4.14E-11	685	405
ENSG00000266709.1	*AC005224.3*	-2.55	4.14E-11	276	108
ENSG00000163378.14	*EOGT*	-2.02	4.15E-11	533	263
ENSG00000197858.11	*GPAA1*	1.70	4.24E-11	1184	2012
ENSG00000180801.14	*ARSJ*	-1.57	4.34E-11	1710	1086
ENSG00000184117.12	*NIPSNAP1*	2.08	4.35E-11	183	382
ENSG00000113742.14	*CPEB4*	-2.53	4.42E-11	619	245
ENSG00000157107.14	*FCHO2*	-2.21	4.52E-11	596	269
ENSG00000024526.17	*DEPDC1*	-1.81	4.53E-11	1840	1016
ENSG00000060656.20	*PTPRU*	4.45	4.88E-11	58	259
ENSG00000106723.17	*SPIN1*	-1.65	4.92E-11	2127	1288
ENSG00000152465.18	*NMT2*	-1.75	4.94E-11	832	476
ENSG00000106571.14	*GLI3*	-599.79	4.94E-11	136	0
ENSG00000126088.14	*UROD*	1.77	4.97E-11	1423	2517
ENSG00000102125.16	*TAZ*	2.12	5.18E-11	160	340
ENSG00000123992.19	*DNPEP*	2.41	5.99E-11	404	973
ENSG00000107290.14	*SETX*	-1.90	6.39E-11	1052	553
ENSG00000165115.15	*KIF27*	-2.90	6.77E-11	266	92
ENSG00000173517.10	*PEAK1*	-2.74	6.94E-11	586	214
ENSG00000119630.14	*PGF*	3.07	7.25E-11	72	222
ENSG00000173889.16	*PHC3*	-3.36	7.27E-11	1243	370
ENSG00000164880.16	*INTS1*	1.75	7.55E-11	1157	2021
ENSG00000196914.9	*ARHGEF12*	-1.99	7.56E-11	4457	2238
ENSG00000183696.14	*UPP1*	1.93	7.68E-11	520	1003
ENSG00000106636.8	*YKT6*	1.62	7.68E-11	1311	2128
ENSG00000166780.11	*BMERB1*	2.93	7.74E-11	79	231
ENSG00000134278.15	*SPIRE1*	-1.60	8.05E-11	1386	867
ENSG00000102781.14	*KATNAL1*	-2.05	8.11E-11	485	237
ENSG00000222041.11	*CYTOR*	1.91	8.16E-11	1222	2337
ENSG00000175866.15	*BAIAP2*	1.65	8.18E-11	755	1243
ENSG00000049541.11	*RFC2*	1.58	8.19E-11	1118	1766
ENSG00000145623.13	*OSMR*	-1.62	8.38E-11	2094	1294
ENSG00000173145.11	*NOC3L*	-2.29	8.51E-11	881	384
ENSG00000135723.14	*FHOD1*	1.59	8.83E-11	580	922
ENSG00000047597.7	*XK*	-2.22	8.92E-11	292	132
ENSG00000162402.14	*USP24*	-2.57	9.73E-11	2701	1051

ENSG00000168653.11	*NDUFS5*	1.94	9.90E-11	1475	2859
ENSG00000168894.10	*RNF181*	1.95	9.94E-11	650	1269
ENSG00000186687.16	*LYRM7*	-1.84	9.94E-11	573	311
ENSG00000250899.3	*AC125807.2*	-1.62	1.00E-10	874	539
ENSG00000166446.15	*CDYL2*	-1.81	1.06E-10	650	359
ENSG00000162614.18	*NEXN*	-2.22	1.06E-10	427	192
ENSG00000148481.14	*MINDY3*	-1.89	1.08E-10	556	294
ENSG00000075420.13	*FNDC3B*	-1.68	1.09E-10	1873	1114
ENSG00000178585.15	*CTNNBIP1*	1.75	1.14E-10	600	1051
ENSG00000166925.9	*TSC22D4*	1.64	1.16E-10	580	951
ENSG00000189350.12	*TOGARAM2*	3.41	1.18E-10	41	140
ENSG00000089157.16	*RPLP0*	1.72	1.21E-10	30379	52166
ENSG00000176244.7	*ACBD7*	-2.84	1.28E-10	323	113
ENSG00000160813.7	*PPP1R35*	2.08	1.40E-10	203	424
ENSG00000241468.7	*ATP5MF*	1.73	1.43E-10	568	984
ENSG00000048052.21	*HDAC9*	-3.13	1.45E-10	390	125
ENSG00000108846.16	*ABCC3*	2.11	1.50E-10	250	527
ENSG00000159363.18	*ATP13A2*	1.55	1.54E-10	1118	1735
ENSG00000130827.6	*PLXNA3*	1.96	1.55E-10	394	774
ENSG00000120885.22	*CLU*	1.62	1.57E-10	1370	2224
ENSG00000020577.13	*SAMD4A*	-2.01	1.57E-10	1716	854
ENSG00000124104.19	*SNX21*	2.21	1.59E-10	215	477
ENSG00000122786.20	*CALD1*	-1.71	1.63E-10	1312	768
ENSG00000165895.19	*ARHGAP42*	-2.39	1.65E-10	346	145
ENSG00000057252.13	*SOAT1*	-1.70	1.70E-10	3497	2053
ENSG00000213186.8	*TRIM59*	-2.55	1.74E-10	300	118
ENSG00000146828.18	*SLC12A9*	1.68	1.79E-10	403	679
ENSG00000106400.12	*ZNHIT1*	2.19	1.81E-10	413	904
ENSG00000138757.14	*G3BP2*	-2.29	1.82E-10	1719	749
ENSG00000187522.16	*HSPA14*	-1.86	1.96E-10	523	282
ENSG00000261061.1	*AC092718.4*	486.63	1.96E-10	0	72
ENSG00000189043.10	*NDUFA4*	2.15	1.96E-10	1025	2206
ENSG00000143816.8	*WNT9A*	2.31	2.11E-10	105	242
ENSG00000189308.11	*LIN54*	-1.94	2.12E-10	753	388
ENSG00000167106.12	*FAM102A*	2.06	2.18E-10	617	1269
ENSG00000102908.22	*NFAT5*	-2.52	2.19E-10	864	343
ENSG00000171241.9	*SHCBP1*	-1.59	2.22E-10	1259	794
ENSG00000076770.14	*MBNL3*	-2.72	2.22E-10	228	84
ENSG00000114942.14	*EEF1B2*	1.66	2.34E-10	4865	8085
ENSG00000198909.7	*MAP3K3*	-1.90	2.34E-10	649	341
ENSG00000015171.19	*ZMYND11*	-7.36	2.37E-10	156	21
ENSG00000102316.17	*MAGED2*	1.67	2.42E-10	1521	2535
ENSG00000125534.10	*PPDPF*	1.61	2.55E-10	1303	2099

ENSG00000154642.11	*C21orf91*	-2.51	2.59E-10	281	112
ENSG00000175602.4	*CCDC85B*	1.99	2.60E-10	586	1168
ENSG00000146950.13	*SHROOM2*	1.80	2.65E-10	276	496
ENSG00000111335.12	*OAS2*	2.69	2.89E-10	69	187
ENSG00000131023.13	*LATS1*	-1.85	2.91E-10	646	349
ENSG00000047365.12	*ARAP2*	-3.32	3.10E-10	410	123
ENSG00000197601.13	*FAR1*	-2.56	3.12E-10	1616	632
ENSG00000133019.11	*CHRM3*	12.64	3.22E-10	5	62
ENSG00000162702.8	*ZNF281*	-1.67	3.22E-10	936	562
ENSG00000109133.13	*TMEM33*	-1.57	3.26E-10	2275	1450
ENSG00000126005.17	*MMP24OS*	1.62	3.28E-10	895	1451
ENSG00000114268.12	*PFKFB4*	1.89	3.30E-10	230	435
ENSG00000177600.9	*RPLP2*	1.67	3.33E-10	4163	6966
ENSG00000090530.10	*P3H2*	-2.06	3.33E-10	1286	625
ENSG00000105928.16	*GSDME*	1.57	3.34E-10	971	1522
ENSG00000114270.17	*COL7A1*	2.34	3.34E-10	184	431
ENSG00000137404.14	*NRM*	2.20	3.46E-10	155	341
ENSG00000074211.14	*PPP2R2C*	-7.95	3.76E-10	122	15
ENSG00000090266.13	*NDUFB2*	1.97	3.94E-10	561	1109
ENSG00000136710.10	*CCDC115*	2.58	4.05E-10	163	420
ENSG00000111775.3	*COX6A1*	1.80	4.38E-10	2297	4143
ENSG00000150782.12	*IL18*	-1.69	4.42E-10	1039	615
ENSG00000184254.17	*ALDH1A3*	-7.33	4.46E-10	187	25
ENSG00000198618.5	*PPIAP22*	1.90	4.48E-10	467	886
ENSG00000236104.3	*ZBTB22*	1.89	4.69E-10	296	558
ENSG00000164347.18	*GFM2*	-1.71	4.82E-10	719	420
ENSG00000175550.8	*DRAP1*	1.65	4.99E-10	2147	3536
ENSG00000124151.19	*NCOA3*	-1.84	4.99E-10	732	399
ENSG00000062650.19	*WAPL*	-1.65	5.61E-10	1660	1009
ENSG00000091527.15	*CDV3*	-1.63	5.66E-10	1397	859
ENSG00000100075.10	*SLC25A1*	1.54	5.67E-10	826	1273
ENSG00000149743.14	*TRPT1*	2.09	5.75E-10	176	367
ENSG00000105669.14	*COPE*	1.57	5.90E-10	1468	2302
ENSG00000147874.11	*HAUS6*	-2.16	5.96E-10	981	454
ENSG00000168393.13	*DTYMK*	1.79	6.66E-10	1613	2883
ENSG00000135090.14	*TAOK3*	-1.79	6.82E-10	1758	982
ENSG00000172794.20	*RAB37*	4.87	7.15E-10	26	126
ENSG00000142227.11	*EMP3*	1.68	7.16E-10	3092	5179
ENSG00000108602.18	*ALDH3A1*	3.82	7.19E-10	32	123
ENSG00000168874.13	*ATOH8*	2.49	7.39E-10	95	236
ENSG00000143702.16	*CEP170*	-2.12	7.97E-10	2825	1330
ENSG00000127329.15	*PTPRB*	-10.70	7.98E-10	64	6
ENSG00000148344.11	*PTGES*	1.75	8.40E-10	400	701

ENSG00000117640.18	*MTFR1L*	1.68	8.46E-10	553	929
ENSG00000189339.12	*SLC35E2B*	-1.56	8.96E-10	1509	969
ENSG00000159459.12	*UBR1*	-2.19	9.18E-10	676	309
ENSG00000168268.11	*NT5DC2*	1.55	9.37E-10	1778	2755
ENSG00000151806.14	*GUF1*	-1.67	9.39E-10	1239	740
ENSG00000160917.15	*CPSF4*	1.59	9.41E-10	637	1016
ENSG00000118873.16	*RAB3GAP2*	-1.96	1.03E-09	1037	530
ENSG00000144583.5	*MARCHF4*	-1.92	1.07E-09	446	232
ENSG00000139163.16	*ETNK1*	-1.72	1.11E-09	1031	598
ENSG00000124191.18	*TOX2*	1.83	1.13E-09	286	524
ENSG00000171617.14	*ENC1*	-3.99	1.15E-09	795	199
ENSG00000204220.11	*PFDN6*	1.69	1.15E-09	530	897
ENSG00000100731.16	*PCNX1*	-1.80	1.15E-09	1221	679
ENSG00000107281.10	*NPDC1*	2.49	1.16E-09	166	415
ENSG00000225756.1	*DBH-AS1*	3.71	1.17E-09	31	117
ENSG00000134186.12	*PRPF38B*	-1.55	1.18E-09	1435	925
ENSG00000102854.16	*MSLN*	-2.01	1.20E-09	397	197
ENSG00000170955.10	*CAVIN3*	1.66	1.35E-09	1677	2779
ENSG00000100625.9	*SIX4*	-1.79	1.41E-09	831	465
ENSG00000240225.10	*ZNF542P*	5.71	1.42E-09	16	90
ENSG00000086712.13	*TXLNG*	-1.73	1.43E-09	990	572
ENSG00000119669.5	*IRF2BPL*	1.58	1.49E-09	788	1248
ENSG00000154845.15	*PPP4R1*	-1.80	1.50E-09	1216	677
ENSG00000075213.11	*SEMA3A*	-2.37	1.55E-09	919	388
ENSG00000198146.4	*ZNF770*	-1.93	1.59E-09	673	348
ENSG00000081377.17	*CDC14B*	-1.52	1.64E-09	1084	713
ENSG00000109920.13	*FNBP4*	-1.70	1.72E-09	851	502
ENSG00000170619.10	*COMMD5*	1.66	1.92E-09	523	867
ENSG00000108424.10	*KPNB1*	-1.80	1.94E-09	13127	7307
ENSG00000113845.10	*TIMMDC1*	1.61	1.96E-09	502	807
ENSG00000166439.6	*RNF169*	-1.98	1.98E-09	952	480
ENSG00000150967.18	*ABCB9*	1.93	2.10E-09	193	372
ENSG00000142733.17	*MAP3K6*	1.76	2.21E-09	333	587
ENSG00000181444.13	*ZNF467*	3.55	2.35E-09	39	138
ENSG00000170759.11	*KIF5B*	-1.87	2.36E-09	7046	3773
ENSG00000163430.12	*FSTL1*	-5.05	2.36E-09	765	151
ENSG00000149289.11	*ZC3H12C*	-2.23	2.40E-09	595	267
ENSG00000106268.15	*NUDT1*	2.52	2.43E-09	81	205
ENSG00000112651.12	*MRPL2*	1.60	2.53E-09	868	1391
ENSG00000166845.15	*C18orf54*	-2.05	2.58E-09	545	266
ENSG00000134897.14	*BIVM*	-2.19	2.63E-09	411	188
ENSG00000132485.14	*ZRANB2*	-1.76	2.65E-09	1443	819
ENSG00000170175.11	*CHRNB1*	-1.74	2.71E-09	817	470

ENSG00000075223.14	*SEMA3C*	-2.03	2.79E-09	2740	1348
ENSG00000129315.11	*CCNT1*	-1.83	2.82E-09	1145	625
ENSG00000118200.14	*CAMSAP2*	-2.05	2.91E-09	582	284
ENSG00000188483.8	*IER5L*	2.22	3.03E-09	174	386
ENSG00000159479.17	*MED8*	1.54	3.05E-09	519	800
ENSG00000108797.12	*CNTNAP1*	-1.71	3.14E-09	717	420
ENSG00000173705.9	*SUSD5*	-1.94	3.17E-09	526	272
ENSG00000242802.9	*AP5Z1*	1.83	3.28E-09	327	597
ENSG00000167671.12	*UBXN6*	1.56	3.36E-09	756	1180
ENSG00000119685.20	*TTLL5*	-1.69	3.56E-09	1039	616
ENSG00000117226.12	*GBP3*	-2.16	3.56E-09	541	251
ENSG00000119632.4	*IFI27L2*	2.72	3.61E-09	151	411
ENSG00000125148.7	*MT2A*	1.54	3.62E-09	7176	11027
ENSG00000104643.10	*MTMR9*	-1.95	3.89E-09	349	178
ENSG00000104960.15	*PTOV1*	1.61	3.97E-09	1093	1759
ENSG00000137288.10	*UQCC2*	1.83	4.02E-09	551	1008
ENSG00000166831.9	*RBPMS2*	-3.91	4.06E-09	123	31
ENSG00000164323.14	*CFAP97*	-2.12	4.14E-09	688	325
ENSG00000170296.10	*GABARAP*	1.73	4.52E-09	1640	2842
ENSG00000073711.11	*PPP2R3A*	-2.33	4.55E-09	375	161
ENSG00000102753.10	*KPNA3*	-1.55	4.72E-09	1540	993
ENSG00000102531.16	*FNDC3A*	-1.98	4.77E-09	1037	524
ENSG00000114388.14	*NPRL2*	1.84	4.84E-09	341	626
ENSG00000164023.14	*SGMS2*	-3.42	4.90E-09	189	55
ENSG00000144560.15	*VGLL4*	1.71	5.38E-09	474	812
ENSG00000101017.14	*CD40*	2.02	5.38E-09	212	428
ENSG00000173482.16	*PTPRM*	-2.03	5.49E-09	1284	632
ENSG00000204227.5	*RING1*	1.72	6.14E-09	441	759
ENSG00000275342.5	*PRAG1*	1.54	6.14E-09	1004	1542
ENSG00000065243.20	*PKN2*	-2.11	6.17E-09	1461	691
ENSG00000197756.10	*RPL37A*	1.83	6.21E-09	7884	14468
ENSG00000163507.14	*CIP2A*	-2.10	6.42E-09	1526	728
ENSG00000164898.13	*FMC1*	2.87	6.56E-09	69	198
ENSG00000115808.12	*STRN*	-2.17	6.56E-09	645	297
ENSG00000131263.13	*RLIM*	-2.28	6.57E-09	990	434
ENSG00000186010.19	*NDUFA13*	1.78	6.81E-09	1251	2223
ENSG00000170035.16	*UBE2E3*	1.65	6.87E-09	1720	2840
ENSG00000090097.21	*PCBP4*	1.83	7.00E-09	432	792
ENSG00000129116.19	*PALLD*	-1.59	7.00E-09	1714	1079
ENSG00000106399.11	*RPA3*	1.96	7.08E-09	443	867
ENSG00000123684.13	*LPGAT1*	-1.61	7.13E-09	988	613
ENSG00000104529.17	*EEF1D*	1.77	7.16E-09	4461	7878
ENSG00000133961.20	*NUMB*	-1.59	7.49E-09	1419	892

ENSG00000117020.18	*AKT3*	-1.93	7.62E-09	1104	571
ENSG00000184838.15	*PRR16*	-3.96	7.69E-09	152	38
ENSG00000115661.14	*STK16*	1.74	7.77E-09	466	813
ENSG00000185697.16	*MYBL1*	-3.56	7.98E-09	140	39
ENSG00000140464.20	*PML*	1.54	8.00E-09	757	1169
ENSG00000130304.17	*SLC27A1*	2.37	8.04E-09	133	314
ENSG00000129493.15	*HEATR5A*	-1.93	8.05E-09	621	322
ENSG00000174748.21	*RPL15*	1.59	8.11E-09	9487	15112
ENSG00000137845.15	*ADAM10*	-2.54	8.11E-09	2491	982
ENSG00000067798.16	*NAV3*	-1.89	8.31E-09	948	500
ENSG00000170832.13	*USP32*	-1.83	8.31E-09	1438	785
ENSG00000135801.9	*TAF5L*	-1.99	8.34E-09	379	190
ENSG00000272622.2	*AC010735.2*	2.79	8.49E-09	111	309
ENSG00000113504.21	*SLC12A7*	2.15	8.51E-09	269	577
ENSG00000163104.17	*SMARCAD1*	-2.31	8.52E-09	431	187
ENSG00000178464.6	*RPL10P16*	3.29	8.65E-09	42	139
ENSG00000196526.10	*AFAP1*	-1.77	8.74E-09	1574	887
ENSG00000029363.17	*BCLAF1*	-2.32	9.12E-09	2472	1065
ENSG00000023516.9	*AKAP11*	-2.55	9.12E-09	1037	406
ENSG00000110075.14	*PPP6R3*	-4.00	9.12E-09	667	167
ENSG00000144713.13	*RPL32*	1.67	9.28E-09	10025	16767
ENSG00000130724.9	*CHMP2A*	1.69	1.02E-08	677	1144
ENSG00000213553.4	*RPLP0P6*	1.96	1.05E-08	212	416
ENSG00000167191.12	*GPRC5B*	-2.68	1.05E-08	252	94
ENSG00000180530.11	*NRIP1*	-2.90	1.05E-08	383	132
ENSG00000151748.15	*SAV1*	-1.58	1.05E-08	949	601
ENSG00000166938.13	*DIS3L*	-1.71	1.06E-08	791	463
ENSG00000154518.9	*ATP5MC3*	1.90	1.09E-08	2255	4289
ENSG00000231500.7	*RPS18*	1.57	1.09E-08	15870	24944
ENSG00000102038.15	*SMARCA1*	-2.02	1.09E-08	823	408
ENSG00000157224.16	*CLDN12*	-1.57	1.14E-08	1151	735
ENSG00000149554.13	*CHEK1*	-1.60	1.19E-08	1058	663
ENSG00000180008.9	*SOCS4*	-1.92	1.22E-08	980	511
ENSG00000106638.17	*TBL2*	1.55	1.23E-08	687	1066
ENSG00000155629.15	*PIK3AP1*	-10.74	1.28E-08	84	8
ENSG00000162852.14	*CNST*	-1.82	1.28E-08	542	298
ENSG00000205339.10	*IPO7*	-1.75	1.29E-08	5266	3014
ENSG00000164236.12	*ANKRD33B*	-1.56	1.31E-08	810	518
ENSG00000170485.17	*NPAS2*	2.12	1.36E-08	912	1936
ENSG00000099814.16	*CEP170B*	1.70	1.39E-08	436	743
ENSG00000012124.17	*CD22*	-1.82	1.39E-08	415	228
ENSG00000178057.15	*NDUFAF3*	1.74	1.40E-08	566	984
ENSG00000117155.16	*SSX2IP*	-4.71	1.40E-08	172	37

ENSG00000100577.19	*GSTZ1*	1.89	1.42E-08	297	561
ENSG00000138604.10	*GLCE*	-1.74	1.42E-08	642	368
ENSG00000065150.21	*IPO5*	-1.52	1.45E-08	6611	4337
ENSG00000131116.12	*ZNF428*	1.99	1.54E-08	238	475
ENSG00000114744.9	*COMMD2*	-1.84	1.59E-08	512	278
ENSG00000088538.13	*DOCK3*	2.76	1.59E-08	54	150
ENSG00000204371.11	*EHMT2*	1.83	1.60E-08	584	1066
ENSG00000105968.18	*H2AFV*	1.67	1.60E-08	2337	3898
ENSG00000197045.13	*GMFB*	-1.65	1.62E-08	2541	1543
ENSG00000076944.16	*STXBP2*	1.99	1.64E-08	445	886
ENSG00000122008.15	*POLK*	-2.94	1.69E-08	259	88
ENSG00000049323.16	*LTBP1*	1.86	1.70E-08	498	926
ENSG00000167468.17	*GPX4*	1.64	1.72E-08	2584	4227
ENSG00000162378.13	*ZYG11B*	-1.71	1.82E-08	712	417
ENSG00000204228.4	*HSD17B8*	4.03	1.83E-08	25	101
ENSG00000154380.17	*ENAH*	-1.95	1.83E-08	913	468
ENSG00000049769.14	*PPP1R3F*	2.20	1.88E-08	246	540
ENSG00000167695.15	*TLCD3A*	-1.60	1.94E-08	957	598
ENSG00000183048.12	*SLC25A10*	1.57	1.96E-08	782	1230
ENSG00000114346.13	*ECT2*	-1.78	1.98E-08	773	435
ENSG00000085224.22	*ATRX*	-2.04	2.01E-08	560	275
ENSG00000214736.7	*TOMM6*	1.91	2.02E-08	525	1001
ENSG00000270231.4	*NBPF8*	-1.57	2.03E-08	1450	925
ENSG00000232112.3	*TMA7*	1.57	2.05E-08	2028	3190
ENSG00000123575.9	*FAM199X*	-1.58	2.12E-08	692	437
ENSG00000109189.13	*USP46*	-1.70	2.16E-08	687	403
ENSG00000198087.7	*CD2AP*	-1.79	2.23E-08	1472	823
ENSG00000163714.18	*U2SURP*	-2.02	2.27E-08	1838	912
ENSG00000134602.16	*STK26*	-2.35	2.36E-08	292	124
ENSG00000143924.19	*EML4*	-1.53	2.37E-08	1282	836
ENSG00000110717.13	*NDUFS8*	1.68	2.43E-08	1098	1849
ENSG00000147383.11	*NSDHL*	1.66	2.44E-08	448	743
ENSG00000162139.10	*NEU3*	-1.86	2.47E-08	655	353
ENSG00000123572.17	*NRK*	-3.13	2.51E-08	166	53
ENSG00000101986.12	*ABCD1*	2.44	2.52E-08	162	395
ENSG00000226688.7	*ENTPD1-AS1*	-1.78	2.52E-08	448	251
ENSG00000151062.15	*CACNA2D4*	-2.39	2.52E-08	193	81
ENSG00000162408.11	*NOL9*	-1.67	2.58E-08	672	403
ENSG00000131435.13	*PDLIM4*	2.34	2.61E-08	218	511
ENSG00000155090.15	*KLF10*	1.55	2.62E-08	532	824
ENSG00000069974.16	*RAB27A*	-1.77	2.65E-08	503	284
ENSG00000197982.14	*C1orf122*	1.90	2.76E-08	304	577
ENSG00000135002.12	*RFK*	-1.55	2.83E-08	1022	659

ENSG00000106153.13	*CHCHD2*	1.63	2.92E-08	3001	4898
ENSG00000099812.9	*MISP*	1.85	2.94E-08	224	416
ENSG00000118454.13	*ANKRD13C*	-1.70	3.04E-08	1002	591
ENSG00000156052.11	*GNAQ*	-1.53	3.07E-08	795	519
ENSG00000172201.12	*ID4*	2.96	3.07E-08	48	143
ENSG00000114779.19	*ABHD14B*	2.48	3.08E-08	88	218
ENSG00000162576.16	*MXRA8*	2.57	3.11E-08	117	300
ENSG00000164877.19	*MICALL2*	2.29	3.16E-08	108	248
ENSG00000170113.16	*NIPA1*	-1.72	3.23E-08	1009	588
ENSG00000129534.14	*MIS18BP1*	-1.96	3.25E-08	1161	593
ENSG00000275052.5	*PPP4R3B*	-1.81	3.31E-08	1120	617
ENSG00000162729.14	*IGSF8*	2.03	3.33E-08	148	300
ENSG00000164951.16	*PDP1*	-1.68	3.39E-08	692	412
ENSG00000111530.13	*CAND1*	-1.87	3.40E-08	3464	1852
ENSG00000112972.15	*HMGCS1*	-1.71	3.42E-08	527	308
ENSG00000164187.7	*LMBRD2*	-1.94	3.43E-08	412	212
ENSG00000134313.15	*KIDINS220*	-1.94	3.49E-08	670	346
ENSG00000107331.17	*ABCA2*	-1.80	3.69E-08	746	415
ENSG00000101911.12	*PRPS2*	-3.24	3.69E-08	178	55
ENSG00000111799.21	*COL12A1*	-2.15	3.74E-08	2487	1158
ENSG00000129317.14	*PUS7L*	-4.27	3.75E-08	236	55
ENSG00000064651.14	*SLC12A2*	-2.04	3.76E-08	956	470
ENSG00000198018.7	*ENTPD7*	-1.82	3.96E-08	371	204
ENSG00000078967.13	*UBE2D4*	2.02	4.25E-08	201	407
ENSG00000139218.18	*SCAF11*	-1.70	4.36E-08	1682	992
ENSG00000162517.13	*PEF1*	1.67	4.42E-08	786	1308
ENSG00000131459.13	*GFPT2*	1.65	4.42E-08	750	1240
ENSG00000104805.16	*NUCB1*	1.63	4.54E-08	894	1454
ENSG00000164327.13	*RICTOR*	-2.38	4.58E-08	720	303
ENSG00000164897.14	*TMUB1*	1.70	4.59E-08	655	1115
ENSG00000136213.10	*CHST12*	1.72	4.61E-08	346	593
ENSG00000234745.11	*HLA-B*	1.64	4.71E-08	918	1502
ENSG00000164713.10	*BRI3*	1.64	4.74E-08	940	1544
ENSG00000133104.14	*SPART*	-1.67	4.78E-08	999	599
ENSG00000131018.24	*SYNE1*	-2.77	4.87E-08	537	194
ENSG00000126067.12	*PSMB2*	1.56	4.88E-08	2460	3839
ENSG00000227671.4	*AL390728.4*	-2.23	4.92E-08	294	132
ENSG00000123739.11	*PLA2G12A*	1.77	4.95E-08	257	455
ENSG00000107263.18	*RAPGEF1*	-1.54	4.95E-08	1722	1121
ENSG00000172466.16	*ZNF24*	-1.67	5.00E-08	1128	676
ENSG00000103266.11	*STUB1*	1.53	5.02E-08	982	1504
ENSG00000244462.8	*RBM12*	-1.54	5.09E-08	3200	2079
ENSG00000160972.9	*PPP1R16A*	1.69	5.17E-08	483	816

ENSG00000180329.14	*CCDC43*	-1.65	5.37E-08	641	390
ENSG00000128524.5	*ATP6V1F*	1.66	5.51E-08	854	1414
ENSG00000178295.15	*GEN1*	-3.16	5.55E-08	424	134
ENSG00000204568.12	*MRPS18B*	1.55	5.56E-08	1292	2009
ENSG00000058668.14	*ATP2B4*	3.92	5.62E-08	53	208
ENSG00000125430.9	*HS3ST3B1*	-2.39	5.77E-08	281	118
ENSG00000104915.15	*STX10*	1.54	6.07E-08	634	979
ENSG00000174606.14	*ANGEL2*	-2.03	6.61E-08	688	338
ENSG00000240694.9	*PNMA2*	-1.59	6.73E-08	637	400
ENSG00000060491.16	*OGFR*	1.57	6.75E-08	1822	2853
ENSG00000151012.13	*SLC7A11*	-1.90	6.78E-08	1808	952
ENSG00000275131.3	*AC241952.1*	-3.65	6.82E-08	216	59
ENSG00000171681.12	*ATF7IP*	-2.54	6.84E-08	890	350
ENSG00000175040.6	*CHST2*	1.75	6.92E-08	237	416
ENSG00000119917.14	*IFIT3*	-1.67	7.04E-08	1229	736
ENSG00000197872.11	*FAM49A*	-5.57	7.14E-08	96	17
ENSG00000117597.18	*UTP25*	-1.69	7.24E-08	828	489
ENSG00000177084.17	*POLE*	4.39	7.32E-08	72	317
ENSG00000233476.3	*EEF1A1P6*	1.97	7.32E-08	316	623
ENSG00000166503.9	*HDGFL3*	-1.81	7.32E-08	880	486
ENSG00000140264.19	*SERF2*	1.81	7.38E-08	2304	4162
ENSG00000100580.8	*TMED8*	-1.63	7.40E-08	1067	655
ENSG00000144659.13	*SLC25A38*	1.68	7.42E-08	607	1018
ENSG00000137941.17	*TTLL7*	-2.37	7.44E-08	404	171
ENSG00000070018.9	*LRP6*	-2.11	7.46E-08	1426	675
ENSG00000116670.15	*MAD2L2*	1.72	7.76E-08	566	973
ENSG00000269556.8	*TMEM185A*	1.86	7.94E-08	223	416
ENSG00000100578.17	*KIAA0586*	-1.66	8.08E-08	956	576
ENSG00000164164.17	*OTUD4*	-1.90	8.20E-08	1398	735
ENSG00000169715.15	*MT1E*	1.64	8.47E-08	1242	2036
ENSG00000146826.17	*MAP11*	1.76	8.79E-08	239	421
ENSG00000127125.9	*PPCS*	1.72	8.88E-08	413	711
ENSG00000137880.6	*GCHFR*	4.88	8.91E-08	19	93
ENSG00000215808.4	*LINC01139*	-14.26	8.92E-08	61	4
ENSG00000145040.4	*UCN2*	2.26	8.96E-08	127	287
ENSG00000137818.12	*RPLP1*	1.65	8.97E-08	6877	11366
ENSG00000276672.1	*AL161891.1*	-2.05	9.04E-08	303	148
ENSG00000095321.17	*CRAT*	1.65	9.23E-08	309	508
ENSG00000134884.15	*ARGLU1*	-1.66	9.34E-08	1492	900
ENSG00000099364.16	*FBXL19*	1.76	9.34E-08	272	480
ENSG00000152229.18	*PSTPIP2*	-5.34	9.78E-08	85	16
ENSG00000158636.16	*EMSY*	-1.95	9.81E-08	545	279
ENSG00000184047.19	*DIABLO*	1.57	9.83E-08	862	1357

ENSG00000005100.13	*DHX33*	-1.62	9.93E-08	1777	1096
ENSG00000107560.12	*RAB11FIP2*	-1.87	1.01E-07	478	255
ENSG00000099849.15	*RASSF7*	1.70	1.07E-07	425	722
ENSG00000163960.12	*UBXN7*	-1.78	1.08E-07	1127	634
ENSG00000142327.13	*RNPEPL1*	2.18	1.10E-07	373	813
ENSG00000083720.13	*OXCT1*	-1.68	1.10E-07	679	405
ENSG00000094975.14	*SUCO*	-1.74	1.10E-07	1753	1006
ENSG00000204439.4	*C6orf47*	1.64	1.10E-07	390	640
ENSG00000112159.12	*MDN1*	-2.74	1.13E-07	1134	415
ENSG00000185164.14	*NOMO2*	1.83	1.15E-07	494	902
ENSG00000218336.9	*TENM3*	-2.54	1.15E-07	859	338
ENSG00000029725.17	*RABEP1*	-1.65	1.15E-07	1943	1176
ENSG00000156011.17	*PSD3*	-1.99	1.15E-07	855	429
ENSG00000126456.16	*IRF3*	1.57	1.15E-07	812	1276
ENSG00000159147.18	*DONSON*	-1.59	1.16E-07	623	392
ENSG00000198836.10	*OPA1*	-2.01	1.17E-07	1849	922
ENSG00000113649.11	*TCERG1*	-2.44	1.17E-07	808	331
ENSG00000138035.15	*PNPT1*	-1.77	1.18E-07	816	461
ENSG00000105409.19	*ATP1A3*	-2.23	1.19E-07	214	96
ENSG00000156381.9	*ANKRD9*	1.82	1.22E-07	379	688
ENSG00000173905.9	*GOLIM4*	-1.96	1.22E-07	1419	723
ENSG00000069399.15	*BCL3*	2.29	1.23E-07	140	321
ENSG00000214253.9	*FIS1*	1.69	1.24E-07	728	1227
ENSG00000178028.14	*DMAP1*	1.56	1.24E-07	401	625
ENSG00000187118.14	*CMC1*	1.81	1.25E-07	314	569
ENSG00000121579.13	*NAA50*	-1.71	1.27E-07	2685	1567
ENSG00000047188.16	*YTHDC2*	-1.93	1.34E-07	670	348
ENSG00000196954.14	*CASP4*	-1.87	1.36E-07	773	412
ENSG00000144278.15	*GALNT13*	-2.23	1.36E-07	210	94
ENSG00000149428.19	*HYOU1*	-1.68	1.36E-07	1710	1017
ENSG00000163755.9	*HPS3*	-1.62	1.37E-07	663	408
ENSG00000178104.19	*PDE4DIP*	-1.76	1.37E-07	547	310
ENSG00000152661.9	*GJA1*	-1.58	1.37E-07	732	463
ENSG00000277972.2	*CISD3*	1.69	1.39E-07	506	855
ENSG00000218510.8	*LINC00339*	2.06	1.41E-07	150	310
ENSG00000178038.17	*ALS2CL*	-1.86	1.42E-07	355	191
ENSG00000162409.11	*PRKAA2*	-2.01	1.44E-07	519	258
ENSG00000164151.12	*ICE1*	-2.02	1.45E-07	1054	521
ENSG00000203930.12	*LINC00632*	-30.04	1.46E-07	68	2
ENSG00000158292.7	*GPR153*	1.81	1.48E-07	291	528
ENSG00000197930.13	*ERO1A*	-1.54	1.49E-07	2623	1704
ENSG00000187764.11	*SEMA4D*	2.13	1.51E-07	171	363
ENSG00000106266.11	*SNX8*	1.88	1.55E-07	867	1630

ENSG00000056097.16	*ZFR*	-1.54	1.56E-07	2975	1936
ENSG00000205189.12	*ZBTB10*	-1.99	1.56E-07	410	207
ENSG00000172985.11	*SH3RF3*	1.76	1.58E-07	338	595
ENSG00000198887.9	*SMC5*	-2.50	1.60E-07	682	272
ENSG00000110881.11	*ASIC1*	-183.06	1.62E-07	42	0
ENSG00000157778.9	*PSMG3*	1.66	1.64E-07	404	670
ENSG00000179886.6	*TIGD5*	1.91	1.65E-07	258	493
ENSG00000185986.12	*SDHAP3*	4.62	1.71E-07	17	78
ENSG00000102218.6	*RP2*	-1.58	1.71E-07	602	382
ENSG00000110218.9	*PANX1*	-1.67	1.76E-07	509	306
ENSG00000171365.17	*CLCN5*	-2.41	1.80E-07	339	141
ENSG00000167889.12	*MGAT5B*	1.86	1.80E-07	199	369
ENSG00000126878.13	*AIF1L*	-2.11	1.83E-07	238	113
ENSG00000137802.14	*MAPKBP1*	-1.54	1.84E-07	667	432
ENSG00000124593.16	*AL365205.1*	1.94	1.94E-07	145	281
ENSG00000124596.17	*OARD1*	1.68	1.94E-07	434	729
ENSG00000143198.13	*MGST3*	1.97	1.96E-07	464	912
ENSG00000179526.17	*SHARPIN*	1.66	1.96E-07	713	1183
ENSG00000164338.10	*UTP15*	-1.83	1.98E-07	590	322
ENSG00000112715.22	*VEGFA*	2.03	1.98E-07	505	1026
ENSG00000168306.13	*ACOX2*	2.33	1.98E-07	116	271
ENSG00000168615.12	*ADAM9*	-1.61	1.99E-07	4634	2876
ENSG00000198768.11	*APCDD1L*	-3.18	1.99E-07	110	35
ENSG00000040199.18	*PHLPP2*	-1.95	2.01E-07	416	213
ENSG00000049130.16	*KITLG*	-2.06	2.02E-07	244	118
ENSG00000163344.6	*PMVK*	1.71	2.03E-07	404	692
ENSG00000175938.7	*ORAI3*	2.09	2.04E-07	179	374
ENSG00000132429.10	*POPDC3*	1.99	2.05E-07	125	248
ENSG00000215301.10	*DDX3X*	-2.06	2.05E-07	5518	2680
ENSG00000174915.12	*PTDSS2*	1.54	2.09E-07	629	968
ENSG00000173436.15	*MICOS10*	1.63	2.11E-07	986	1608
ENSG00000110871.15	*COQ5*	2.15	2.12E-07	127	273
ENSG00000072954.7	*TMEM38A*	1.65	2.19E-07	489	805
ENSG00000100360.15	*IFT27*	2.10	2.21E-07	147	310
ENSG00000114948.13	*ADAM23*	-6.38	2.21E-07	64	10
ENSG00000184060.11	*ADAP2*	-8.72	2.23E-07	56	6
ENSG00000198695.2	*MT-ND6*	-1.53	2.23E-07	1813	1188
ENSG00000178209.15	*PLEC*	1.59	2.29E-07	14788	23507
ENSG00000156587.16	*UBE2L6*	1.76	2.29E-07	228	400
ENSG00000278053.5	*DDX52*	-1.57	2.29E-07	1176	748
ENSG00000129003.18	*VPS13C*	-2.75	2.30E-07	429	156
ENSG00000117408.11	*IPO13*	1.67	2.31E-07	499	836

ENSG00000131669.10	*NINJ1*	1.76	2.35E-07	265	466
ENSG00000113645.14	*WWC1*	-1.70	2.35E-07	730	430
ENSG00000164209.17	*SLC25A46*	-1.73	2.35E-07	1305	752
ENSG00000108523.15	*RNF167*	1.74	2.38E-07	513	893
ENSG00000203880.12	*PCMTD2*	-1.87	2.43E-07	826	442
ENSG00000144791.10	*LIMD1*	-1.52	2.47E-07	1692	1112
ENSG00000141424.13	*SLC39A6*	-1.67	2.47E-07	915	548
ENSG00000274211.6	*SOCS7*	-1.80	2.54E-07	480	267
ENSG00000060688.13	*SNRNP40*	1.60	2.60E-07	1282	2053
ENSG00000240972.2	*MIF*	1.69	2.63E-07	2343	3966
ENSG00000163659.13	*TIPARP*	-1.59	2.65E-07	908	571
ENSG00000112379.9	*ARFGEF3*	-1.95	2.65E-07	874	449
ENSG00000186767.7	*SPIN4*	-1.74	2.69E-07	645	372
ENSG00000008311.15	*AASS*	-2.33	2.69E-07	636	273
ENSG00000121775.18	*TMEM39B*	1.57	2.81E-07	433	678
ENSG00000135776.5	*ABCB10*	-1.56	2.91E-07	762	489
ENSG00000167578.18	*RAB4B*	2.86	2.99E-07	69	196
ENSG00000114062.20	*UBE3A*	-1.65	3.03E-07	1480	897
ENSG00000143867.7	*OSR1*	2.09	3.04E-07	119	248
ENSG00000131746.13	*TNS4*	4.39	3.06E-07	20	87
ENSG00000085788.14	*DDHD2*	-2.47	3.07E-07	691	280
ENSG00000143207.21	*COP1*	1.55	3.10E-07	388	601
ENSG00000204389.10	*HSPA1A*	1.67	3.16E-07	277	462
ENSG00000197323.12	*TRIM33*	-1.55	3.20E-07	1379	888
ENSG00000213563.7	*C8orf82*	2.05	3.23E-07	268	550
ENSG00000103540.16	*CCP110*	-2.89	3.34E-07	364	126
ENSG00000166326.7	*TRIM44*	-1.55	3.45E-07	3101	1995
ENSG00000142156.14	*COL6A1*	15.78	3.51E-07	6	102
ENSG00000205765.9	*C5orf51*	-1.52	3.52E-07	838	551
ENSG00000124275.15	*MTRR*	-1.74	3.54E-07	1160	668
ENSG00000170381.14	*SEMA3E*	-4.42	3.57E-07	109	25
ENSG00000168952.15	*STXBP6*	-6.09	3.63E-07	86	14
ENSG00000213047.13	*DENND1B*	-2.35	3.66E-07	285	121
ENSG00000144724.20	*PTPRG*	-1.56	3.70E-07	2016	1290
ENSG00000158079.16	*PTPDC1*	-1.94	3.72E-07	605	312
ENSG00000138944.8	*SHISAL1*	5.47	3.80E-07	11	61
ENSG00000164307.13	*ERAP1*	-1.59	3.88E-07	1028	647
ENSG00000138078.15	*PREPL*	-1.77	3.90E-07	775	437
ENSG00000123989.14	*CHPF*	1.59	3.98E-07	544	866
ENSG00000196476.12	*C20orf96*	2.02	4.06E-07	116	235
ENSG00000130520.10	*LSM4*	1.66	4.13E-07	1659	2754
ENSG00000185043.12	*CIB1*	1.59	4.15E-07	615	978
ENSG00000039319.17	*ZFYVE16*	-2.42	4.20E-07	704	291

ENSG00000198270.13	*TMEM116*	1.77	4.23E-07	240	424
ENSG00000276550.4	*HERC2P2*	-2.30	4.23E-07	893	389
ENSG00000153132.13	*CLGN*	-1.87	4.26E-07	386	206
ENSG00000136279.20	*DBNL*	1.54	4.27E-07	1021	1570
ENSG00000112531.17	*QKI*	-1.73	4.33E-07	2535	1465
ENSG00000078177.14	*N4BP2*	-2.35	4.33E-07	190	81
ENSG00000178691.11	*SUZ12*	-1.59	4.38E-07	1748	1099
ENSG00000198162.12	*MAN1A2*	-1.75	4.40E-07	1153	658
ENSG00000106404.13	*CLDN15*	2.41	4.44E-07	67	161
ENSG00000106537.8	*TSPAN13*	2.23	4.44E-07	91	204
ENSG00000141562.18	*NARF*	1.72	4.60E-07	622	1069
ENSG00000187957.8	*DNER*	-4.28	4.60E-07	79	19
ENSG00000137825.11	*ITPKA*	2.69	4.65E-07	46	124
ENSG00000062582.14	*MRPS24*	1.79	4.74E-07	1015	1815
ENSG00000136874.11	*STX17*	-1.78	4.86E-07	563	315
ENSG00000183530.14	*PRR14L*	-1.79	4.92E-07	486	271
ENSG00000212724.3	*KRTAP2-3*	-7.09	4.96E-07	66	9
ENSG00000138246.17	*DNAJC13*	-2.52	5.15E-07	1316	523
ENSG00000112306.8	*RPS12*	1.62	5.16E-07	5554	9002
ENSG00000175793.12	*SFN*	1.57	5.31E-07	1097	1718
ENSG00000100911.16	*PSME2*	1.58	5.32E-07	1269	2006
ENSG00000099937.11	*SERPIND1*	5.15	5.32E-07	15	76
ENSG00000173166.18	*RAPH1*	-1.85	5.43E-07	1859	1007
ENSG00000162407.9	*PLPP3*	1.70	5.49E-07	263	448
ENSG00000091039.17	*OSBPL8*	-1.88	5.51E-07	2132	1134
ENSG00000166266.14	*CUL5*	-1.99	5.75E-07	755	380
ENSG00000140396.13	*NCOA2*	-2.37	5.80E-07	411	173
ENSG00000233327.10	*USP32P2*	-3.69	5.87E-07	279	76
ENSG00000108510.10	*MED13*	-2.04	5.92E-07	1484	728
ENSG00000106348.18	*IMPDH1*	1.65	6.44E-07	599	990
ENSG00000165959.12	*CLMN*	-3.47	6.44E-07	118	34
ENSG00000114315.4	*HES1*	2.05	6.54E-07	176	361
ENSG00000161904.12	*LEMD2*	1.53	6.58E-07	840	1285
ENSG00000110422.12	*HIPK3*	-1.73	6.67E-07	639	370
ENSG00000204427.12	*ABHD16A*	1.61	6.88E-07	566	914
ENSG00000189077.11	*TMEM120A*	1.93	6.89E-07	171	329
ENSG00000204116.11	*CHIC1*	-212.58	6.89E-07	48	0
ENSG00000187954.12	*CYHR1*	1.57	6.94E-07	366	573
ENSG00000148400.12	*NOTCH1*	-1.61	7.02E-07	1007	625
ENSG00000197415.12	*VEPH1*	-2.74	7.34E-07	208	76
ENSG00000080493.17	*SLC4A4*	-54.94	7.38E-07	57	1
ENSG00000120539.14	*MASTL*	-1.78	7.39E-07	781	440

ENSG00000277053.4	*GTF2IP1*	1.61	7.40E-07	873	1404
ENSG00000135636.14	*DYSF*	-3.22	7.40E-07	401	125
ENSG00000038210.14	*PI4K2B*	-1.57	7.46E-07	1156	735
ENSG00000138448.12	*ITGAV*	-2.00	7.46E-07	1351	677
ENSG00000127946.17	*HIP1*	-2.75	7.51E-07	323	117
ENSG00000123836.15	*PFKFB2*	-2.06	7.56E-07	492	239
ENSG00000099795.7	*NDUFB7*	1.74	7.61E-07	725	1262
ENSG00000082512.15	*TRAF5*	-2.10	7.62E-07	370	176
ENSG00000139746.15	*RBM26*	-1.67	7.63E-07	858	515
ENSG00000148362.11	*PAXX*	1.57	7.78E-07	504	793
ENSG00000083457.12	*ITGAE*	1.81	7.81E-07	471	852
ENSG00000188613.7	*NANOS1*	-3.30	7.82E-07	111	34
ENSG00000112851.14	*ERBIN*	-2.18	7.88E-07	1908	876
ENSG00000112144.15	*ICK*	-208.39	8.08E-07	47	0
ENSG00000083845.9	*RPS5*	1.63	8.10E-07	7273	11846
ENSG00000106789.13	*CORO2A*	-1.57	8.12E-07	579	370
ENSG00000115042.10	*FAHD2A*	1.80	8.18E-07	238	427
ENSG00000077514.9	*POLD3*	-1.59	8.36E-07	965	608
ENSG00000204054.14	*LINC00963*	2.25	8.40E-07	95	214
ENSG00000068079.7	*IFI35*	1.77	8.55E-07	175	309
ENSG00000116183.11	*PAPPA2*	15.77	8.59E-07	4	69
ENSG00000090376.11	*IRAK3*	-2.57	8.63E-07	195	76
ENSG00000008513.16	*ST3GAL1*	1.57	8.63E-07	679	1064
ENSG00000116898.12	*MRPS15*	1.58	8.63E-07	772	1216
ENSG00000128185.10	*DGCR6L*	1.73	8.64E-07	252	436
ENSG00000131725.14	*WDR44*	-1.80	8.70E-07	419	232
ENSG00000197183.14	*NOL4L*	-1.97	8.70E-07	330	167
ENSG00000145241.11	*CENPC*	-2.14	8.76E-07	398	186
ENSG00000117448.13	*AKR1A1*	1.65	9.02E-07	391	645
ENSG00000177685.17	*CRACR2B*	2.11	9.09E-07	155	327
ENSG00000173276.14	*ZBTB21*	-2.12	9.10E-07	286	135
ENSG00000151893.15	*CACUL1*	-1.75	9.22E-07	1621	927
ENSG00000134716.11	*CYP2J2*	-2.95	9.25E-07	112	38
ENSG00000171492.14	*LRRC8D*	-1.84	9.45E-07	1123	611
ENSG00000171456.19	*ASXL1*	-1.56	9.47E-07	5029	3230
ENSG00000215182.8	*MUC5AC*	2.50	9.55E-07	189	472
ENSG00000116903.7	*EXOC8*	-1.71	9.65E-07	531	310
ENSG00000106330.12	*MOSPD3*	1.94	9.67E-07	145	282
ENSG00000169020.10	*ATP5ME*	1.80	9.69E-07	402	723
ENSG00000162664.17	*ZNF326*	-1.59	9.69E-07	624	392
ENSG00000144824.21	*PHLDB2*	-1.78	9.84E-07	553	311
ENSG00000164609.10	*SLU7*	-1.55	9.86E-07	738	476

ENSG00000126432.14	*PRDX5*	1.58	1.00E-06	1125	1780
ENSG00000124006.15	*OBSL1*	1.55	1.03E-06	473	734
ENSG00000133119.13	*RFC3*	-1.63	1.03E-06	959	587
ENSG00000151553.15	*FAM160B1*	-1.88	1.03E-06	318	170
ENSG00000047634.15	*SCML1*	-1.59	1.04E-06	748	469
ENSG00000125885.13	*MCM8*	-1.84	1.05E-06	1901	1035
ENSG00000152620.13	*NADK2*	-1.61	1.06E-06	512	318
ENSG00000147459.18	*DOCK5*	-1.58	1.06E-06	2218	1408
ENSG00000189223.15	*PAX8-AS1*	1.68	1.12E-06	547	920
ENSG00000125826.20	*RBCK1*	1.54	1.12E-06	893	1378
ENSG00000174373.16	*RALGAPA1*	-1.93	1.12E-06	266	137
ENSG00000013563.14	*DNASE1L1*	1.82	1.13E-06	282	512
ENSG00000073060.16	*SCARB1*	-1.74	1.16E-06	414	238
ENSG00000176853.16	*FAM91A1*	-1.61	1.17E-06	1852	1153
ENSG00000143643.13	*TTC13*	-1.86	1.18E-06	790	425
ENSG00000093000.19	*NUP50*	-1.71	1.18E-06	2353	1375
ENSG00000114857.18	*NKTR*	-1.78	1.20E-06	1318	739
ENSG00000198743.7	*SLC5A3*	-1.92	1.22E-06	714	372
ENSG00000149932.17	*TMEM219*	1.60	1.22E-06	599	957
ENSG00000198862.14	*LTN1*	-2.30	1.26E-06	467	203
ENSG00000148516.21	*ZEB1*	-2.35	1.26E-06	1081	459
ENSG00000096717.12	*SIRT1*	-1.76	1.27E-06	559	318
ENSG00000196405.13	*EVL*	-4.72	1.27E-06	69	15
ENSG00000124614.16	*RPS10*	1.61	1.28E-06	10000	16101
ENSG00000245648.2	*AC022075.1*	4.79	1.32E-06	15	71
ENSG00000136144.12	*RCBTB1*	-1.63	1.32E-06	557	342
ENSG00000172965.16	*MIR4435-2HG*	1.75	1.32E-06	1062	1859
ENSG00000109436.8	*TBC1D9*	-1.53	1.32E-06	691	450
ENSG00000165209.19	*STRBP*	-1.92	1.35E-06	493	257
ENSG00000116641.18	*DOCK7*	-1.85	1.39E-06	1260	680
ENSG00000168827.14	*GFM1*	-1.80	1.39E-06	901	501
ENSG00000186501.14	*TMEM222*	1.55	1.40E-06	442	686
ENSG00000196917.6	*HCAR1*	3.84	1.40E-06	20	77
ENSG00000145715.15	*RASA1*	-1.55	1.43E-06	1347	871
ENSG00000112308.13	*C6orf62*	2.51	1.43E-06	506	1272
ENSG00000166401.15	*SERPINB8*	-1.53	1.45E-06	789	516
ENSG00000185862.7	*EVI2B*	-2.10	1.47E-06	426	203
ENSG00000120784.16	*ZFP30*	-2.44	1.47E-06	254	104
ENSG00000196187.12	*TMEM63A*	1.74	1.49E-06	610	1058
ENSG00000176973.8	*FAM89B*	1.64	1.50E-06	266	437
ENSG00000084070.12	*SMAP2*	1.55	1.55E-06	324	502
ENSG00000170921.15	*TANC2*	-2.10	1.55E-06	1282	610
ENSG00000121743.4	*GJA3*	-2.47	1.59E-06	168	68

ENSG00000176340.4	*COX8A*	1.63	1.60E-06	2147	3494
ENSG00000213341.11	*CHUK*	-1.63	1.64E-06	886	542
ENSG00000111897.7	*SERINC1*	-1.66	1.64E-06	1904	1146
ENSG00000238266.2	*LINC00707*	-6.00	1.65E-06	59	10
ENSG00000083223.18	*TUT7*	-2.21	1.68E-06	382	173
ENSG00000128563.13	*PRKRIP1*	1.57	1.68E-06	374	587
ENSG00000074695.6	*LMAN1*	-1.78	1.70E-06	3001	1685
ENSG00000060237.17	*WNK1*	-1.81	1.70E-06	3577	1976
ENSG00000100941.9	*PNN*	-1.96	1.70E-06	2611	1335
ENSG00000172159.16	*FRMD3*	-2.03	1.71E-06	361	178
ENSG00000184992.12	*BRI3BP*	-1.61	1.72E-06	936	583
ENSG00000069248.12	*NUP133*	-1.62	1.72E-06	1377	851
ENSG00000204386.11	*NEU1*	1.59	1.76E-06	728	1158
ENSG00000100065.15	*CARD10*	1.57	1.76E-06	495	776
ENSG00000175073.8	*VCPIP1*	-1.68	1.78E-06	462	275
ENSG00000181817.6	*LSM10*	1.71	1.81E-06	418	717
ENSG00000203875.12	*SNHG5*	1.61	1.82E-06	2631	4234
ENSG00000178149.17	*DALRD3*	1.68	1.86E-06	453	761
ENSG00000065000.18	*AP3D1*	3.41	1.91E-06	50	172
ENSG00000173272.16	*MZT2A*	1.74	1.92E-06	459	799
ENSG00000116001.16	*TIA1*	-2.31	1.92E-06	586	254
ENSG00000146733.14	*PSPH*	2.06	1.94E-06	370	763
ENSG00000135720.13	*DYNC1LI2*	-1.66	1.96E-06	1453	875
ENSG00000109320.13	*NFKB1*	-2.01	2.02E-06	830	413
ENSG00000105976.15	*MET*	-3.48	2.04E-06	99	28
ENSG00000181649.8	*PHLDA2*	1.58	2.06E-06	2016	3191
ENSG00000107816.17	*LZTS2*	2.01	2.06E-06	172	347
ENSG00000221838.10	*AP4M1*	1.68	2.08E-06	249	419
ENSG00000072195.15	*SPEG*	2.30	2.15E-06	169	387
ENSG00000116977.18	*LGALS8*	-1.88	2.15E-06	1452	773
ENSG00000152683.14	*SLC30A6*	-1.53	2.18E-06	648	423
ENSG00000229373.9	*LINC00452*	-2.04	2.18E-06	231	113
ENSG00000141469.18	*SLC14A1*	4.62	2.18E-06	17	78
ENSG00000166479.10	*TMX3*	-1.72	2.20E-06	1294	751
ENSG00000198816.7	*ZNF358*	1.84	2.27E-06	266	488
ENSG00000104976.12	*SNAPC2*	1.70	2.28E-06	279	474
ENSG00000198937.9	*CCDC167*	1.80	2.32E-06	261	470
ENSG00000277734.8	*TRAC*	4.04	2.32E-06	16	63
ENSG00000156508.18	*EEF1A1*	-1.74	2.36E-06	755	433
ENSG00000109586.12	*GALNT7*	-1.62	2.37E-06	1220	754
ENSG00000057757.10	*PITHD1*	1.55	2.38E-06	627	971
ENSG00000132432.14	*SEC61G*	1.70	2.41E-06	624	1060
ENSG00000253304.2	*TMEM200B*	1.53	2.41E-06	453	693

ENSG00000113810.16	*SMC4*	-1.67	2.41E-06	3614	2166
ENSG00000286219.1	*NOTCH2NLC*	-131.07	2.41E-06	30	0
ENSG00000117280.13	*RAB29*	-1.61	2.44E-06	601	373
ENSG00000159086.15	*PAXBP1*	-1.69	2.46E-06	529	314
ENSG00000143850.16	*PLEKHA6*	-1.64	2.52E-06	1487	907
ENSG00000105404.11	*RABAC1*	1.74	2.54E-06	408	710
ENSG00000241370.5	*RPP21*	2.14	2.55E-06	118	254
ENSG00000153214.11	*TMEM87B*	1.62	2.55E-06	879	1425
ENSG00000147813.16	*NAPRT*	1.79	2.56E-06	236	423
ENSG00000130449.6	*ZSWIM6*	-1.92	2.60E-06	844	440
ENSG00000083520.15	*DIS3*	-2.03	2.83E-06	839	413
ENSG00000135047.15	*CTSL*	-1.88	2.85E-06	321	171
ENSG00000151491.14	*EPS8*	-1.61	2.90E-06	1208	751
ENSG00000107485.18	*GATA3*	-3.12	3.02E-06	89	28
ENSG00000189057.11	*FAM111B*	-1.83	3.03E-06	655	359
ENSG00000063241.8	*ISOC2*	1.75	3.07E-06	486	853
ENSG00000106976.20	*DNM1*	1.85	3.08E-06	171	315
ENSG00000164885.13	*CDK5*	1.86	3.10E-06	351	653
ENSG00000116754.13	*SRSF11*	-2.04	3.11E-06	1827	895
ENSG00000106665.15	*CLIP2*	1.75	3.14E-06	402	704
ENSG00000164252.13	*AGGF1*	-1.62	3.17E-06	584	361
ENSG00000163832.16	*ELP6*	1.57	3.21E-06	809	1269
ENSG00000151240.17	*DIP2C*	-1.59	3.23E-06	487	306
ENSG00000138802.11	*SEC24B*	-1.74	3.23E-06	969	557
ENSG00000113300.13	*CNOT6*	-1.60	3.26E-06	1087	678
ENSG00000233927.5	*RPS28*	1.66	3.26E-06	2729	4534
ENSG00000176108.9	*CHMP6*	1.61	3.26E-06	428	691
ENSG00000198042.11	*MAK16*	-1.66	3.27E-06	639	385
ENSG00000067533.6	*RRP15*	-1.55	3.28E-06	910	588
ENSG00000166173.11	*LARP6*	1.57	3.29E-06	389	611
ENSG00000143324.14	*XPR1*	-1.70	3.29E-06	1010	594
ENSG00000136108.15	*CKAP2*	-1.80	3.29E-06	1691	941
ENSG00000179841.8	*AKAP5*	-2.85	3.31E-06	122	43
ENSG00000242265.5	*PEG10*	2.05	3.33E-06	689	1416
ENSG00000121879.5	*PIK3CA*	-1.99	3.35E-06	490	246
ENSG00000164896.20	*FASTK*	1.54	3.41E-06	1158	1781
ENSG00000172175.15	*MALT1*	-1.95	3.44E-06	480	246
ENSG00000126814.7	*TRMT5*	-1.69	3.47E-06	916	542
ENSG00000119013.9	*NDUFB3*	1.61	3.51E-06	460	742
ENSG00000108395.14	*TRIM37*	-1.55	3.52E-06	1148	740
ENSG00000185246.18	*PRPF39*	-2.14	3.55E-06	467	218
ENSG00000156671.15	*SAMD8*	-1.68	3.55E-06	706	420

ENSG00000023572.9	*GLRX2*	-2.03	3.57E-06	256	126
ENSG00000113161.16	*HMGCR*	-1.59	3.57E-06	1374	863
ENSG00000188994.13	*ZNF292*	-4.24	3.57E-06	122	29
ENSG00000099282.10	*TSPAN15*	1.66	3.57E-06	282	468
ENSG00000158186.13	*MRAS*	-3.07	3.59E-06	104	34
ENSG00000160948.14	*VPS28*	1.53	3.59E-06	837	1283
ENSG00000123352.17	*SPATS2*	-1.82	3.60E-06	536	295
ENSG00000163848.19	*ZNF148*	-5.43	3.61E-06	138	25
ENSG00000171988.19	*JMJD1C*	-2.08	3.62E-06	988	474
ENSG00000079950.14	*STX7*	-1.74	3.64E-06	919	528
ENSG00000198160.14	*MIER1*	-1.78	3.75E-06	941	529
ENSG00000139324.12	*TMTC3*	-1.73	3.78E-06	794	459
ENSG00000169018.6	*FEM1B*	-1.59	3.83E-06	683	430
ENSG00000100485.12	*SOS2*	-1.59	3.85E-06	656	413
ENSG00000071246.11	*VASH1*	-2.72	3.87E-06	116	43
ENSG00000171522.6	*PTGER4*	-1.89	4.00E-06	220	116
ENSG00000196656.7	*AC004057.1*	1.57	4.10E-06	2536	3986
ENSG00000198948.12	*MFAP3L*	-2.52	4.15E-06	198	79
ENSG00000164466.13	*SFXN1*	-1.52	4.24E-06	2729	1799
ENSG00000138759.19	*FRAS1*	-1.66	4.25E-06	1173	709
ENSG00000111727.12	*HCFC2*	-1.84	4.27E-06	280	152
ENSG00000143952.20	*VPS54*	-1.89	4.32E-06	381	202
ENSG00000140416.21	*TPM1*	-1.95	4.32E-06	363	186
ENSG00000177674.16	*AGTRAP*	1.64	4.32E-06	359	589
ENSG00000119471.15	*HSDL2*	-1.53	4.37E-06	1467	959
ENSG00000176946.12	*THAP4*	1.59	4.43E-06	732	1167
ENSG00000167969.13	*ECI1*	1.61	4.44E-06	423	680
ENSG00000126267.11	*COX6B1*	1.56	4.69E-06	1969	3067
ENSG00000128059.8	*PPAT*	-1.96	4.79E-06	1087	555
ENSG00000164329.13	*TENT2*	-1.66	4.84E-06	472	284
ENSG00000230882.1	*AC005077.4*	4.62	4.85E-06	13	61
ENSG00000167861.16	*HID1*	1.84	4.89E-06	170	313
ENSG00000132466.19	*ANKRD17*	-1.88	5.00E-06	2758	1467
ENSG00000132906.18	*CASP9*	1.91	5.03E-06	123	234
ENSG00000116857.17	*TMEM9*	1.54	5.03E-06	474	732
ENSG00000162636.16	*FAM102B*	-1.73	5.05E-06	776	448
ENSG00000138675.16	*FGF5*	-2.91	5.12E-06	514	176
ENSG00000173486.13	*FKBP2*	1.59	5.17E-06	527	837
ENSG00000123200.16	*ZC3H13*	-1.65	5.18E-06	869	528
ENSG00000174842.17	*GLMN*	-1.86	5.31E-06	305	164
ENSG00000118193.12	*KIF14*	-2.32	5.31E-06	1145	493
ENSG00000144747.17	*TMF1*	-2.07	5.31E-06	736	356
ENSG00000215374.6	*FAM66B*	-11.01	5.50E-06	40	4

ENSG00000166200.15	*COPS2*	-1.85	5.50E-06	928	501
ENSG00000028137.19	*TNFRSF1B*	-2.31	5.57E-06	154	67
ENSG00000071794.16	*HLTF*	-1.88	5.67E-06	804	428
ENSG00000065183.16	*WDR3*	-2.29	5.68E-06	2011	878
ENSG00000005889.15	*ZFX*	-2.16	5.89E-06	411	191
ENSG00000125703.15	*ATG4C*	-1.89	5.91E-06	281	149
ENSG00000120992.18	*LYPLA1*	-1.52	5.93E-06	923	607
ENSG00000198689.11	*SLC9A6*	3.12	5.98E-06	57	177
ENSG00000120694.20	*HSPH1*	-1.57	6.01E-06	3660	2326
ENSG00000272398.6	*CD24*	2.60	6.09E-06	60	157
ENSG00000170906.16	*NDUFA3*	1.68	6.18E-06	344	580
ENSG00000141295.14	*SCRN2*	1.55	6.27E-06	304	473
ENSG00000277778.2	*PGM5P2*	-3.87	6.28E-06	85	22
ENSG00000085999.13	*RAD54L*	1.65	6.29E-06	515	848
ENSG00000071889.16	*FAM3A*	2.47	6.36E-06	145	359
ENSG00000198399.14	*ITSN2*	-1.74	6.55E-06	532	306
ENSG00000171320.15	*ESCO2*	-2.28	6.68E-06	397	174
ENSG00000083937.9	*CHMP2B*	-1.53	6.69E-06	638	416
ENSG00000164332.8	*UBLCP1*	-1.76	6.73E-06	674	382
ENSG00000257379.1	*AC023509.1*	-7.54	6.78E-06	67	9
ENSG00000138698.14	*RAP1GDS1*	-1.61	6.88E-06	725	449
ENSG00000146376.11	*ARHGAP18*	-1.83	6.92E-06	684	373
ENSG00000183287.14	*CCBE1*	-1.61	6.96E-06	465	289
ENSG00000106133.18	*NSUN5P2*	2.14	6.96E-06	68	145
ENSG00000164619.10	*BMPER*	-5.58	6.97E-06	52	9
ENSG00000172366.20	*MCRIP2*	1.84	7.09E-06	157	289
ENSG00000204392.11	*LSM2*	1.53	7.26E-06	878	1343
ENSG00000144369.13	*FAM171B*	-1.69	7.34E-06	371	220
ENSG00000112339.15	*HBS1L*	-1.87	7.34E-06	1049	560
ENSG00000204186.10	*ZDBF2*	-2.41	7.63E-06	187	77
ENSG00000265817.3	*FSBP*	-2.11	7.76E-06	164	78
ENSG00000168685.15	*IL7R*	-4.39	7.82E-06	366	83
ENSG00000176018.13	*LYSMD3*	-1.68	7.86E-06	461	275
ENSG00000163788.14	*SNRK*	-1.68	7.92E-06	536	319
ENSG00000156017.13	*CARNMT1*	-1.71	8.09E-06	559	327
ENSG00000225684.4	*FAM225B*	1.57	8.10E-06	287	451
ENSG00000073849.15	*ST6GAL1*	-10.24	8.10E-06	47	5
ENSG00000117620.15	*SLC35A3*	-1.55	8.12E-06	619	398
ENSG00000108622.11	*ICAM2*	-1.80	8.20E-06	254	141
ENSG00000100330.15	*MTMR3*	-1.59	8.23E-06	460	289
ENSG00000151090.19	*THRB*	-2.84	8.29E-06	102	36
ENSG00000204498.11	*NFKBIL1*	1.57	8.29E-06	282	443
ENSG00000113575.10	*PPP2CA*	-1.57	8.46E-06	988	629

ENSG00000091656.19	*ZFHX4*	-2.19	8.53E-06	328	150
ENSG00000144895.12	*EIF2A*	-1.65	8.62E-06	1182	717
ENSG00000140044.13	*JDP2*	1.88	8.65E-06	152	285
ENSG00000212802.4	*RPL15P3*	1.77	8.65E-06	407	719
ENSG00000102119.10	*EMD*	1.83	8.78E-06	280	512
ENSG00000175054.16	*ATR*	-1.90	8.82E-06	563	297
ENSG00000172164.15	*SNTB1*	1.61	8.86E-06	260	418
ENSG00000204308.8	*RNF5*	1.58	8.88E-06	1003	1583
ENSG00000151461.20	*UPF2*	-2.04	8.92E-06	560	275
ENSG00000103490.14	*PYCARD*	4.15	9.01E-06	16	66
ENSG00000064419.13	*TNPO3*	-2.27	9.12E-06	160	70
ENSG00000164190.19	*NIPBL*	-1.64	9.16E-06	897	548
ENSG00000110880.10	*CORO1C*	-2.72	9.21E-06	150	55
ENSG00000125652.8	*ALKBH7*	2.14	9.30E-06	164	351
ENSG00000139410.15	*SDSL*	2.08	9.39E-06	143	299
ENSG00000213442.5	*RPL18AP3*	1.55	9.45E-06	374	580
ENSG00000156973.14	*PDE6D*	1.75	9.47E-06	270	472
ENSG00000188015.10	*S100A3*	2.26	9.55E-06	62	139
ENSG00000119927.14	*GPAM*	-1.71	9.81E-06	425	249
ENSG00000173264.14	*GPR137*	1.64	9.87E-06	241	397
ENSG00000165219.22	*GAPVD1*	-1.63	9.95E-06	1419	870
ENSG00000177485.7	*ZBTB33*	-1.83	1.00E-05	341	186
ENSG00000163041.11	*H3F3A*	-7.99	1.01E-05	138	17
ENSG00000163702.20	*IL17RC*	2.46	1.02E-05	116	285
ENSG00000243943.10	*ZNF512*	-1.67	1.02E-05	499	298
ENSG00000174799.11	*CEP135*	-2.27	1.03E-05	222	98
ENSG00000239779.7	*WBP1*	1.82	1.04E-05	235	428
ENSG00000077458.13	*FAM76B*	-1.96	1.04E-05	293	149
ENSG00000011566.15	*MAP4K3*	-1.71	1.04E-05	511	299
ENSG00000081307.12	*UBA5*	-1.81	1.04E-05	352	194
ENSG00000165650.12	*PDZD8*	-1.81	1.09E-05	2095	1159
ENSG00000111817.17	*DSE*	-2.10	1.10E-05	381	181
ENSG00000198301.12	*SDAD1*	-1.64	1.10E-05	1101	672
ENSG00000103064.15	*SLC7A6*	-1.64	1.12E-05	1094	668
ENSG00000156804.7	*FBXO32*	2.27	1.16E-05	108	246
ENSG00000143079.15	*CTTNBP2NL*	-1.70	1.17E-05	677	398
ENSG00000254598.3	*CSNK2A3*	-1.53	1.18E-05	557	364
ENSG00000155846.17	*PPARGC1B*	-2.24	1.20E-05	210	94
ENSG00000119729.12	*RHOQ*	-2.35	1.20E-05	475	202
ENSG00000197119.13	*SLC25A29*	1.58	1.20E-05	394	622
ENSG00000100865.15	*CINP*	1.64	1.21E-05	541	887
ENSG00000113083.14	*LOX*	-1.76	1.21E-05	650	370
ENSG00000143429.10	*LSP1P4*	8.17	1.22E-05	19	157

ENSG00000143797.12	*MBOAT2*	-1.69	1.24E-05	496	293
ENSG00000160993.4	*ALKBH4*	1.90	1.25E-05	134	256
ENSG00000031003.10	*FAM13B*	-1.78	1.25E-05	1003	565
ENSG00000105245.9	*NUMBL*	-1.58	1.26E-05	521	328
ENSG00000151014.6	*NOCT*	-2.05	1.27E-05	296	144
ENSG00000101680.15	*LAMA1*	-10.33	1.27E-05	35	3
ENSG00000089916.18	*GPATCH2L*	-2.13	1.30E-05	1289	606
ENSG00000101473.17	*ACOT8*	1.83	1.31E-05	355	648
ENSG00000183421.12	*RIPK4*	2.12	1.32E-05	80	170
ENSG00000196305.17	*IARS*	-2.01	1.33E-05	2027	1010
ENSG00000141219.15	*C17orf80*	-2.45	1.33E-05	222	91
ENSG00000170542.6	*SERPINB9*	-1.74	1.33E-05	290	167
ENSG00000182196.13	*ARL6IP4*	1.68	1.34E-05	1001	1683
ENSG00000105612.9	*DNASE2*	1.75	1.36E-05	251	440
ENSG00000173226.17	*IQCB1*	-2.11	1.36E-05	171	81
ENSG00000178685.14	*PARP10*	1.76	1.37E-05	237	418
ENSG00000125170.11	*DOK4*	3.41	1.40E-05	41	141
ENSG00000228794.9	*LINC01128*	-2.09	1.45E-05	242	116
ENSG00000250644.3	*AC068580.4*	2.42	1.45E-05	81	196
ENSG00000169155.10	*ZBTB43*	-1.67	1.45E-05	443	266
ENSG00000127920.6	*GNG11*	1.86	1.46E-05	195	362
ENSG00000047315.16	*POLR2B*	-1.56	1.48E-05	4011	2564
ENSG00000111885.7	*MAN1A1*	-1.68	1.50E-05	414	246
ENSG00000170471.15	*RALGAPB*	-1.55	1.51E-05	1737	1119
ENSG00000141449.14	*GREB1L*	-4.65	1.51E-05	81	17
ENSG00000139350.11	*NEDD1*	-1.91	1.51E-05	255	134
ENSG00000111678.11	*C12orf57*	1.74	1.53E-05	479	834
ENSG00000095564.14	*BTAF1*	-7.07	1.53E-05	40	6
ENSG00000172379.21	*ARNT2*	-2.63	1.54E-05	389	148
ENSG00000120800.5	*UTP20*	-1.97	1.54E-05	2203	1118
ENSG00000169554.21	*ZEB2*	-1.76	1.61E-05	248	141
ENSG00000160446.19	*ZDHHC12*	1.57	1.61E-05	465	729
ENSG00000156162.16	*DPY19L4*	-1.63	1.61E-05	1005	617
ENSG00000120008.16	*WDR11*	-1.57	1.62E-05	1307	833
ENSG00000130313.7	*PGLS*	1.63	1.62E-05	618	1005
ENSG00000151239.13	*TWF1*	-4.48	1.63E-05	88	20
ENSG00000131095.13	*GFAP*	2.90	1.64E-05	49	143
ENSG00000138172.11	*CALHM2*	1.73	1.64E-05	160	277
ENSG00000166170.9	*BAG5*	-126.99	1.64E-05	29	0
ENSG00000162981.14	*LRATD1*	-2.98	1.67E-05	105	35
ENSG00000162645.13	*GBP2*	1.70	1.68E-05	161	275
ENSG00000074356.17	*NCBP3*	-1.61	1.73E-05	1910	1189

ENSG00000040275.17	*SPDL1*	-1.76	1.73E-05	1642	933
ENSG00000171604.12	*CXXC5*	1.81	1.76E-05	210	380
ENSG00000163884.4	*KLF15*	-4.08	1.76E-05	61	15
ENSG00000134574.11	*DDB2*	2.12	1.77E-05	74	157
ENSG00000148737.17	*TCF7L2*	-1.63	1.77E-05	358	220
ENSG00000134852.15	*CLOCK*	-1.91	1.79E-05	1224	641
ENSG00000130695.15	*CEP85*	3.79	1.79E-05	25	97
ENSG00000130830.15	*MPP1*	1.85	1.80E-05	140	259
ENSG00000112659.14	*CUL9*	1.94	1.81E-05	370	720
ENSG00000114646.10	*CSPG5*	1.88	1.81E-05	139	260
ENSG00000143891.17	*GALM*	1.86	1.81E-05	143	265
ENSG00000225972.1	*MTND1P23*	7.42	1.85E-05	6	42
ENSG00000104177.18	*MYEF2*	-1.72	1.88E-05	767	446
ENSG00000145332.14	*KLHL8*	-1.96	1.88E-05	762	390
ENSG00000008294.21	*SPAG9*	-1.91	1.90E-05	2272	1188
ENSG00000156928.5	*MALSU1*	1.69	1.91E-05	397	673
ENSG00000099256.19	*PRTFDC1*	-1.60	1.91E-05	338	212
ENSG00000157106.16	*SMG1*	-12.18	1.91E-05	35	3
ENSG00000167565.13	*SERTAD3*	1.64	1.91E-05	233	381
ENSG00000136859.10	*ANGPTL2*	1.77	1.96E-05	257	457
ENSG00000170802.16	*FOXN2*	-2.15	1.97E-05	548	254
ENSG00000119285.11	*HEATR1*	-1.90	1.97E-05	1605	846
ENSG00000134508.12	*CABLES1*	1.75	2.01E-05	171	299
ENSG00000234420.7	*ZNF37BP*	-2.98	2.02E-05	229	77
ENSG00000096092.6	*TMEM14A*	1.72	2.02E-05	330	568
ENSG00000142731.11	*PLK4*	-1.69	2.02E-05	545	322
ENSG00000111319.13	*SCNN1A*	2.68	2.02E-05	69	185
ENSG00000171858.18	*RPS21*	1.58	2.04E-05	3521	5547
ENSG00000270872.2	*SRGAP2D*	-1.83	2.05E-05	275	150
ENSG00000051523.11	*CYBA*	1.69	2.06E-05	633	1071
ENSG00000175482.9	*POLD4*	2.19	2.07E-05	141	310
ENSG00000088305.18	*DNMT3B*	-1.77	2.17E-05	270	153
ENSG00000149308.17	*NPAT*	-2.26	2.19E-05	425	188
ENSG00000131174.7	*COX7B*	1.66	2.21E-05	633	1052
ENSG00000166855.9	*CLPX*	-1.55	2.21E-05	703	452
ENSG00000204590.12	*GNL1*	1.70	2.22E-05	245	417
ENSG00000111581.10	*NUP107*	-1.78	2.23E-05	1637	918
ENSG00000171105.14	*INSR*	-1.70	2.23E-05	720	424
ENSG00000160957.13	*RECQL4*	2.01	2.24E-05	340	683
ENSG00000175445.17	*LPL*	-2.99	2.25E-05	135	45
ENSG00000111261.14	*MANSC1*	2.03	2.27E-05	108	219
ENSG00000097046.13	*CDC7*	-1.95	2.28E-05	747	383
ENSG00000105894.12	*PTN*	12.01	2.32E-05	8	94

ENSG00000145780.8	*FEM1C*	-1.72	2.32E-05	660	384
ENSG00000066933.16	*MYO9A*	-1.80	2.33E-05	518	287
ENSG00000118058.22	*KMT2A*	-4.20	2.38E-05	302	72
ENSG00000273018.6	*FAM106A*	-2.69	2.40E-05	209	77
ENSG00000162836.12	*ACP6*	1.57	2.41E-05	408	641
ENSG00000171960.11	*PPIH*	1.62	2.42E-05	534	866
ENSG00000136824.19	*SMC2*	-1.86	2.43E-05	1714	922
ENSG00000175066.16	*GK5*	-2.06	2.46E-05	262	127
ENSG00000055163.20	*CYFIP2*	-4.47	2.47E-05	84	19
ENSG00000197555.9	*SIPA1L1*	1.56	2.48E-05	509	793
ENSG00000182704.8	*TSKU*	1.59	2.53E-05	317	504
ENSG00000150712.11	*MTMR12*	-1.61	2.54E-05	1295	806
ENSG00000143553.11	*SNAPIN*	1.55	2.56E-05	393	611
ENSG00000127220.6	*ABHD8*	1.63	2.56E-05	245	400
ENSG00000095787.23	*WAC*	-1.87	2.59E-05	1234	659
ENSG00000106538.10	*RARRES2*	3.20	2.64E-05	34	110
ENSG00000107929.14	*LARP4B*	-2.45	2.72E-05	228	93
ENSG00000131089.16	*ARHGEF9*	-1.72	2.75E-05	547	318
ENSG00000178502.6	*KLHL11*	-2.07	2.75E-05	286	138
ENSG00000068650.18	*ATP11A*	-1.58	2.76E-05	902	572
ENSG00000163697.17	*APBB2*	-1.60	2.80E-05	2039	1271
ENSG00000188848.16	*BEND4*	-7.28	2.82E-05	36	5
ENSG00000043093.15	*DCUN1D1*	-1.78	2.82E-05	669	377
ENSG00000168610.14	*STAT3*	-4.13	2.84E-05	104	25
ENSG00000128965.13	*CHAC1*	1.80	2.84E-05	135	242
ENSG00000144591.18	*GMPPA*	2.24	2.86E-05	187	418
ENSG00000077232.18	*DNAJC10*	-1.88	2.94E-05	2201	1170
ENSG00000153404.14	*PLEKHG4B*	13.19	2.96E-05	4	46
ENSG00000038219.13	*BOD1L1*	-1.80	3.00E-05	1108	616
ENSG00000102189.17	*EEA1*	-2.00	3.00E-05	679	339
ENSG00000132481.7	*TRIM47*	1.78	3.02E-05	288	513
ENSG00000040487.13	*SLC66A1*	1.60	3.04E-05	255	408
ENSG00000268001.1	*CARD8-AS1*	-2.18	3.12E-05	176	81
ENSG00000169189.17	*NSMCE1*	1.61	3.13E-05	573	925
ENSG00000091136.14	*LAMB1*	-1.64	3.15E-05	4234	2582
ENSG00000163644.15	*PPM1K*	-1.64	3.17E-05	552	338
ENSG00000122042.10	*UBL3*	-1.61	3.18E-05	452	281
ENSG00000168172.9	*HOOK3*	-1.53	3.19E-05	603	395
ENSG00000196083.10	*IL1RAP*	-2.25	3.21E-05	221	98
ENSG00000163785.12	*RYK*	-1.87	3.21E-05	313	167
ENSG00000035403.17	*VCL*	-1.72	3.23E-05	2230	1297
ENSG00000164220.7	*F2RL2*	-6.91	3.25E-05	38	6
ENSG00000183828.15	*NUDT14*	1.95	3.28E-05	147	287

ENSG00000177556.12	*ATOX1*	1.57	3.28E-05	873	1369
ENSG00000227234.2	*SPANXB1*	-2.37	3.36E-05	114	48
ENSG00000174173.7	*TRMT10C*	-1.52	3.39E-05	639	421
ENSG00000102760.13	*RGCC*	2.40	3.44E-05	47	113
ENSG00000178922.16	*HYI*	1.58	3.47E-05	557	881
ENSG00000117472.10	*TSPAN1*	1.84	3.47E-05	141	259
ENSG00000164118.13	*CEP44*	-1.81	3.53E-05	222	123
ENSG00000280893.1	*AC009133.6*	1.64	3.54E-05	256	420
ENSG00000087470.18	*DNM1L*	-1.93	3.56E-05	1338	692
ENSG00000100503.23	*NIN*	-1.83	3.57E-05	345	189
ENSG00000164070.12	*HSPA4L*	-2.17	3.75E-05	1147	528
ENSG00000066557.6	*LRRC40*	-1.85	3.77E-05	402	218
ENSG00000198963.11	*RORB*	-3.59	3.81E-05	73	20
ENSG00000014123.10	*UFL1*	-2.06	3.81E-05	347	169
ENSG00000029153.14	*ARNTL2*	-2.16	3.84E-05	1683	779
ENSG00000275835.5	*TUBGCP5*	-2.00	3.85E-05	341	170
ENSG00000125449.7	*ARMC7*	1.53	3.86E-05	287	438
ENSG00000273812.3	*BX640514.2*	2.39	3.87E-05	49	117
ENSG00000198000.12	*NOL8*	-1.81	3.91E-05	840	465
ENSG00000107821.14	*KAZALD1*	1.98	3.96E-05	82	163
ENSG00000137166.15	*FOXP4*	1.55	3.96E-05	661	1024
ENSG00000152495.11	*CAMK4*	-1.86	3.96E-05	351	188
ENSG00000130305.17	*NSUN5*	1.58	3.99E-05	511	807
ENSG00000117385.15	*P3H1*	1.79	3.99E-05	314	561
ENSG00000107863.18	*ARHGAP21*	-1.72	4.02E-05	868	505
ENSG00000149212.12	*SESN3*	1.91	4.12E-05	91	174
ENSG00000187608.10	*ISG15*	1.59	4.20E-05	808	1288
ENSG00000102871.16	*TRADD*	1.89	4.21E-05	117	221
ENSG00000269834.6	*ZNF528-AS1*	1.96	4.23E-05	93	182
ENSG00000014138.9	*POLA2*	-2.21	4.24E-05	184	83
ENSG00000147202.18	*DIAPH2*	-2.05	4.33E-05	176	86
ENSG00000128881.17	*TTBK2*	-1.76	4.37E-05	368	209
ENSG00000175279.22	*CENPS*	1.58	4.47E-05	221	348
ENSG00000153406.13	*NMRAL1*	2.05	4.51E-05	182	373
ENSG00000069482.7	*GAL*	-2.09	4.56E-05	136	65
ENSG00000154429.11	*CCSAP*	-1.66	4.59E-05	321	193
ENSG00000164088.18	*PPM1M*	1.58	4.62E-05	215	340
ENSG00000110315.7	*RNF141*	-1.73	4.62E-05	280	162
ENSG00000158747.14	*NBL1*	217.21	4.66E-05	0	32
ENSG00000102554.14	*KLF5*	-1.52	4.66E-05	622	409
ENSG00000124659.7	*TBCC*	1.54	4.68E-05	602	929
ENSG00000167779.9	*IGFBP6*	1.59	4.74E-05	437	695
ENSG00000197329.12	*PELI1*	-2.43	4.75E-05	147	61

ENSG00000180992.7	*MRPL14*	1.58	4.76E-05	1640	2586
ENSG00000141552.17	*ANAPC11*	1.64	4.76E-05	756	1236
ENSG00000141012.13	*GALNS*	1.60	4.78E-05	237	379
ENSG00000144554.10	*FANCD2*	6.15	4.85E-05	42	259
ENSG00000179588.9	*ZFPM1*	3.34	4.85E-05	19	64
ENSG00000091129.20	*NRCAM*	3.04	4.92E-05	25	77
ENSG00000111670.16	*GNPTAB*	-1.72	4.99E-05	647	377
ENSG00000101938.15	*CHRDL1*	-1.81	4.99E-05	284	157
ENSG00000196865.4	*NHLRC2*	-1.66	4.99E-05	1184	715
ENSG00000128165.9	*ADM2*	2.26	5.06E-05	67	151
ENSG00000174371.17	*EXO1*	-1.53	5.06E-05	841	548
ENSG00000170442.12	*KRT86*	2.47	5.12E-05	46	114
ENSG00000138767.13	*CNOT6L*	-3.71	5.19E-05	134	36
ENSG00000039560.14	*RAI14*	-1.74	5.20E-05	2689	1548
ENSG00000013374.16	*NUB1*	-2.35	5.22E-05	339	144
ENSG00000104518.11	*GSDMD*	1.55	5.25E-05	656	1018
ENSG00000152242.11	*C18orf25*	-1.62	5.27E-05	549	338
ENSG00000137142.5	*IGFBPL1*	-1.52	5.30E-05	582	382
ENSG00000150347.16	*ARID5B*	-1.78	5.32E-05	314	176
ENSG00000067248.10	*DHX29*	-1.70	5.37E-05	1132	666
ENSG00000177707.11	*NECTIN3*	-1.75	5.59E-05	822	471
ENSG00000269713.7	*NBPF9*	-1.93	5.59E-05	893	463
ENSG00000182580.3	*EPHB3*	5.56	5.61E-05	10	53
ENSG00000131051.24	*RBM39*	-1.58	5.63E-05	4413	2785
ENSG00000197275.14	*RAD54B*	-1.75	5.68E-05	291	166
ENSG00000163625.15	*WDFY3*	-2.50	5.68E-05	133	53
ENSG00000164902.14	*PHAX*	-1.76	5.72E-05	1368	779
ENSG00000139697.14	*SBNO1*	-1.58	5.75E-05	2158	1368
ENSG00000269242.1	*AC010422.3*	20.06	5.82E-05	1	28
ENSG00000124588.20	*NQO2*	2.65	5.86E-05	33	86
ENSG00000142751.15	*GPN2*	1.54	5.90E-05	493	758
ENSG00000110200.8	*ANAPC15*	1.87	5.92E-05	208	390
ENSG00000107643.16	*MAPK8*	-1.68	5.92E-05	1266	753
ENSG00000198919.13	*DZIP3*	-2.33	5.95E-05	368	158
ENSG00000179029.15	*TMEM107*	1.75	6.00E-05	130	227
ENSG00000125356.7	*NDUFA1*	1.55	6.12E-05	466	720
ENSG00000153485.5	*TMEM251*	1.75	6.19E-05	129	226
ENSG00000166897.15	*ELFN2*	1.70	6.21E-05	228	388
ENSG00000260257.2	*AL035071.1*	2.05	6.26E-05	70	145
ENSG00000151474.23	*FRMD4A*	-1.69	6.28E-05	491	291
ENSG00000123472.12	*ATPAF1*	1.76	6.36E-05	220	388
ENSG00000113119.12	*TMCO6*	-2.22	6.42E-05	125	56
ENSG00000183340.7	*JRKL*	-1.71	6.44E-05	295	172

ENSG00000116985.12	*BMP8B*	-3.38	6.44E-05	80	24
ENSG00000103642.12	*LACTB*	-1.70	6.51E-05	486	286
ENSG00000165490.13	*DDIAS*	-1.71	6.69E-05	491	288
ENSG00000133943.20	*DGLUCY*	1.57	6.75E-05	197	310
ENSG00000243701.7	*DUBR*	-1.92	6.79E-05	187	97
ENSG00000134470.21	*IL15RA*	-1.88	6.80E-05	309	164
ENSG00000176105.14	*YES1*	-1.64	6.81E-05	923	562
ENSG00000152219.5	*ARL14EP*	-1.76	6.87E-05	346	197
ENSG00000136869.16	*TLR4*	-1.58	6.93E-05	450	285
ENSG00000183458.14	*AC138932.1*	-1.76	6.99E-05	311	177
ENSG00000113318.11	*MSH3*	-1.61	7.04E-05	390	242
ENSG00000025434.19	*NR1H3*	2.15	7.05E-05	91	195
ENSG00000153922.10	*CHD1*	-1.75	7.11E-05	288	165
ENSG00000100916.14	*BRMS1L*	-1.70	7.19E-05	344	203
ENSG00000033800.13	*PIAS1*	-2.10	7.19E-05	186	88
ENSG00000253352.9	*TUG1*	-1.65	7.19E-05	1888	1147
ENSG00000121851.13	*POLR3GL*	1.57	7.24E-05	293	461
ENSG00000116005.12	*PCYOX1*	-1.60	7.71E-05	1154	723
ENSG00000284024.2	*HSPA14*	-2.12	7.71E-05	208	98
ENSG00000142330.20	*CAPN10*	1.56	7.71E-05	236	368
ENSG00000197136.4	*PCNX3*	1.58	7.83E-05	238	376
ENSG00000172123.12	*SLFN12*	-2.22	7.88E-05	192	86
ENSG00000178896.9	*EXOSC4*	1.62	7.90E-05	395	639
ENSG00000134184.13	*GSTM1*	-1.62	7.97E-05	270	167
ENSG00000054983.17	*GALC*	-1.52	8.10E-05	559	367
ENSG00000109184.15	*DCUN1D4*	-1.80	8.14E-05	803	447
ENSG00000104067.16	*TJP1*	-1.98	8.18E-05	1057	535
ENSG00000182154.8	*MRPL41*	1.58	8.19E-05	682	1076
ENSG00000123213.23	*NLN*	-1.57	8.19E-05	915	582
ENSG00000216775.3	*AL109918.1*	-2.86	8.27E-05	145	51
ENSG00000137343.18	*ATAT1*	2.13	8.28E-05	68	145
ENSG00000219200.11	*RNASEK*	1.56	8.35E-05	373	581
ENSG00000051825.15	*MPHOSPH9*	-2.04	8.35E-05	771	378
ENSG00000152409.9	*JMY*	-1.86	8.38E-05	185	100
ENSG00000163364.10	*LINC01116*	1.60	8.39E-05	349	558
ENSG00000206149.10	*HERC2P9*	-1.90	8.42E-05	351	184
ENSG00000219201.4	*AC138392.1*	-1.70	8.43E-05	298	176
ENSG00000267405.1	*AC005180.1*	-3.53	8.43E-05	54	15
ENSG00000139154.15	*AEBP2*	-1.72	8.56E-05	709	413
ENSG00000155100.11	*OTUD6B*	-1.79	8.58E-05	359	200
ENSG00000100626.17	*GALNT16*	-10.64	8.68E-05	42	4
ENSG00000166532.16	*RIMKLB*	-1.75	8.80E-05	394	225
ENSG00000158987.21	*RAPGEF6*	3.00	8.84E-05	42	126

ENSG00000119906.13	*SLF2*	-1.82	8.94E-05	1211	666
ENSG00000085871.9	*MGST2*	1.84	8.95E-05	153	282
ENSG00000076555.15	*ACACB*	1.87	8.95E-05	129	240
ENSG00000165655.17	*ZNF503*	2.01	8.96E-05	103	207
ENSG00000144029.12	*MRPS5*	1.56	9.09E-05	697	1090
ENSG00000158966.16	*CACHD1*	-1.78	9.10E-05	242	136
ENSG00000156103.16	*MMP16*	-1.89	9.11E-05	265	140
ENSG00000110092.3	*CCND1*	-3.23	9.11E-05	89	28
ENSG00000088727.12	*KIF9*	1.95	9.34E-05	103	201
ENSG00000162714.12	*ZNF496*	-1.78	9.34E-05	789	444
ENSG00000087299.12	*L2HGDH*	-1.65	9.47E-05	475	288
ENSG00000122971.9	*ACADS*	1.78	9.48E-05	129	230
ENSG00000171159.5	*C9orf16*	1.61	9.48E-05	234	377
ENSG00000172171.11	*TEFM*	-1.72	9.58E-05	240	140
ENSG00000069122.19	*ADGRF5*	2.08	9.70E-05	84	173
ENSG00000180611.7	*MB21D2*	-2.27	9.78E-05	151	66
ENSG00000144589.22	*STK11IP*	1.77	9.79E-05	174	310
ENSG00000132879.14	*FBXO44*	2.37	9.80E-05	50	118
ENSG00000007968.7	*E2F2*	1.61	9.83E-05	172	277
ENSG00000163347.6	*CLDN1*	-2.13	9.88E-05	128	60
ENSG00000033867.16	*SLC4A7*	-1.69	1.00E-04	778	459
ENSG00000174780.17	*SRP72*	-1.55	1.01E-04	3246	2100
ENSG00000144152.13	*FBLN7*	2.88	1.01E-04	33	96
ENSG00000125676.20	*THOC2*	-1.89	1.01E-04	945	499
ENSG00000176842.15	*IRX5*	1.77	1.01E-04	152	268
ENSG00000164171.11	*ITGA2*	-1.54	1.02E-04	6026	3910
ENSG00000173209.23	*AHSA2P*	-1.85	1.02E-04	263	142
ENSG00000083168.11	*KAT6A*	-1.81	1.02E-04	1331	737
ENSG00000148180.19	*GSN*	2.23	1.03E-04	90	200
ENSG00000140262.17	*TCF12*	-1.76	1.03E-04	968	549
ENSG00000179943.8	*FIZ1*	1.63	1.03E-04	195	318
ENSG00000220842.6	*RPL21P16*	1.54	1.05E-04	823	1270
ENSG00000165323.15	*FAT3*	-17.57	1.09E-04	20	1
ENSG00000104870.13	*FCGRT*	1.78	1.09E-04	118	210
ENSG00000131013.4	*PPIL4*	-1.88	1.10E-04	357	190
ENSG00000172086.9	*KRCC1*	1.55	1.10E-04	234	363
ENSG00000120675.6	*DNAJC15*	1.62	1.10E-04	420	680
ENSG00000137767.14	*SQOR*	1.57	1.10E-04	610	958
ENSG00000127540.12	*UQCR11*	1.54	1.10E-04	1215	1867
ENSG00000225663.8	*MCRIP1*	1.53	1.11E-04	363	556
ENSG00000168813.17	*ZNF507*	-2.00	1.12E-04	649	324
ENSG00000174165.8	*ZDHHC24*	1.67	1.15E-04	140	234
ENSG00000196498.13	*NCOR2*	1.61	1.15E-04	1423	2297

ENSG00000067900.8	*ROCK1*	-1.71	1.16E-04	1033	604
ENSG00000148426.13	*PROSER2*	-2.04	1.17E-04	519	255
ENSG00000079819.19	*EPB41L2*	-1.72	1.17E-04	1794	1045
ENSG00000266094.8	*RASSF5*	-1.59	1.18E-04	300	189
ENSG00000085276.19	*MECOM*	-1.88	1.18E-04	1114	594
ENSG00000182983.15	*ZNF662*	-5.11	1.19E-04	39	8
ENSG00000142920.17	*AZIN2*	2.00	1.19E-04	125	250
ENSG00000120549.18	*KIAA1217*	-1.55	1.19E-04	432	279
ENSG00000111912.20	*NCOA7*	-1.85	1.19E-04	633	343
ENSG00000167380.16	*ZNF226*	2.04	1.21E-04	73	149
ENSG00000145331.14	*TRMT10A*	-2.26	1.21E-04	133	59
ENSG00000163923.10	*RPL39L*	1.68	1.26E-04	273	459
ENSG00000127870.17	*RNF6*	-1.71	1.27E-04	554	323
ENSG00000085365.18	*SCAMP1*	-1.71	1.27E-04	779	455
ENSG00000104756.16	*KCTD9*	-1.82	1.28E-04	650	356
ENSG00000213689.14	*TREX1*	1.77	1.28E-04	113	200
ENSG00000176641.11	*RNF152*	-2.09	1.28E-04	175	84
ENSG00000104903.5	*LYL1*	3.06	1.29E-04	19	57
ENSG00000196739.15	*COL27A1*	-1.94	1.29E-04	278	143
ENSG00000166289.6	*PLEKHF1*	2.14	1.29E-04	77	164
ENSG00000263155.6	*MYZAP*	-4.42	1.30E-04	45	10
ENSG00000140575.13	*IQGAP1*	-1.57	1.30E-04	5176	3294
ENSG00000103994.17	*ZNF106*	-2.26	1.31E-04	144	64
ENSG00000164181.14	*ELOVL7*	-2.00	1.33E-04	138	69
ENSG00000123094.15	*RASSF8*	-2.19	1.34E-04	631	288
ENSG00000198208.11	*RPS6KL1*	-2.29	1.35E-04	134	59
ENSG00000182957.16	*SPATA13*	-1.74	1.35E-04	435	251
ENSG00000164850.15	*GPER1*	2.82	1.36E-04	30	85
ENSG00000163558.13	*PRKCI*	-1.82	1.36E-04	1329	730
ENSG00000082258.13	*CCNT2*	-1.88	1.36E-04	496	264
ENSG00000068489.12	*PRR11*	-3.33	1.36E-04	404	121
ENSG00000167799.10	*NUDT8*	3.67	1.37E-04	16	59
ENSG00000172167.8	*MTBP*	-1.61	1.37E-04	514	319
ENSG00000109046.15	*WSB1*	-1.58	1.38E-04	1154	731
ENSG00000204991.11	*SPIRE2*	1.72	1.39E-04	140	242
ENSG00000081014.11	*AP4E1*	-1.84	1.41E-04	397	215
ENSG00000183873.15	*SCN5A*	-2.91	1.42E-04	218	75
ENSG00000135477.11	*KRT87P*	2.14	1.45E-04	65	139
ENSG00000144228.9	*SPOPL*	-1.70	1.46E-04	508	299
ENSG00000213015.9	*ZNF580*	1.81	1.47E-04	180	325
ENSG00000270629.6	*NBPF14*	-1.64	1.47E-04	1441	878
ENSG00000168228.15	*ZCCHC4*	-1.56	1.47E-04	376	242
ENSG00000177311.11	*ZBTB38*	-2.20	1.49E-04	502	228

ENSG00000005700.15	*IBTK*	-1.76	1.49E-04	832	473
ENSG00000113163.16	*CERT1*	-1.70	1.51E-04	633	373
ENSG00000167700.9	*MFSD3*	1.59	1.54E-04	218	347
ENSG00000148925.10	*BTBD10*	-2.48	1.55E-04	243	98
ENSG00000244187.8	*TMEM141*	1.59	1.56E-04	344	548
ENSG00000065057.9	*NTHL1*	1.77	1.56E-04	175	310
ENSG00000205544.4	*TMEM256*	1.84	1.57E-04	251	460
ENSG00000198730.9	*CTR9*	-1.63	1.58E-04	1374	844
ENSG00000004700.16	*RECQL*	-1.78	1.58E-04	978	549
ENSG00000085982.13	*USP40*	1.80	1.60E-04	771	1391
ENSG00000198740.8	*ZNF652*	3.25	1.61E-04	58	188
ENSG00000184319.16	*RPL23AP82*	20.00	1.63E-04	3	53
ENSG00000128203.7	*ASPHD2*	-2.73	1.64E-04	75	28
ENSG00000143303.12	*RRNAD1*	1.89	1.64E-04	120	226
ENSG00000108588.14	*CCDC47*	-1.56	1.65E-04	1936	1241
ENSG00000161798.7	*AQP5*	6.18	1.65E-04	5	29
ENSG00000072501.17	*SMC1A*	-2.44	1.66E-04	322	132
ENSG00000183570.16	*PCBP3*	6.21	1.67E-04	5	31
ENSG00000059377.17	*TBXAS1*	2.72	1.67E-04	33	89
ENSG00000091009.8	*RBM27*	-1.53	1.67E-04	835	546
ENSG00000204564.12	*C6orf136*	1.73	1.68E-04	335	580
ENSG00000143674.11	*MAP3K21*	-1.58	1.69E-04	329	209
ENSG00000114120.13	*SLC25A36*	-1.62	1.70E-04	660	407
ENSG00000165434.8	*PGM2L1*	-1.91	1.72E-04	167	88
ENSG00000184428.13	*TOP1MT*	1.59	1.73E-04	255	406
ENSG00000116747.12	*RO60*	-2.04	1.73E-04	312	153
ENSG00000133083.14	*DCLK1*	-3.56	1.76E-04	58	16
ENSG00000211456.12	*SACM1L*	-1.96	1.79E-04	902	460
ENSG00000242779.7	*ZNF702P*	-1.63	1.80E-04	304	187
ENSG00000185009.12	*AP3M1*	-1.94	1.80E-04	470	242
ENSG00000141646.13	*SMAD4*	-2.10	1.81E-04	150	71
ENSG00000011052.21	*NME1-NME2*	2.18	1.82E-04	98	215
ENSG00000164305.19	*CASP3*	-1.59	1.85E-04	738	463
ENSG00000171262.11	*FAM98B*	-1.61	1.85E-04	709	441
ENSG00000229809.8	*ZNF688*	4.41	1.92E-04	9	38
ENSG00000160712.13	*IL6R*	-3.15	1.92E-04	67	21
ENSG00000196323.14	*ZBTB44*	-1.65	1.92E-04	1002	607
ENSG00000108094.14	*CUL2*	-1.65	2.01E-04	258	156
ENSG00000143319.16	*ISG20L2*	-1.69	2.01E-04	595	352
ENSG00000147044.21	*CASK*	-1.93	2.04E-04	419	218
ENSG00000173281.5	*PPP1R3B*	-1.94	2.06E-04	157	81
ENSG00000110442.12	*COMMD9*	1.70	2.06E-04	394	669
ENSG00000233954.6	*UQCRHL*	1.87	2.07E-04	101	189

ENSG00000205755.12	*CRLF2*	3.94	2.10E-04	12	47
ENSG00000180747.15	*SMG1P3*	-2.89	2.10E-04	110	38
ENSG00000213337.9	*ANKRD39*	1.68	2.10E-04	180	303
ENSG00000087008.16	*ACOX3*	1.58	2.12E-04	197	312
ENSG00000183098.11	*GPC6*	-1.84	2.12E-04	183	100
ENSG00000163029.16	*SMC6*	-2.10	2.13E-04	564	269
ENSG00000172428.11	*COPS9*	1.72	2.14E-04	393	676
ENSG00000205336.12	*ADGRG1*	1.53	2.16E-04	1000	1533
ENSG00000143793.13	*C1orf35*	1.60	2.17E-04	333	531
ENSG00000182712.16	*CMC4*	3.05	2.21E-04	30	92
ENSG00000137628.17	*DDX60*	-2.45	2.22E-04	249	102
ENSG00000141401.12	*IMPA2*	1.72	2.23E-04	173	298
ENSG00000162076.13	*FLYWCH2*	1.67	2.23E-04	130	218
ENSG00000154237.13	*LRRK1*	-1.59	2.24E-04	452	285
ENSG00000143858.12	*SYT2*	6.51	2.25E-04	6	37
ENSG00000148290.10	*SURF1*	1.59	2.28E-04	324	515
ENSG00000066379.15	*ZNRD1*	1.60	2.30E-04	344	551
ENSG00000151422.13	*FER*	-2.40	2.31E-04	656	273
ENSG00000197969.14	*VPS13A*	-2.01	2.32E-04	688	343
ENSG00000152457.18	*DCLRE1C*	-1.81	2.33E-04	416	230
ENSG00000142599.19	*RERE*	-1.84	2.34E-04	594	322
ENSG00000173575.21	*CHD2*	-1.64	2.34E-04	1015	620
ENSG00000151883.18	*PARP8*	-1.85	2.36E-04	345	187
ENSG00000177034.16	*MTX3*	-8.07	2.37E-04	42	5
ENSG00000163684.11	*RPP14*	2.70	2.37E-04	166	447
ENSG00000214425.8	*LRRC37A4P*	-2.16	2.37E-04	434	201
ENSG00000087301.9	*TXNDC16*	-2.02	2.39E-04	168	83
ENSG00000117983.17	*MUC5B*	9.01	2.42E-04	4	40
ENSG00000130881.14	*LRP3*	-2.29	2.43E-04	145	63
ENSG00000165733.8	*BMS1*	-1.59	2.45E-04	2199	1386
ENSG00000156802.13	*ATAD2*	-1.57	2.46E-04	3110	1975
ENSG00000148700.15	*ADD3*	-1.56	2.49E-04	989	635
ENSG00000275740.1	*AC091959.3*	-4.62	2.51E-04	81	18
ENSG00000125864.14	*BFSP1*	1.71	2.52E-04	139	238
ENSG00000230445.4	*LRRC37A6P*	-48.69	2.52E-04	21	0
ENSG00000101695.9	*RNF125*	-2.84	2.52E-04	77	27
ENSG00000050438.17	*SLC4A8*	-1.97	2.53E-04	165	84
ENSG00000115919.15	*KYNU*	-3.22	2.54E-04	66	20
ENSG00000080345.18	*RIF1*	-1.90	2.54E-04	1333	700
ENSG00000198315.11	*ZKSCAN8*	-1.53	2.54E-04	799	522
ENSG00000118762.8	*PKD2*	-1.63	2.54E-04	905	555
ENSG00000173890.17	*GPR160*	-2.54	2.56E-04	90	35
ENSG00000161653.11	*NAGS*	1.60	2.58E-04	187	298

ENSG00000185880.13	*TRIM69*	1.92	2.59E-04	117	225
ENSG00000267368.1	*UPK3BL1*	2.26	2.60E-04	129	291
ENSG00000211450.10	*SELENOH*	1.55	2.61E-04	852	1325
ENSG00000206560.11	*ANKRD28*	-1.52	2.63E-04	1544	1016
ENSG00000067992.15	*PDK3*	3.75	2.66E-04	11	41
ENSG00000271425.9	*NBPF10*	-1.63	2.69E-04	1199	736
ENSG00000141655.17	*TNFRSF11A*	-1.65	2.70E-04	449	272
ENSG00000165185.14	*KIAA1958*	-2.41	2.70E-04	228	95
ENSG00000018408.14	*WWTR1*	-4.32	2.71E-04	50	12
ENSG00000118496.5	*FBXO30*	-1.57	2.74E-04	403	256
ENSG00000106852.15	*LHX6*	2.67	2.76E-04	24	63
ENSG00000137819.14	*PAQR5*	-1.65	2.78E-04	630	381
ENSG00000112576.12	*CCND3*	1.73	2.83E-04	262	452
ENSG00000153914.16	*SREK1*	-1.77	2.84E-04	1269	718
ENSG00000103024.7	*NME3*	2.46	2.85E-04	55	136
ENSG00000113594.10	*LIFR*	-1.72	2.89E-04	1079	627
ENSG00000110492.15	*MDK*	2.25	2.93E-04	74	167
ENSG00000162777.17	*DENND2D*	2.05	2.95E-04	60	123
ENSG00000166912.17	*MTMR10*	-1.80	3.02E-04	268	149
ENSG00000189079.17	*ARID2*	-1.87	3.02E-04	502	269
ENSG00000109805.10	*NCAPG*	-1.70	3.02E-04	2428	1428
ENSG00000145388.15	*METTL14*	-2.10	3.02E-04	366	174
ENSG00000075391.16	*RASAL2*	-2.37	3.03E-04	151	64
ENSG00000178401.16	*DNAJC22*	1.79	3.06E-04	99	177
ENSG00000106484.16	*MEST*	2.51	3.06E-04	76	192
ENSG00000163635.18	*ATXN7*	-2.22	3.06E-04	160	72
ENSG00000179627.10	*ZBTB42*	2.07	3.09E-04	52	107
ENSG00000063046.17	*EIF4B*	-1.79	3.10E-04	471	263
ENSG00000088543.15	*C3orf18*	1.78	3.11E-04	128	228
ENSG00000157483.9	*MYO1E*	-2.23	3.11E-04	556	249
ENSG00000077157.22	*PPP1R12B*	-2.12	3.14E-04	218	103
ENSG00000143786.8	*CNIH3*	1.74	3.14E-04	161	280
ENSG00000243364.8	*EFNA4*	1.88	3.17E-04	77	145
ENSG00000228474.6	*OST4*	1.54	3.19E-04	622	957
ENSG00000100784.12	*RPS6KA5*	-1.88	3.21E-04	171	91
ENSG00000178053.19	*MLF1*	-1.85	3.21E-04	198	107
ENSG00000103145.10	*HCFC1R1*	2.16	3.22E-04	151	327
ENSG00000131503.21	*ANKHD1*	-1.63	3.24E-04	1203	739
ENSG00000197603.14	*CPLANE1*	-1.92	3.25E-04	213	111
ENSG00000159733.13	*ZFYVE28*	1.81	3.25E-04	132	239
ENSG00000125772.13	*GPCPD1*	-8.49	3.26E-04	67	8
ENSG00000152377.14	*SPOCK1*	4.48	3.28E-04	10	46
ENSG00000282851.2	*BISPR*	4.70	3.28E-04	8	36

ENSG00000106610.15	*STAG3L4*	2.06	3.30E-04	70	145
ENSG00000214049.8	*UCA1*	2.82	3.34E-04	21	59
ENSG00000152082.14	*MZT2B*	2.32	3.34E-04	54	126
ENSG00000149054.16	*ZNF215*	-1.98	3.35E-04	233	117
ENSG00000169045.17	*HNRNPH1*	-1.76	3.37E-04	5670	3225
ENSG00000228594.4	*FNDC10*	-2.96	3.39E-04	78	26
ENSG00000186871.7	*ERCC6L*	-1.77	3.40E-04	453	257
ENSG00000131370.16	*SH3BP5*	-1.53	3.45E-04	283	184
ENSG00000105755.8	*ETHE1*	1.66	3.49E-04	230	383
ENSG00000134987.11	*WDR36*	-32.59	3.51E-04	22	1
ENSG00000034677.13	*RNF19A*	-1.73	3.53E-04	641	371
ENSG00000139687.15	*RB1*	-23.31	3.56E-04	44	2
ENSG00000272655.2	*POLR2J4*	1.87	3.58E-04	140	262
ENSG00000103742.12	*IGDCC4*	-1.60	3.59E-04	377	236
ENSG00000154734.15	*ADAMTS1*	-1.65	3.63E-04	655	396
ENSG00000126106.14	*TMEM53*	2.27	3.67E-04	73	167
ENSG00000147162.14	*OGT*	-1.54	3.67E-04	1345	872
ENSG00000159433.12	*STARD9*	-1.85	3.67E-04	264	143
ENSG00000179454.13	*KLHL28*	-43.32	3.71E-04	22	1
ENSG00000151116.17	*UEVLD*	-1.64	3.74E-04	416	254
ENSG00000164031.17	*DNAJB14*	-1.88	3.75E-04	620	330
ENSG00000264343.6	*NOTCH2NLA*	-2.38	3.77E-04	122	51
ENSG00000162616.9	*DNAJB4*	-1.78	3.79E-04	331	186
ENSG00000145734.19	*BDP1*	-2.08	3.80E-04	739	355
ENSG00000124523.16	*SIRT5*	3.59	3.82E-04	20	73
ENSG00000133466.14	*C1QTNF6*	2.09	3.84E-04	53	110
ENSG00000138660.12	*AP1AR*	-1.67	3.84E-04	633	378
ENSG00000197530.12	*MIB2*	1.85	3.87E-04	191	353
ENSG00000081386.12	*ZNF510*	-4.85	3.93E-04	99	20
ENSG00000263020.6	*AL662899.2*	2.02	3.96E-04	139	282
ENSG00000164219.10	*PGGT1B*	-1.63	3.97E-04	439	269
ENSG00000146267.12	*FAXC*	2.12	4.01E-04	53	113
ENSG00000125995.16	*ROMO1*	1.65	4.04E-04	733	1208
ENSG00000232677.8	*LINC00665*	4.25	4.04E-04	28	117
ENSG00000269958.1	*AL049840.5*	1.74	4.04E-04	103	180
ENSG00000081019.13	*RSBN1*	-1.58	4.04E-04	507	321
ENSG00000225383.8	*SFTA1P*	-1.63	4.06E-04	262	160
ENSG00000205746.9	*AC126755.1*	-2.18	4.07E-04	214	98
ENSG00000111300.10	*NAA25*	-1.55	4.09E-04	1316	851
ENSG00000204335.4	*SP5*	2.06	4.11E-04	77	159
ENSG00000152601.17	*MBNL1*	-1.71	4.13E-04	790	462
ENSG00000168502.17	*MTCL1*	-1.54	4.13E-04	557	361
ENSG00000054690.14	*PLEKHH1*	-2.91	4.16E-04	204	70

ENSG00000152464.15	*RPP38*	-1.56	4.39E-04	304	194
ENSG00000101670.12	*LIPG*	-1.74	4.42E-04	198	114
ENSG00000268205.1	*AC005261.1*	1.60	4.45E-04	165	263
ENSG00000083642.19	*PDS5B*	-1.66	4.54E-04	593	357
ENSG00000152078.10	*TLCD4*	-1.54	4.57E-04	429	279
ENSG00000116830.12	*TTF2*	-1.74	4.58E-04	1019	586
ENSG00000232573.1	*RPL3P4*	1.70	4.59E-04	434	739
ENSG00000006327.13	*TNFRSF12A*	1.60	4.61E-04	399	637
ENSG00000117475.14	*BLZF1*	-1.90	4.63E-04	347	182
ENSG00000138642.14	*HERC6*	-12.37	4.65E-04	33	3
ENSG00000187800.13	*PEAR1*	-1.89	4.72E-04	666	352
ENSG00000248690.8	*HAS2-AS1*	3.12	4.77E-04	17	53
ENSG00000161677.11	*JOSD2*	2.20	4.84E-04	67	147
ENSG00000273142.1	*LINC02604*	2.92	4.89E-04	18	53
ENSG00000175591.11	*P2RY2*	1.70	4.90E-04	185	314
ENSG00000182195.9	*LDOC1*	1.76	4.90E-04	148	261
ENSG00000117152.13	*RGS4*	-3.69	4.91E-04	51	14
ENSG00000086730.17	*LAT2*	2.01	4.95E-04	55	111
ENSG00000123843.13	*C4BPB*	-1.54	5.00E-04	332	215
ENSG00000273230.1	*AC102953.2*	2.19	5.09E-04	58	128
ENSG00000090989.18	*EXOC1*	-1.84	5.11E-04	725	393
ENSG00000164610.9	*RP9*	1.67	5.11E-04	190	317
ENSG00000172059.11	*KLF11*	-1.61	5.16E-04	299	186
ENSG00000011454.17	*RABGAP1*	-1.57	5.21E-04	1010	645
ENSG00000090263.16	*MRPS33*	1.60	5.22E-04	328	525
ENSG00000181029.9	*TRAPPC5*	1.74	5.42E-04	363	631
ENSG00000180098.9	*TRNAU1AP*	1.76	5.49E-04	293	517
ENSG00000113389.16	*NPR3*	-2.63	5.49E-04	119	45
ENSG00000126804.13	*ZBTB1*	-2.80	5.49E-04	176	63
ENSG00000137992.14	*DBT*	-1.55	5.50E-04	467	302
ENSG00000165660.8	*ABRAXAS2*	-1.70	5.51E-04	555	327
ENSG00000107036.12	*RIC1*	-1.92	5.58E-04	374	194
ENSG00000073614.13	*KDM5A*	-1.74	5.61E-04	994	572
ENSG00000169247.12	*SH3TC2*	1.59	5.69E-04	375	597
ENSG00000137502.10	*RAB30*	-1.73	5.70E-04	718	414
ENSG00000113522.14	*RAD50*	-1.83	5.70E-04	605	330
ENSG00000183943.6	*PRKX*	-1.58	5.71E-04	447	283
ENSG00000241749.4	*RPSAP52*	-2.52	5.80E-04	76	30
ENSG00000104267.10	*CA2*	-1.65	5.82E-04	282	170
ENSG00000165029.16	*ABCA1*	-2.04	5.85E-04	184	90
ENSG00000036549.13	*AC118549.1*	-1.60	5.93E-04	1033	648
ENSG00000172137.19	*CALB2*	1.58	5.95E-04	290	459
ENSG00000239789.6	*MRPS17*	1.54	5.95E-04	331	510

ENSG00000250571.7	*GLI4*	1.75	5.96E-04	105	184
ENSG00000022267.19	*FHL1*	1.55	5.96E-04	165	256
ENSG00000158163.15	*DZIP1L*	-2.31	5.97E-04	122	53
ENSG00000130150.12	*MOSPD2*	-1.94	5.99E-04	297	154
ENSG00000175315.3	*CST6*	5.27	6.04E-04	6	32
ENSG00000132031.13	*MATN3*	-3.30	6.10E-04	60	18
ENSG00000164134.13	*NAA15*	-1.59	6.15E-04	643	404
ENSG00000115468.12	*EFHD1*	1.64	6.22E-04	164	270
ENSG00000185842.15	*DNAH14*	-2.16	6.23E-04	122	56
ENSG00000197019.5	*SERTAD1*	1.64	6.29E-04	366	599
ENSG00000078747.15	*ITCH*	-4.25	6.31E-04	152	36
ENSG00000197457.10	*STMN3*	1.82	6.41E-04	96	175
ENSG00000141574.8	*SECTM1*	2.03	6.43E-04	79	161
ENSG00000144909.8	*OSBPL11*	-1.62	6.45E-04	357	221
ENSG00000225345.3	*SNX18P3*	-5.83	6.48E-04	27	5
ENSG00000171097.14	*KYAT1*	1.62	6.48E-04	211	343
ENSG00000047932.14	*GOPC*	-1.53	6.56E-04	741	483
ENSG00000141741.12	*MIEN1*	1.61	6.58E-04	391	628
ENSG00000171160.18	*MORN4*	1.60	6.60E-04	199	319
ENSG00000112183.15	*RBM24*	-1.55	6.60E-04	336	217
ENSG00000244198.7	*AC004889.1*	-4.02	6.60E-04	60	15
ENSG00000159214.13	*CCDC24*	2.05	6.66E-04	55	114
ENSG00000107614.22	*TRDMT1*	-2.03	6.66E-04	270	133
ENSG00000176410.8	*DNAJC30*	1.67	6.67E-04	166	277
ENSG00000117407.17	*ARTN*	2.31	6.68E-04	39	90
ENSG00000188707.6	*ZBED6CL*	2.09	6.68E-04	107	224
ENSG00000163660.11	*CCNL1*	-2.43	6.86E-04	426	175
ENSG00000205220.12	*PSMB10*	1.58	6.91E-04	164	259
ENSG00000165288.11	*BRWD3*	-1.94	6.94E-04	203	104
ENSG00000118260.15	*CREB1*	-1.56	6.97E-04	813	521
ENSG00000197943.10	*PLCG2*	-7.49	6.98E-04	64	9
ENSG00000155545.19	*MIER3*	-1.54	7.02E-04	525	342
ENSG00000092978.11	*GPATCH2*	-1.56	7.05E-04	328	210
ENSG00000107771.17	*CCSER2*	-1.67	7.05E-04	752	450
ENSG00000115020.17	*PIKFYVE*	-1.73	7.07E-04	842	486
ENSG00000166997.8	*CNPY4*	1.70	7.10E-04	133	226
ENSG00000174796.12	*THAP6*	-1.61	7.14E-04	241	149
ENSG00000058729.11	*RIOK2*	-1.76	7.14E-04	490	279
ENSG00000151304.6	*SRFBP1*	-2.24	7.16E-04	269	120
ENSG00000259495.3	*AC016705.2*	-13.53	7.24E-04	22	2
ENSG00000156795.8	*WDYHV1*	1.63	7.26E-04	195	319
ENSG00000164463.12	*CREBRF*	-1.96	7.29E-04	172	88
ENSG00000221829.9	*FANCG*	2.69	7.29E-04	62	168

ENSG00000180921.7	*FAM83H*	-1.94	7.30E-04	149	77
ENSG00000244313.3	*AC024293.1*	1.55	7.37E-04	759	1175
ENSG00000162688.17	*AGL*	-1.81	7.43E-04	468	259
ENSG00000105518.14	*TMEM205*	1.59	7.56E-04	398	633
ENSG00000069329.18	*VPS35*	-1.52	7.62E-04	2236	1468
ENSG00000069702.11	*TGFBR3*	-1.54	7.66E-04	611	396
ENSG00000163629.13	*PTPN13*	-1.97	7.69E-04	363	184
ENSG00000228960.6	*OR2A9P*	-11.27	7.85E-04	22	2
ENSG00000167562.12	*ZNF701*	-7.46	7.85E-04	30	4
ENSG00000104047.15	*DTWD1*	-1.61	7.86E-04	294	183
ENSG00000165813.20	*CCDC186*	-2.26	7.89E-04	195	86
ENSG00000122417.15	*ODF2L*	-1.63	7.91E-04	387	237
ENSG00000033100.16	*CHPF2*	8.10	7.93E-04	44	359
ENSG00000134318.14	*ROCK2*	-1.87	8.02E-04	1267	678
ENSG00000242612.7	*DECR2*	1.68	8.15E-04	126	212
ENSG00000074657.13	*ZNF532*	-1.55	8.19E-04	482	310
ENSG00000134755.17	*DSC2*	-4.29	8.24E-04	56	13
ENSG00000182809.10	*CRIP2*	4.90	8.26E-04	10	49
ENSG00000163636.10	*PSMD6*	-1.75	8.29E-04	267	152
ENSG00000101109.12	*STK4*	-1.65	8.40E-04	2016	1218
ENSG00000100068.13	*LRP5L*	2.15	8.40E-04	71	153
ENSG00000120913.23	*PDLIM2*	-1.63	8.43E-04	328	201
ENSG00000072163.19	*LIMS2*	2.26	8.48E-04	117	264
ENSG00000178075.20	*GRAMD1C*	-4.14	8.52E-04	89	22
ENSG00000154274.15	*C4orf19*	-1.64	8.54E-04	181	110
ENSG00000126562.17	*WNK4*	-3.92	8.55E-04	45	11
ENSG00000196693.15	*ZNF33B*	-2.03	8.65E-04	149	73
ENSG00000005249.13	*PRKAR2B*	-2.31	8.68E-04	176	76
ENSG00000095015.6	*MAP3K1*	-1.58	8.73E-04	446	283
ENSG00000198826.11	*ARHGAP11A*	-2.70	8.74E-04	2573	955
ENSG00000280106.1	*AC008555.7*	2.81	8.76E-04	19	53
ENSG00000145348.16	*TBCK*	-2.05	8.85E-04	127	62
ENSG00000079150.18	*FKBP7*	1.83	9.01E-04	89	163
ENSG00000123505.17	*AMD1*	-1.52	9.02E-04	1779	1171
ENSG00000183444.10	*OR7E38P*	2.73	9.04E-04	47	129
ENSG00000179387.10	*ELMOD2*	-1.58	9.09E-04	346	219
ENSG00000116525.14	*TRIM62*	1.73	9.21E-04	99	172
ENSG00000160284.15	*SPATC1L*	1.59	9.21E-04	134	214
ENSG00000169432.16	*SCN9A*	-3.63	9.31E-04	61	17
ENSG00000142684.9	*ZNF593*	1.66	9.33E-04	232	384
ENSG00000008869.12	*HEATR5B*	-1.76	9.34E-04	398	226
ENSG00000172766.19	*NAA16*	-1.74	9.38E-04	298	172
ENSG00000137871.20	*ZNF280D*	-2.64	9.39E-04	129	49

ENSG00000177675.8	*CD163L1*	4.48	9.41E-04	27	120
ENSG00000102786.15	*INTS6*	-1.92	9.43E-04	809	422
ENSG00000267855.6	*NDUFA7*	1.56	9.43E-04	283	441
ENSG00000163545.10	*NUAK2*	-3.00	9.44E-04	56	19
ENSG00000090339.9	*ICAM1*	-1.53	9.45E-04	272	178
ENSG00000060566.14	*CREB3L3*	-3.41	9.45E-04	43	13
ENSG00000157514.16	*TSC22D3*	1.96	9.52E-04	56	109
ENSG00000115226.10	*FNDC4*	-4.25	9.59E-04	36	9
ENSG00000198795.11	*ZNF521*	-1.52	9.67E-04	304	200
ENSG00000061987.16	*MON2*	-1.92	9.70E-04	770	402
ENSG00000204348.10	*DXO*	1.54	9.71E-04	201	309
ENSG00000105426.16	*PTPRS*	-1.71	9.83E-04	472	276
ENSG00000075407.18	*ZNF37A*	-1.77	9.84E-04	310	175
ENSG00000122034.15	*GTF3A*	1.73	9.96E-04	156	269
ENSG00000177868.12	*SVBP*	1.73	9.97E-04	129	224
ENSG00000100151.16	*PICK1*	1.73	1.00E-03	123	213
ENSG00000145990.11	*GFOD1*	-1.53	1.02E-03	274	179
ENSG00000119969.15	*HELLS*	-1.75	1.04E-03	319	182
ENSG00000250312.8	*ZNF718*	-1.67	1.05E-03	181	108
ENSG00000260916.7	*CCPG1*	-1.56	1.05E-03	351	226
ENSG00000075399.14	*VPS9D1*	1.89	1.06E-03	60	113
ENSG00000198408.14	*OGA*	-1.58	1.06E-03	1744	1107
ENSG00000136273.13	*HUS1*	1.55	1.07E-03	151	233
ENSG00000163701.19	*IL17RE*	2.12	1.07E-03	45	96
ENSG00000153815.16	*CMIP*	-1.57	1.08E-03	803	512
ENSG00000148459.16	*PDSS1*	-1.67	1.08E-03	347	208
ENSG00000176208.9	*ATAD5*	-1.91	1.10E-03	379	198
ENSG00000078043.16	*PIAS2*	-1.54	1.10E-03	347	225
ENSG00000112294.13	*ALDH5A1*	-1.77	1.10E-03	151	86
ENSG00000146263.11	*MMS22L*	-2.98	1.11E-03	119	40
ENSG00000137876.10	*RSL24D1*	-1.62	1.11E-03	717	442
ENSG00000143498.18	*TAF1A*	-1.67	1.12E-03	290	174
ENSG00000128052.10	*KDR*	-2.06	1.13E-03	136	66
ENSG00000182263.14	*FIGN*	-1.95	1.13E-03	368	189
ENSG00000234616.8	*JRK*	3.38	1.14E-03	32	109
ENSG00000139112.11	*GABARAPL1*	1.54	1.14E-03	220	337
ENSG00000063180.9	*CA11*	8.19	1.14E-03	3	26
ENSG00000105371.10	*ICAM4*	2.96	1.15E-03	18	54
ENSG00000182378.14	*PLCXD1*	-2.87	1.15E-03	181	63
ENSG00000204839.9	*MROH6*	1.86	1.15E-03	65	121
ENSG00000170006.12	*TMEM154*	-2.69	1.16E-03	87	33
ENSG00000164114.19	*MAP9*	-1.92	1.16E-03	205	106
ENSG00000259529.2	*AL136295.5*	-2.34	1.17E-03	79	34

ENSG00000167272.11	*POP5*	1.60	1.19E-03	321	515
ENSG00000155729.13	*KCTD18*	1.76	1.19E-03	85	149
ENSG00000280079.1	*AC011447.7*	2.43	1.20E-03	35	86
ENSG00000240230.6	*COX19*	1.54	1.20E-03	199	307
ENSG00000131941.8	*RHPN2*	-1.78	1.21E-03	594	334
ENSG00000242252.2	*BGLAP*	5.44	1.23E-03	5	27
ENSG00000012174.12	*MBTPS2*	-1.55	1.23E-03	513	332
ENSG00000239887.6	*C1orf226*	-1.67	1.24E-03	201	120
ENSG00000203706.8	*SERTAD4-AS1*	1.86	1.24E-03	116	215
ENSG00000029534.20	*ANK1*	1.99	1.24E-03	52	104
ENSG00000171443.7	*ZNF524*	1.70	1.26E-03	96	163
ENSG00000152413.15	*HOMER1*	-2.01	1.27E-03	374	186
ENSG00000197822.11	*OCLN*	1.95	1.27E-03	137	266
ENSG00000250320.6	*AC113383.1*	-2.64	1.28E-03	79	30
ENSG00000227097.5	*RPS28P7*	1.57	1.28E-03	283	445
ENSG00000165630.14	*PRPF18*	-1.94	1.29E-03	253	131
ENSG00000006704.10	*GTF2IRD1*	1.78	1.30E-03	321	571
ENSG00000092621.12	*PHGDH*	3.21	1.30E-03	45	143
ENSG00000162601.11	*MYSM1*	-4.68	1.31E-03	204	44
ENSG00000198108.4	*CHSY3*	-1.78	1.31E-03	151	85
ENSG00000135211.6	*TMEM60*	1.56	1.31E-03	182	284
ENSG00000175105.7	*ZNF654*	-1.68	1.32E-03	320	190
ENSG00000099822.3	*HCN2*	2.88	1.33E-03	17	48
ENSG00000011426.11	*ANLN*	-1.52	1.33E-03	6044	3979
ENSG00000100523.14	*DDHD1*	-1.56	1.35E-03	278	179
ENSG00000100647.8	*SUSD6*	-1.62	1.35E-03	291	180
ENSG00000143033.18	*MTF2*	-1.76	1.35E-03	502	286
ENSG00000078237.7	*TIGAR*	-1.67	1.37E-03	296	177
ENSG00000116819.8	*TFAP2E*	3.14	1.37E-03	17	52
ENSG00000112149.10	*CD83*	-1.56	1.38E-03	252	161
ENSG00000196139.14	*AKR1C3*	1.70	1.39E-03	195	333
ENSG00000066827.16	*ZFAT*	1.66	1.40E-03	155	256
ENSG00000163882.9	*POLR2H*	1.53	1.41E-03	712	1090
ENSG00000080839.12	*RBL1*	-1.52	1.42E-03	976	642
ENSG00000171222.10	*SCAND1*	1.90	1.44E-03	64	122
ENSG00000138496.16	*PARP9*	-3.57	1.47E-03	124	35
ENSG00000002330.13	*BAD*	2.05	1.48E-03	79	162
ENSG00000047621.12	*C12orf4*	-1.57	1.49E-03	570	364
ENSG00000115750.17	*TAF1B*	-1.91	1.50E-03	469	245
ENSG00000170577.8	*SIX2*	1.75	1.51E-03	80	140
ENSG00000169583.13	*CLIC3*	2.39	1.51E-03	36	86
ENSG00000117305.15	*HMGCL*	1.68	1.52E-03	172	289
ENSG00000163683.12	*SMIM14*	2.05	1.55E-03	213	436

ENSG00000255330.9	*AL096711.2*	-2.55	1.56E-03	67	26
ENSG00000184497.13	*TMEM255B*	1.62	1.56E-03	199	322
ENSG00000183386.10	*FHL3*	1.55	1.57E-03	201	312
ENSG00000113966.10	*ARL6*	-1.68	1.58E-03	225	134
ENSG00000140386.13	*SCAPER*	-2.21	1.58E-03	188	85
ENSG00000183172.9	*SMDT1*	1.88	1.60E-03	190	357
ENSG00000205307.12	*SAP25*	5.74	1.61E-03	5	26
ENSG00000243156.9	*MICAL3*	-1.52	1.62E-03	710	467
ENSG00000087842.11	*PIR*	2.05	1.62E-03	89	182
ENSG00000130748.7	*TMEM160*	1.59	1.63E-03	216	344
ENSG00000126970.16	*ZC4H2*	-1.83	1.63E-03	193	105
ENSG00000111266.9	*DUSP16*	-1.64	1.64E-03	375	229
ENSG00000204442.4	*FAM155A*	-1.76	1.65E-03	137	78
ENSG00000186472.20	*PCLO*	-1.79	1.65E-03	156	87
ENSG00000150510.16	*FAM124A*	-3.56	1.66E-03	41	12
ENSG00000112419.14	*PHACTR2*	-2.24	1.66E-03	224	100
ENSG00000052795.13	*FNIP2*	-1.83	1.67E-03	400	218
ENSG00000124920.13	*MYRF*	-1.76	1.67E-03	197	111
ENSG00000181544.15	*FANCB*	-5.77	1.69E-03	63	11
ENSG00000166833.21	*NAV2*	-1.82	1.70E-03	1714	940
ENSG00000172469.16	*MANEA*	-1.87	1.71E-03	196	105
ENSG00000054148.17	*PHPT1*	1.73	1.74E-03	109	188
ENSG00000129083.12	*COPB1*	-2.00	1.76E-03	461	230
ENSG00000151881.14	*TMEM267*	-2.24	1.79E-03	181	81
ENSG00000022567.9	*SLC45A4*	-2.58	1.80E-03	158	61
ENSG00000158106.14	*RHPN1*	1.67	1.81E-03	168	281
ENSG00000065665.21	*SEC61A2*	-1.77	1.83E-03	186	105
ENSG00000149591.17	*TAGLN*	-1.61	1.85E-03	249	155
ENSG00000184209.15	*SNRNP35*	1.54	1.86E-03	272	418
ENSG00000168477.19	*TNXB*	1.89	1.86E-03	77	144
ENSG00000127533.4	*F2RL3*	3.60	1.87E-03	11	39
ENSG00000230551.4	*AC021078.1*	-1.70	1.87E-03	195	115
ENSG00000203666.12	*EFCAB2*	-1.78	1.87E-03	145	82
ENSG00000171448.9	*ZBTB26*	-1.66	1.89E-03	158	95
ENSG00000162817.7	*C1orf115*	-1.75	1.90E-03	129	74
ENSG00000247134.7	*AC090204.1*	2.51	1.90E-03	24	61
ENSG00000198198.17	*SZT2*	1.55	1.92E-03	414	640
ENSG00000135390.20	*ATP5MC2*	1.92	1.93E-03	51	98
ENSG00000175175.6	*PPM1E*	-3.49	1.95E-03	46	13
ENSG00000213920.9	*MDP1*	1.70	1.96E-03	191	324
ENSG00000138061.12	*CYP1B1*	1.67	1.97E-03	337	560
ENSG00000234664.1	*HMGN2P5*	1.65	1.98E-03	273	450
ENSG00000172728.16	*FUT10*	-1.61	1.98E-03	216	134

ENSG00000078674.17	*PCM1*	-1.53	1.99E-03	481	315
ENSG00000148634.15	*HERC4*	-2.07	1.99E-03	178	86
ENSG00000123815.12	*COQ8B*	-11.82	2.00E-03	32	3
ENSG00000153162.9	*BMP6*	-3.07	2.00E-03	49	16
ENSG00000211455.8	*STK38L*	-1.86	2.01E-03	558	299
ENSG00000138696.11	*BMPR1B*	-1.86	2.04E-03	153	82
ENSG00000152749.8	*GPR180*	-1.53	2.04E-03	274	179
ENSG00000092020.10	*PPP2R3C*	-1.80	2.05E-03	253	141
ENSG00000169696.16	*ASPSCR1*	1.60	2.05E-03	283	454
ENSG00000040933.15	*INPP4A*	-2.32	2.05E-03	176	76
ENSG00000135605.13	*TEC*	-1.64	2.10E-03	193	118
ENSG00000179403.12	*VWA1*	1.87	2.11E-03	103	192
ENSG00000082175.15	*PGR*	-11.81	2.11E-03	30	3
ENSG00000138796.16	*HADH*	3.49	2.12E-03	32	111
ENSG00000165671.20	*NSD1*	-3.05	2.14E-03	50	16
ENSG00000138468.16	*SENP7*	-2.13	2.14E-03	150	71
ENSG00000145242.13	*EPHA5*	-4.34	2.15E-03	36	8
ENSG00000137274.13	*BPHL*	2.00	2.15E-03	126	251
ENSG00000141068.14	*KSR1*	-2.46	2.16E-03	181	74
ENSG00000180626.10	*ZNF594*	-2.30	2.24E-03	98	43
ENSG00000185187.13	*SIGIRR*	1.77	2.26E-03	150	265
ENSG00000090905.19	*TNRC6A*	-1.60	2.27E-03	1567	978
ENSG00000159256.13	*MORC3*	-1.89	2.28E-03	321	170
ENSG00000047056.16	*WDR37*	-2.18	2.29E-03	684	314
ENSG00000163611.11	*SPICE1*	-1.84	2.30E-03	135	73
ENSG00000168000.14	*BSCL2*	2.20	2.30E-03	104	229
ENSG00000123066.8	*MED13L*	-2.34	2.31E-03	481	206
ENSG00000156787.17	*TBC1D31*	-1.59	2.31E-03	447	281
ENSG00000197860.10	*SGTB*	-1.73	2.33E-03	249	144
ENSG00000176261.15	*ZBTB8OS*	2.07	2.37E-03	43	90
ENSG00000025708.14	*TYMP*	2.60	2.38E-03	24	62
ENSG00000115816.15	*CEBPZ*	-1.53	2.41E-03	704	460
ENSG00000174099.11	*MSRB3*	-1.62	2.42E-03	676	419
ENSG00000164830.18	*OXR1*	-1.64	2.42E-03	392	240
ENSG00000135905.19	*DOCK10*	-35.98	2.43E-03	23	1
ENSG00000160058.18	*BSDC1*	1.62	2.43E-03	352	569
ENSG00000163874.11	*ZC3H12A*	1.86	2.45E-03	57	106
ENSG00000129675.16	*ARHGEF6*	-9.22	2.48E-03	19	2
ENSG00000176485.11	*PLAAT3*	1.67	2.48E-03	378	631
ENSG00000177150.13	*FAM210A*	-1.59	2.49E-03	438	276
ENSG00000164867.11	*NOS3*	-6.44	2.50E-03	40	6
ENSG00000189007.16	*ADAT2*	-1.85	2.51E-03	163	88
ENSG00000198924.8	*DCLRE1A*	-1.55	2.52E-03	509	329

ENSG00000174718.12	*RESF1*	-2.35	2.52E-03	207	88
ENSG00000155970.12	*MICU3*	-2.05	2.52E-03	96	47
ENSG00000143416.21	*SELENBP1*	1.74	2.53E-03	125	218
ENSG00000169515.8	*CCDC8*	1.71	2.53E-03	82	141
ENSG00000165644.11	*COMTD1*	1.70	2.56E-03	93	158
ENSG00000186130.5	*ZBTB6*	-1.56	2.56E-03	228	146
ENSG00000115112.8	*TFCP2L1*	-5.06	2.56E-03	26	5
ENSG00000153790.12	*C7orf31*	2.48	2.58E-03	24	61
ENSG00000055732.13	*MCOLN3*	-1.94	2.59E-03	133	69
ENSG00000146477.6	*SLC22A3*	-1.53	2.60E-03	214	139
ENSG00000165626.17	*BEND7*	-2.24	2.60E-03	452	202
ENSG00000139116.18	*KIF21A*	-2.06	2.62E-03	576	280
ENSG00000271605.6	*MILR1*	1.64	2.63E-03	149	244
ENSG00000158006.14	*PAFAH2*	1.53	2.64E-03	129	198
ENSG00000166396.13	*SERPINB7*	-5.82	2.66E-03	25	4
ENSG00000053770.12	*AP5M1*	-1.70	2.66E-03	815	480
ENSG00000128891.15	*CCDC32*	-2.50	2.67E-03	103	41
ENSG00000107518.18	*ATRNL1*	-1.82	2.67E-03	149	82
ENSG00000115355.17	*CCDC88A*	-1.60	2.71E-03	1520	952
ENSG00000227038.3	*GTF2IP7*	7.57	2.74E-03	3	21
ENSG00000124406.16	*ATP8A1*	2.19	2.75E-03	90	197
ENSG00000164291.17	*ARSK*	-1.52	2.76E-03	236	155
ENSG00000105963.15	*ADAP1*	2.01	2.78E-03	47	94
ENSG00000116127.18	*ALMS1*	-2.58	2.78E-03	200	77
ENSG00000068885.15	*IFT80*	-2.12	2.78E-03	340	160
ENSG00000104361.10	*NIPAL2*	-1.65	2.79E-03	170	103
ENSG00000154319.16	*FAM167A*	-1.54	2.79E-03	251	164
ENSG00000124942.14	*AHNAK*	-1.53	2.81E-03	37190	24261
ENSG00000112282.18	*MED23*	-1.75	2.83E-03	378	216
ENSG00000156265.15	*MAP3K7CL*	-2.73	2.83E-03	65	24
ENSG00000242299.1	*AC073861.1*	2.29	2.85E-03	30	69
ENSG00000285108.1	*AC103718.1*	-4.05	2.95E-03	28	7
ENSG00000227496.3	*AC099066.2*	5.48	2.95E-03	4	23
ENSG00000138346.15	*DNA2*	-1.68	2.98E-03	462	276
ENSG00000066777.9	*ARFGEF1*	-1.54	3.00E-03	612	397
ENSG00000137713.16	*PPP2R1B*	-1.54	3.06E-03	821	534
ENSG00000156398.13	*SFXN2*	-1.64	3.06E-03	416	254
ENSG00000271270.7	*TMCC1-AS1*	-2.81	3.07E-03	52	18
ENSG00000215252.11	*GOLGA8B*	-1.59	3.09E-03	426	268
ENSG00000147316.13	*MCPH1*	-2.31	3.10E-03	119	52
ENSG00000111860.14	*CEP85L*	-1.94	3.10E-03	118	61
ENSG00000100393.13	*EP300*	-1.68	3.14E-03	1285	767
ENSG00000166575.17	*TMEM135*	-1.87	3.14E-03	386	207

ENSG00000196428.12	*TSC22D2*	-1.60	3.16E-03	279	174
ENSG00000149970.16	*CNKSR2*	-1.70	3.20E-03	142	84
ENSG00000138621.12	*PPCDC*	1.56	3.22E-03	188	293
ENSG00000066248.15	*NGEF*	1.66	3.23E-03	108	179
ENSG00000179295.17	*PTPN11*	-3.46	3.24E-03	85	25
ENSG00000163539.17	*CLASP2*	-1.62	3.24E-03	927	573
ENSG00000059588.10	*TARBP1*	-1.57	3.24E-03	310	198
ENSG00000168273.8	*SMIM4*	1.94	3.24E-03	109	211
ENSG00000234287.1	*AC099560.2*	1.80	3.29E-03	122	219
ENSG00000257103.8	*LSM14A*	-1.90	3.32E-03	539	284
ENSG00000136878.13	*USP20*	1.91	3.32E-03	173	330
ENSG00000157181.16	*ODR4*	-1.80	3.34E-03	344	191
ENSG00000103363.14	*ELOB*	1.56	3.34E-03	631	985
ENSG00000070269.14	*TMEM260*	-1.58	3.34E-03	264	167
ENSG00000100473.18	*COCH*	-1.59	3.35E-03	168	106
ENSG00000151151.6	*IPMK*	-1.61	3.41E-03	273	169
ENSG00000239445.6	*ST3GAL6-AS1*	-2.21	3.43E-03	67	30
ENSG00000143127.13	*ITGA10*	1.70	3.51E-03	90	153
ENSG00000145358.6	*DDIT4L*	-5.05	3.51E-03	25	5
ENSG00000135049.15	*AGTPBP1*	-1.72	3.55E-03	373	216
ENSG00000187091.13	*PLCD1*	3.35	3.56E-03	22	73
ENSG00000128039.11	*SRD5A3*	2.42	3.56E-03	44	106
ENSG00000138592.14	*USP8*	-1.73	3.56E-03	455	263
ENSG00000132300.19	*PTCD3*	-1.60	3.58E-03	1770	1110
ENSG00000170242.18	*USP47*	-1.78	3.58E-03	928	522
ENSG00000177576.11	*C18orf32*	5.72	3.60E-03	24	137
ENSG00000278615.4	*C11orf98*	1.71	3.65E-03	79	135
ENSG00000253738.2	*OTUD6B-AS1*	-1.54	3.66E-03	347	226
ENSG00000067606.17	*PRKCZ*	-1.71	3.68E-03	154	90
ENSG00000143195.13	*ILDR2*	-2.22	3.68E-03	276	124
ENSG00000144642.22	*RBMS3*	-1.58	3.71E-03	294	186
ENSG00000214941.8	*ZSWIM7*	1.74	3.73E-03	118	206
ENSG00000168769.13	*TET2*	-13.94	3.74E-03	37	3
ENSG00000173846.13	*PLK3*	1.62	3.74E-03	145	234
ENSG00000125967.16	*NECAB3*	1.76	3.80E-03	229	403
ENSG00000130164.13	*LDLR*	-2.36	3.85E-03	258	109
ENSG00000100077.15	*GRK3*	-1.75	3.88E-03	121	69
ENSG00000213694.5	*S1PR3*	-1.86	3.89E-03	101	54
ENSG00000137040.10	*RANBP6*	-1.74	3.92E-03	293	168
ENSG00000171466.10	*ZNF562*	-1.74	3.95E-03	755	433
ENSG00000092439.16	*TRPM7*	-1.92	3.95E-03	506	264
ENSG00000257219.6	*LNCOG*	-4.73	3.97E-03	25	5
ENSG00000010626.15	*LRRC23*	2.99	4.00E-03	17	51

ENSG00000221821.4	*C6orf226*	2.06	4.02E-03	38	78
ENSG00000259623.1	*AC125257.1*	1.85	4.02E-03	85	156
ENSG00000135740.17	*SLC9A5*	2.13	4.03E-03	39	84
ENSG00000215039.7	*CD27-AS1*	1.85	4.03E-03	70	129
ENSG00000280693.2	*SH3PXD2A-AS1*	5.03	4.06E-03	5	25
ENSG00000248593.3	*DSTNP2*	2.10	4.07E-03	47	98
ENSG00000165169.11	*DYNLT3*	-1.52	4.09E-03	283	186
ENSG00000242193.11	*CRYZL2P*	-1.65	4.10E-03	158	96
ENSG00000189367.15	*KIAA0408*	-3.45	4.13E-03	42	12
ENSG00000204540.11	*PSORS1C1*	-2.77	4.14E-03	49	18
ENSG00000269821.1	*KCNQ1OT1*	-1.88	4.16E-03	146	77
ENSG00000095066.11	*HOOK2*	1.72	4.17E-03	91	156
ENSG00000245060.8	*LINC00847*	1.57	4.20E-03	134	211
ENSG00000170369.4	*CST2*	2.30	4.23E-03	40	93
ENSG00000149499.11	*EML3*	2.06	4.25E-03	101	208
ENSG00000182379.10	*NXPH4*	1.92	4.25E-03	44	84
ENSG00000170166.6	*HOXD4*	-2.07	4.27E-03	72	35
ENSG00000157470.12	*FAM81A*	-4.17	4.28E-03	56	13
ENSG00000032444.16	*PNPLA6*	1.69	4.28E-03	199	337
ENSG00000263142.5	*LRRC37A17P*	-2.57	4.32E-03	73	28
ENSG00000158062.20	*UBXN11*	1.76	4.33E-03	182	321
ENSG00000170264.13	*FAM161A*	-1.85	4.40E-03	146	79
ENSG00000257176.3	*AC009318.1*	-3.25	4.48E-03	34	10
ENSG00000112559.14	*MDFI*	5.66	4.50E-03	9	52
ENSG00000102081.14	*FMR1*	-4.00	4.52E-03	149	37
ENSG00000188186.10	*LAMTOR4*	1.84	4.53E-03	101	186
ENSG00000175305.17	*CCNE2*	-7.47	4.54E-03	19	3
ENSG00000170185.10	*USP38*	-2.61	4.55E-03	141	54
ENSG00000120738.8	*EGR1*	2.06	4.57E-03	36	74
ENSG00000269416.6	*LINC01224*	2.83	4.58E-03	22	62
ENSG00000288258.1	*BX470111.1*	2.60	4.58E-03	16	42
ENSG00000167702.12	*KIFC2*	1.66	4.59E-03	229	379
ENSG00000122870.12	*BICC1*	-1.61	4.61E-03	231	143
ENSG00000132970.14	*WASF3*	-1.87	4.62E-03	116	62
ENSG00000113638.14	*TTC33*	-1.53	4.73E-03	366	239
ENSG00000176428.6	*VPS37D*	2.87	4.75E-03	14	41
ENSG00000028277.21	*POU2F2*	-1.87	4.78E-03	127	68
ENSG00000182224.12	*CYB5D1*	-1.63	4.80E-03	164	101
ENSG00000152422.15	*XRCC4*	-1.62	4.83E-03	246	152
ENSG00000110318.15	*CEP126*	-1.81	4.88E-03	99	55
ENSG00000204315.4	*FKBPL*	1.56	4.94E-03	201	313
ENSG00000198265.12	*HELZ*	-1.65	4.98E-03	589	357

ENSG00000103226.18	*NOMO3*	-18.69	5.09E-03	247	13
ENSG00000169860.7	*P2RY1*	-4.26	5.10E-03	41	10
ENSG00000131389.17	*SLC6A6*	-1.59	5.11E-03	1170	738
ENSG00000145882.11	*PCYOX1L*	-1.60	5.13E-03	203	127
ENSG00000102595.20	*UGGT2*	-1.78	5.15E-03	243	136
ENSG00000163393.13	*SLC22A15*	-1.94	5.15E-03	109	56
ENSG00000119686.10	*FLVCR2*	1.79	5.16E-03	73	130
ENSG00000151229.13	*SLC2A13*	-1.57	5.18E-03	285	182
ENSG00000168214.20	*RBPJ*	-1.74	5.19E-03	640	368
ENSG00000185864.16	*NPIPB4*	-1.83	5.20E-03	135	74
ENSG00000139793.18	*MBNL2*	-1.88	5.24E-03	204	108
ENSG00000182324.6	*KCNJ14*	2.20	5.25E-03	30	65
ENSG00000184675.11	*AMER1*	-1.66	5.35E-03	196	118
ENSG00000198324.13	*PHETA1*	2.29	5.38E-03	30	69
ENSG00000168255.20	*POLR2J3*	1.69	5.39E-03	245	414
ENSG00000137038.8	*DMAC1*	1.76	5.43E-03	126	222
ENSG00000148429.14	*USP6NL*	1.67	5.51E-03	90	151
ENSG00000181982.18	*CCDC149*	1.58	5.55E-03	120	189
ENSG00000136997.19	*MYC*	-1.54	5.61E-03	394	256
ENSG00000111325.16	*OGFOD2*	1.56	5.62E-03	178	278
ENSG00000170801.10	*HTRA3*	-2.39	5.62E-03	52	22
ENSG00000279342.2	*AP000866.6*	-2.86	5.64E-03	51	18
ENSG00000205002.4	*AARD*	2.65	5.67E-03	24	64
ENSG00000102934.10	*PLLP*	1.69	5.67E-03	76	128
ENSG00000233338.1	*TLR8-AS1*	5.34	5.67E-03	3	19
ENSG00000153044.10	*CENPH*	1.67	5.76E-03	105	175
ENSG00000178449.9	*COX14*	1.64	5.76E-03	246	402
ENSG00000119514.7	*GALNT12*	2.85	5.78E-03	18	51
ENSG00000147804.9	*SLC39A4*	1.61	5.83E-03	191	307
ENSG00000102109.9	*PCSK1N*	4.03	5.84E-03	6	23
ENSG00000171843.16	*MLLT3*	-1.65	5.88E-03	278	168
ENSG00000088247.17	*KHSRP*	-1.76	5.89E-03	1235	702
ENSG00000263002.8	*ZNF234*	-1.62	5.92E-03	162	100
ENSG00000182150.16	*ERCC6L2*	-4.00	5.93E-03	64	16
ENSG00000147364.16	*FBXO25*	-1.69	6.00E-03	166	98
ENSG00000165983.14	*PTER*	-2.76	6.04E-03	247	89
ENSG00000179862.7	*CITED4*	5.12	6.11E-03	4	18
ENSG00000158246.8	*TENT5B*	-1.63	6.12E-03	147	90
ENSG00000227615.1	*AP001324.1*	2.14	6.13E-03	33	70
ENSG00000259146.4	*AC005476.2*	5.22	6.17E-03	3	18
ENSG00000112695.11	*COX7A2*	1.80	6.24E-03	74	134
ENSG00000249863.2	*AC021106.1*	-4.93	6.26E-03	22	4
ENSG00000166004.15	*CEP295*	-2.02	6.26E-03	295	146

ENSG00000134901.13	*POGLUT2*	-2.00	6.30E-03	83	41
ENSG00000111554.14	*MDM1*	-2.21	6.37E-03	65	30
ENSG00000151150.22	*ANK3*	-2.33	6.38E-03	77	33
ENSG00000181754.7	*AMIGO1*	-1.59	6.38E-03	193	121
ENSG00000134371.13	*CDC73*	-1.70	6.41E-03	345	203
ENSG00000241058.4	*NSUN6*	-1.63	6.47E-03	241	148
ENSG00000110693.18	*SOX6*	-3.94	6.51E-03	51	13
ENSG00000102098.19	*SCML2*	-1.52	6.52E-03	288	189
ENSG00000121690.11	*DEPDC7*	-3.56	6.54E-03	45	13
ENSG00000012211.13	*PRICKLE3*	1.59	6.58E-03	151	240
ENSG00000083097.14	*DOP1A*	-2.74	6.59E-03	82	30
ENSG00000232472.1	*EEF1B2P3*	1.74	6.73E-03	99	173
ENSG00000136758.18	*YME1L1*	-4.26	6.75E-03	695	163
ENSG00000108375.12	*RNF43*	5.45	6.77E-03	6	33
ENSG00000032219.19	*ARID4A*	-1.55	6.78E-03	369	238
ENSG00000153898.13	*MCOLN2*	-1.91	6.81E-03	181	95
ENSG00000229119.3	*AC026403.1*	2.38	6.85E-03	20	47
ENSG00000154781.16	*CCDC174*	1.63	6.85E-03	226	368
ENSG00000172663.9	*TMEM134*	1.86	6.95E-03	125	233
ENSG00000163131.11	*CTSS*	-10.67	6.95E-03	50	5
ENSG00000234975.6	*FTH1P2*	2.98	6.97E-03	16	47
ENSG00000113013.15	*HSPA9*	-1.52	6.98E-03	725	478
ENSG00000267745.1	*AC060766.7*	-2.53	7.02E-03	54	21
ENSG00000189120.5	*SP6*	-1.91	7.05E-03	78	41
ENSG00000127589.4	*TUBBP1*	1.98	7.16E-03	33	65
ENSG00000196632.10	*WNK3*	-1.79	7.19E-03	143	80
ENSG00000232593.7	*KANTR*	-1.73	7.21E-03	131	76
ENSG00000185010.15	*F8*	2.09	7.24E-03	36	75
ENSG00000135837.16	*CEP350*	-2.00	7.26E-03	674	336
ENSG00000177788.6	*AL162595.1*	1.59	7.29E-03	90	142
ENSG00000131188.12	*PRR7*	1.59	7.32E-03	110	174
ENSG00000105514.8	*RAB3D*	1.83	7.33E-03	60	111
ENSG00000133026.12	*MYH10*	-1.60	7.39E-03	1620	1013
ENSG00000174306.21	*ZHX3*	-1.91	7.39E-03	659	344
ENSG00000115255.11	*REEP6*	1.75	7.45E-03	62	108
ENSG00000072571.20	*HMMR*	-1.59	7.47E-03	195	123
ENSG00000168517.10	*HEXIM2*	1.91	7.51E-03	46	89
ENSG00000121210.16	*TMEM131L*	-1.72	7.65E-03	266	155
ENSG00000287463.1	*AC110620.2*	6.51	7.83E-03	3	19
ENSG00000173511.9	*VEGFB*	1.60	7.88E-03	131	209
ENSG00000160818.16	*GPATCH4*	-4.18	7.88E-03	87	21
ENSG00000169855.20	*ROBO1*	-1.61	7.93E-03	1047	652
ENSG00000184156.17	*KCNQ3*	-3.10	7.98E-03	54	17

ENSG00000242288.9	*BMS1P4-AGAP5*	-10.07	8.00E-03	39	4
ENSG00000119943.13	*PYROXD2*	1.63	8.02E-03	103	167
ENSG00000173113.6	*TRMT112*	1.62	8.02E-03	265	429
ENSG00000114127.10	*XRN1*	-3.45	8.03E-03	130	38
ENSG00000131127.14	*ZNF141*	-1.69	8.08E-03	251	149
ENSG00000196458.11	*ZNF605*	-2.22	8.15E-03	199	89
ENSG00000124074.12	*ENKD1*	1.74	8.22E-03	55	96
ENSG00000169251.12	*NMD3*	-3.30	8.23E-03	43	13
ENSG00000198604.11	*BAZ1A*	-1.55	8.28E-03	1396	898
ENSG00000240342.3	*RPS2P5*	1.64	8.30E-03	91	150
ENSG00000103995.14	*CEP152*	-1.67	8.36E-03	292	174
ENSG00000124486.13	*USP9X*	-3.12	8.37E-03	114	36
ENSG00000071537.14	*SEL1L*	-1.53	8.38E-03	1386	906
ENSG00000062524.16	*LTK*	1.78	8.38E-03	58	104
ENSG00000165322.18	*ARHGAP12*	-1.54	8.38E-03	518	336
ENSG00000259820.1	*AC083843.3*	-1.94	8.42E-03	86	44
ENSG00000262209.3	*PCDHGB3*	-3.16	8.48E-03	37	12
ENSG00000055609.18	*KMT2C*	-1.81	8.50E-03	379	210
ENSG00000120594.17	*PLXDC2*	-1.95	8.50E-03	149	76
ENSG00000204084.13	*INPP5B*	1.54	8.51E-03	115	177
ENSG00000075539.14	*FRYL*	-1.60	8.52E-03	335	209
ENSG00000113593.12	*PPWD1*	-1.61	8.55E-03	480	297
ENSG00000114416.18	*FXR1*	-1.52	8.58E-03	2474	1630
ENSG00000237310.2	*AC008267.5*	4.08	8.63E-03	6	24
ENSG00000264112.1	*AC015813.1*	1.70	8.63E-03	132	224
ENSG00000132424.16	*PNISR*	-1.61	8.65E-03	521	325
ENSG00000138778.12	*CENPE*	-2.40	8.66E-03	227	95
ENSG00000176826.15	*FKBP9P1*	5.38	8.68E-03	3	18
ENSG00000152527.14	*PLEKHH2*	-2.09	8.72E-03	73	35
ENSG00000136100.14	*VPS36*	-1.52	8.73E-03	509	335
ENSG00000230795.3	*HLA-K*	1.99	8.73E-03	39	77
ENSG00000059378.12	*PARP12*	2.37	8.76E-03	46	108
ENSG00000126934.13	*MAP2K2*	1.68	8.88E-03	175	295
ENSG00000134569.10	*LRP4*	-2.08	8.90E-03	144	69
ENSG00000102878.16	*HSF4*	3.15	8.93E-03	10	32
ENSG00000105711.12	*SCN1B*	1.81	8.96E-03	74	135
ENSG00000182670.13	*TTC3*	-2.82	8.96E-03	194	69
ENSG00000171388.12	*APLN*	-1.57	9.01E-03	158	101
ENSG00000100307.13	*CBX7*	1.54	9.04E-03	165	254
ENSG00000137218.10	*FRS3*	1.78	9.09E-03	88	157
ENSG00000189423.13	*USP32P3*	-3.65	9.15E-03	52	14
ENSG00000177679.16	*SRRM3*	2.06	9.21E-03	33	68

ENSG00000074603.19	*DPP8*	-1.64	9.24E-03	551	337
ENSG00000158555.15	*GDPD5*	-1.82	9.27E-03	99	55
ENSG00000128923.11	*MINDY2*	-1.61	9.32E-03	312	194
ENSG00000138669.9	*PRKG2*	-3.94	9.32E-03	26	7
ENSG00000139133.7	*ALG10*	-1.81	9.33E-03	127	70
ENSG00000143970.17	*ASXL2*	-1.76	9.37E-03	232	132
ENSG00000171130.18	*ATP6V0E2*	-5.09	9.40E-03	35	7
ENSG00000086200.16	*IPO11*	4.55	9.40E-03	31	143
ENSG00000151131.11	*C12orf45*	1.60	9.48E-03	241	385
ENSG00000119844.15	*AFTPH*	-1.53	9.48E-03	299	196
ENSG00000068796.16	*KIF2A*	-2.18	9.50E-03	282	130
ENSG00000188092.15	*GPR89B*	-1.87	9.50E-03	143	76
ENSG00000173588.15	*CEP83*	-1.77	9.51E-03	172	97
ENSG00000136436.14	*CALCOCO2*	-1.60	9.59E-03	529	330
ENSG00000067191.16	*CACNB1*	-1.58	9.64E-03	194	123
ENSG00000198846.6	*TOX*	-1.58	9.64E-03	162	103
ENSG00000090238.12	*YPEL3*	1.81	9.66E-03	85	153
ENSG00000170100.13	*ZNF778*	-2.53	9.68E-03	78	31
ENSG00000153933.10	*DGKE*	-1.98	9.69E-03	71	36
ENSG00000109689.16	*STIM2*	-1.95	9.76E-03	174	90
ENSG00000118620.13	*ZNF430*	-1.68	9.84E-03	107	63
ENSG00000048471.14	*SNX29*	-1.61	9.92E-03	187	117
ENSG00000263731.1	*AC145207.5*	1.71	9.93E-03	127	218
ENSG00000178773.15	*CPNE7*	-2.20	9.97E-03	75	34
ENSG00000086619.14	*ERO1B*	-1.76	1.01E-02	126	72
ENSG00000235043.3	*TECRP1*	1.76	1.02E-02	145	256
ENSG00000103381.12	*CPPED1*	-1.68	1.02E-02	183	109
ENSG00000109323.11	*MANBA*	-1.54	1.02E-02	166	108
ENSG00000149809.15	*TM7SF2*	2.20	1.02E-02	26	58
ENSG00000186470.14	*BTN3A2*	1.55	1.03E-02	163	252
ENSG00000080603.17	*SRCAP*	-1.68	1.03E-02	384	228
ENSG00000183137.14	*CEP57L1*	-2.01	1.04E-02	158	78
ENSG00000164542.12	*KIAA0895*	-2.79	1.04E-02	89	32
ENSG00000258659.6	*TRIM34*	-1.81	1.04E-02	180	99
ENSG00000008517.16	*IL32*	-4.93	1.05E-02	25	5
ENSG00000204130.13	*RUFY2*	-5.23	1.05E-02	35	7
ENSG00000156876.10	*SASS6*	-1.67	1.05E-02	324	194
ENSG00000010818.10	*HIVEP2*	-1.76	1.06E-02	331	189
ENSG00000165948.11	*IFI27L1*	1.62	1.07E-02	134	217
ENSG00000169946.14	*ZFPM2*	-1.96	1.08E-02	67	34
ENSG00000237296.9	*SMG1P1*	-2.13	1.08E-02	156	73
ENSG00000282057.1	*AC092807.3*	-2.27	1.08E-02	63	28
ENSG00000092140.16	*G2E3*	-1.74	1.09E-02	494	284

ENSG00000251022.6	*THAP9-AS1*	-1.76	1.09E-02	583	332
ENSG00000069869.16	*NEDD4*	-2.32	1.09E-02	146	63
ENSG00000132434.9	*LANCL2*	1.70	1.10E-02	76	130
ENSG00000244257.5	*PKD1P1*	-1.62	1.11E-02	225	139
ENSG00000182504.11	*CEP97*	-3.42	1.11E-02	850	248
ENSG00000226121.2	*AC009487.2*	-2.20	1.12E-02	97	44
ENSG00000141738.14	*GRB7*	3.91	1.13E-02	6	24
ENSG00000052841.15	*TTC17*	-1.98	1.13E-02	183	92
ENSG00000103254.10	*ANTKMT*	1.65	1.14E-02	115	189
ENSG00000158220.14	*ESYT3*	-2.60	1.14E-02	40	15
ENSG00000254535.4	*PABPC4L*	-1.89	1.14E-02	81	43
ENSG00000155313.15	*USP25*	-1.67	1.14E-02	589	352
ENSG00000228049.7	*POLR2J2*	2.04	1.15E-02	48	99
ENSG00000084207.17	*GSTP1*	2.36	1.15E-02	37	87
ENSG00000039123.16	*MTREX*	-1.57	1.16E-02	482	307
ENSG00000227036.8	*LINC00511*	1.60	1.17E-02	101	161
ENSG00000125457.14	*MIF4GD*	1.56	1.18E-02	95	147
ENSG00000133247.14	*KMT5C*	1.62	1.18E-02	70	114
ENSG00000065618.21	*COL17A1*	1.63	1.18E-02	153	250
ENSG00000176749.9	*CDK5R1*	-1.56	1.19E-02	173	111
ENSG00000091592.16	*NLRP1*	-3.24	1.19E-02	145	45
ENSG00000165272.16	*AQP3*	1.68	1.19E-02	63	105
ENSG00000180263.14	*FGD6*	-2.07	1.19E-02	259	125
ENSG00000157326.19	*DHRS4*	1.56	1.21E-02	120	188
ENSG00000100036.13	*SLC35E4*	-1.76	1.22E-02	113	64
ENSG00000213599.10	*SLX1A-SULT1A3*	1.60	1.22E-02	116	186
ENSG00000254929.6	*AL591684.2*	-2.16	1.22E-02	61	28
ENSG00000185760.15	*KCNQ5*	-1.85	1.23E-02	257	139
ENSG00000035928.16	*RFC1*	-1.64	1.23E-02	1297	792
ENSG00000169126.16	*ARMC4*	-1.88	1.23E-02	137	73
ENSG00000183072.10	*NKX2-5*	-4.81	1.24E-02	18	4
ENSG00000066185.13	*ZMYND12*	2.90	1.25E-02	12	35
ENSG00000040341.18	*STAU2*	-1.58	1.25E-02	537	340
ENSG00000187266.14	*EPOR*	1.70	1.25E-02	66	112
ENSG00000184110.14	*EIF3C*	1.54	1.25E-02	928	1425
ENSG00000227706.4	*AL713998.1*	1.83	1.25E-02	53	96
ENSG00000205362.11	*MT1A*	2.58	1.26E-02	16	43
ENSG00000198598.6	*MMP17*	2.72	1.26E-02	15	40
ENSG00000163577.8	*EIF5A2*	-1.60	1.27E-02	383	240
ENSG00000003147.19	*ICA1*	1.59	1.27E-02	100	159
ENSG00000153064.12	*BANK1*	-2.03	1.29E-02	96	48
ENSG00000169570.10	*DTWD2*	-1.69	1.29E-02	120	71

ENSG00000135917.15	*SLC19A3*	-3.61	1.30E-02	32	9
ENSG00000158716.9	*DUSP23*	1.58	1.31E-02	132	208
ENSG00000109452.12	*INPP4B*	-2.59	1.32E-02	72	28
ENSG00000182310.14	*SPACA6*	2.10	1.32E-02	32	66
ENSG00000132952.12	*USPL1*	-1.56	1.32E-02	256	164
ENSG00000116586.11	*LAMTOR2*	1.88	1.33E-02	67	126
ENSG00000085382.12	*HACE1*	-1.65	1.33E-02	271	164
ENSG00000278107.1	*AC027575.2*	4.08	1.34E-02	7	27
ENSG00000153339.14	*TRAPPC8*	-1.73	1.34E-02	345	199
ENSG00000285077.2	*AC091057.6*	-2.42	1.34E-02	84	35
ENSG00000170214.5	*ADRA1B*	2.33	1.34E-02	26	61
ENSG00000257167.2	*TMPO-AS1*	1.62	1.35E-02	68	110
ENSG00000164967.10	*RPP25L*	1.53	1.35E-02	219	335
ENSG00000204681.11	*GABBR1*	2.26	1.36E-02	35	80
ENSG00000135482.7	*ZC3H10*	1.55	1.36E-02	128	198
ENSG00000213123.11	*TCTEX1D2*	1.75	1.37E-02	93	162
ENSG00000009950.16	*MLXIPL*	2.60	1.39E-02	16	41
ENSG00000116809.11	*ZBTB17*	2.24	1.39E-02	28	62
ENSG00000113494.17	*PRLR*	-4.47	1.39E-02	60	13
ENSG00000204859.13	*ZBTB48*	1.57	1.39E-02	127	199
ENSG00000138085.16	*ATRAID*	1.61	1.40E-02	141	227
ENSG00000168234.13	*TTC39C*	1.53	1.40E-02	137	210
ENSG00000269335.5	*IKBKG*	2.12	1.41E-02	259	547
ENSG00000171587.15	*DSCAM*	-2.48	1.42E-02	45	18
ENSG00000142556.19	*ZNF614*	-1.64	1.42E-02	153	94
ENSG00000178531.6	*CTXN1*	1.53	1.43E-02	169	259
ENSG00000140265.12	*ZSCAN29*	-4.00	1.43E-02	97	24
ENSG00000167964.13	*RAB26*	2.79	1.43E-02	13	35
ENSG00000172667.11	*ZMAT3*	-1.52	1.45E-02	374	246
ENSG00000260920.2	*AL031985.3*	2.07	1.47E-02	32	66
ENSG00000139641.12	*ESYT1*	1.63	1.47E-02	228	372
ENSG00000163359.15	*COL6A3*	2.39	1.48E-02	46	111
ENSG00000206538.9	*VGLL3*	-2.00	1.49E-02	83	41
ENSG00000167034.10	*NKX3-1*	-1.52	1.51E-02	220	145
ENSG00000115839.17	*RAB3GAP1*	-3.27	1.52E-02	202	62
ENSG00000003249.13	*DBNDD1*	2.54	1.53E-02	15	37
ENSG00000178026.13	*LRRC75B*	3.00	1.54E-02	12	36
ENSG00000113391.19	*FAM172A*	-1.54	1.54E-02	211	138
ENSG00000276170.4	*AC244153.1*	2.63	1.54E-02	18	46
ENSG00000215424.10	*MCM3AP-AS1*	-1.78	1.54E-02	84	47
ENSG00000181513.14	*ACBD4*	2.05	1.55E-02	52	106
ENSG00000066279.18	*ASPM*	-2.28	1.55E-02	1761	773
ENSG00000221947.8	*XKR9*	-1.82	1.56E-02	94	52

ENSG00000111224.14	*PARP11*	-1.98	1.56E-02	100	50
ENSG00000196678.14	*ERI2*	-1.74	1.57E-02	266	153
ENSG00000105877.18	*DNAH11*	-5.80	1.58E-02	37	6
ENSG00000126756.12	*UXT*	1.98	1.59E-02	60	118
ENSG00000270136.6	*MICOS10-NBL1*	1.61	1.59E-02	130	210
ENSG00000178188.14	*SH2B1*	1.65	1.59E-02	108	178
ENSG00000149527.18	*PLCH2*	3.21	1.59E-02	7	23
ENSG00000167785.9	*ZNF558*	1.78	1.60E-02	72	129
ENSG00000205356.10	*TECPR1*	1.62	1.60E-02	260	421
ENSG00000160799.11	*CCDC12*	2.23	1.61E-02	39	88
ENSG00000139044.12	*B4GALNT3*	2.24	1.61E-02	70	156
ENSG00000116711.10	*PLA2G4A*	-1.86	1.62E-02	75	40
ENSG00000137434.11	*C6orf52*	1.87	1.62E-02	57	106
ENSG00000085274.15	*MYNN*	-1.54	1.63E-02	230	150
ENSG00000068305.17	*MEF2A*	-1.73	1.63E-02	659	381
ENSG00000185860.13	*CCDC190*	-3.60	1.64E-02	41	11
ENSG00000154265.16	*ABCA5*	-1.65	1.64E-02	114	69
ENSG00000168386.18	*FILIP1L*	-1.82	1.66E-02	100	55
ENSG00000226332.2	*AL354836.1*	2.42	1.66E-02	18	43
ENSG00000140993.11	*TIGD7*	-1.73	1.66E-02	102	59
ENSG00000008988.9	*RPS20*	1.57	1.67E-02	93	147
ENSG00000142235.10	*LMTK3*	2.57	1.68E-02	17	44
ENSG00000105290.12	*APLP1*	2.44	1.68E-02	28	69
ENSG00000130312.6	*MRPL34*	1.80	1.68E-02	74	132
ENSG00000162105.19	*SHANK2*	2.49	1.69E-02	62	155
ENSG00000112062.10	*MAPK14*	-2.70	1.69E-02	43	16
ENSG00000187607.16	*ZNF286A*	-1.54	1.70E-02	365	236
ENSG00000113721.14	*PDGFRB*	3.39	1.71E-02	10	35
ENSG00000136381.13	*IREB2*	-1.84	1.74E-02	869	473
ENSG00000121361.5	*KCNJ8*	-2.09	1.74E-02	59	28
ENSG00000109016.17	*DHRS7B*	2.70	1.79E-02	17	46
ENSG00000146414.16	*SHPRH*	-1.94	1.79E-02	215	110
ENSG00000101974.14	*ATP11C*	-1.68	1.80E-02	249	148
ENSG00000162415.7	*ZSWIM5*	4.34	1.80E-02	4	18
ENSG00000285867.1	*BX470102.2*	2.41	1.80E-02	16	38
ENSG00000100201.21	*DDX17*	-1.78	1.80E-02	354	199
ENSG00000228649.9	*SNHG26*	2.51	1.80E-02	21	53
ENSG00000125384.7	*PTGER2*	-3.15	1.82E-02	28	9
ENSG00000074966.11	*TXK*	-2.85	1.82E-02	40	14
ENSG00000065154.11	*OAT*	-4.45	1.82E-02	19	4
ENSG00000169203.16	*NPIPB12*	-2.64	1.82E-02	71	27
ENSG00000258790.1	*AL121594.1*	-1.89	1.83E-02	255	135

ENSG00000177076.6	*ACER2*	-2.88	1.83E-02	33	11
ENSG00000164011.18	*ZNF691*	1.79	1.83E-02	69	124
ENSG00000186815.12	*TPCN1*	1.62	1.85E-02	605	978
ENSG00000241316.8	*SUCLG2-AS1*	-1.60	1.86E-02	192	120
ENSG00000065609.14	*SNAP91*	-2.61	1.86E-02	67	26
ENSG00000068784.13	*SRBD1*	-1.54	1.86E-02	204	132
ENSG00000237870.6	*AC073130.1*	-2.07	1.87E-02	71	34
ENSG00000141854.9	*MISP3*	3.09	1.88E-02	9	28
ENSG00000257594.4	*GALNT4*	-1.55	1.88E-02	301	195
ENSG00000275882.1	*IKBKGP1*	1.78	1.89E-02	66	117
ENSG00000198001.13	*IRAK4*	-1.96	1.91E-02	72	37
ENSG00000226137.5	*BAIAP2-DT*	1.69	1.92E-02	87	148
ENSG00000169964.8	*TMEM42*	1.59	1.93E-02	163	259
ENSG00000111679.17	*PTPN6*	3.37	1.93E-02	11	39
ENSG00000081853.15	*PCDHGA2*	-5.58	1.95E-02	17	3
ENSG00000213995.11	*NAXD*	1.57	1.96E-02	177	277
ENSG00000128886.12	*ELL3*	-2.80	1.98E-02	37	13
ENSG00000008086.12	*CDKL5*	-1.79	1.99E-02	91	50
ENSG00000175265.17	*GOLGA8A*	-3.28	2.02E-02	50	15
ENSG00000138758.11	*SEPTIN11*	-1.93	2.03E-02	99	51
ENSG00000127334.10	*DYRK2*	-1.79	2.04E-02	107	60
ENSG00000122986.13	*HVCN1*	3.09	2.04E-02	26	80
ENSG00000247092.7	*SNHG10*	8.83	2.04E-02	3	25
ENSG00000135736.6	*CCDC102A*	1.60	2.05E-02	99	159
ENSG00000061656.10	*SPAG4*	3.19	2.05E-02	17	54
ENSG00000153066.12	*TXNDC11*	2.50	2.05E-02	31	79
ENSG00000106077.18	*ABHD11*	2.09	2.05E-02	37	77
ENSG00000151657.12	*KIN*	-1.75	2.05E-02	184	105
ENSG00000205423.11	*CNEP1R1*	-2.71	2.06E-02	55	20
ENSG00000133619.17	*KRBA1*	3.62	2.11E-02	9	31
ENSG00000023287.13	*RB1CC1*	-1.53	2.11E-02	496	325
ENSG00000136866.13	*ZFP37*	-2.90	2.13E-02	32	11
ENSG00000100342.20	*APOL1*	5.54	2.14E-02	8	42
ENSG00000184887.13	*BTBD6*	3.20	2.15E-02	43	137
ENSG00000173200.13	*PARP15*	5.87	2.15E-02	3	19
ENSG00000172992.12	*DCAKD*	2.09	2.15E-02	81	168
ENSG00000108984.15	*MAP2K6*	2.14	2.16E-02	31	67
ENSG00000151835.16	*SACS*	-2.55	2.16E-02	1454	571
ENSG00000154079.6	*SDHAF4*	1.63	2.17E-02	94	154
ENSG00000235381.1	*AL596202.1*	-3.05	2.18E-02	25	8
ENSG00000115738.10	*ID2*	3.03	2.18E-02	10	30
ENSG00000112893.9	*MAN2A1*	-2.00	2.20E-02	79	40
ENSG00000282416.1	*AC092299.1*	2.11	2.20E-02	30	64

ENSG00000206341.7	*HLA-H*	1.97	2.20E-02	26	52
ENSG00000214135.8	*AC132008.2*	-6.28	2.22E-02	19	3
ENSG00000163728.11	*TTC14*	-1.57	2.23E-02	185	118
ENSG00000204176.14	*SYT15*	2.42	2.24E-02	17	42
ENSG00000259976.3	*AC093010.3*	-7.66	2.25E-02	48	6
ENSG00000104450.12	*SPAG1*	-2.70	2.25E-02	50	19
ENSG00000267787.7	*AC027097.2*	2.85	2.25E-02	11	30
ENSG00000090060.18	*PAPOLA*	-1.61	2.26E-02	260	162
ENSG00000286001.1	*AC021087.5*	-5.65	2.26E-02	18	3
ENSG00000144840.9	*RABL3*	-1.69	2.27E-02	283	167
ENSG00000118482.11	*PHF3*	-1.59	2.27E-02	1212	763
ENSG00000131067.17	*GGT7*	-4.91	2.28E-02	21	4
ENSG00000164169.13	*PRMT9*	-1.68	2.29E-02	95	57
ENSG00000134253.10	*TRIM45*	-1.90	2.30E-02	104	55
ENSG00000133056.13	*PIK3C2B*	11.15	2.31E-02	3	37
ENSG00000287222.1	*AC234917.3*	1.78	2.34E-02	39	69
ENSG00000121413.12	*ZSCAN18*	1.54	2.34E-02	234	361
ENSG00000141447.18	*OSBPL1A*	-1.65	2.35E-02	317	193
ENSG00000110723.12	*EXPH5*	-1.79	2.38E-02	144	81
ENSG00000132781.18	*MUTYH*	2.12	2.38E-02	81	173
ENSG00000196814.15	*MVB12B*	-1.89	2.39E-02	72	38
ENSG00000186517.14	*ARHGAP30*	-2.87	2.43E-02	29	10
ENSG00000254838.5	*GVINP1*	-3.85	2.43E-02	20	5
ENSG00000183718.5	*TRIM52*	-2.42	2.43E-02	93	38
ENSG00000261408.7	*TEN1-CDK3*	3.02	2.43E-02	20	60
ENSG00000160190.14	*SLC37A1*	-2.24	2.43E-02	87	39
ENSG00000137601.16	*NEK1*	-1.72	2.45E-02	144	83
ENSG00000137073.21	*UBAP2*	-1.80	2.45E-02	73	41
ENSG00000166529.15	*ZSCAN21*	1.54	2.45E-02	92	141
ENSG00000140043.11	*PTGR2*	-2.36	2.46E-02	121	51
ENSG00000142494.13	*SLC47A1*	1.63	2.47E-02	69	113
ENSG00000128872.10	*TMOD2*	2.16	2.48E-02	31	67
ENSG00000185499.16	*MUC1*	2.57	2.48E-02	18	46
ENSG00000137878.17	*GCOM1*	-4.02	2.50E-02	30	8
ENSG00000082438.17	*COBLL1*	-3.66	2.54E-02	68	19
ENSG00000135378.4	*PRRG4*	-2.10	2.54E-02	60	28
ENSG00000188452.14	*CERKL*	3.12	2.54E-02	8	26
ENSG00000189056.14	*RELN*	-8.50	2.55E-02	25	3
ENSG00000164615.5	*CAMLG*	1.83	2.62E-02	92	168
ENSG00000233762.3	*AC007969.1*	2.54	2.62E-02	15	39
ENSG00000136014.12	*USP44*	-1.96	2.64E-02	76	39
ENSG00000136848.17	*DAB2IP*	2.28	2.65E-02	163	372
ENSG00000058056.9	*USP13*	-1.57	2.65E-02	800	510

ENSG00000186806.5	*VSIG10L*	3.11	2.67E-02	8	26
ENSG00000115137.12	*DNAJC27*	-1.95	2.68E-02	71	36
ENSG00000232931.6	*LINC00342*	-1.75	2.69E-02	181	103
ENSG00000196683.10	*TOMM7*	2.00	2.70E-02	33	66
ENSG00000124602.10	*UNC5CL*	3.07	2.70E-02	8	26
ENSG00000182185.18	*RAD51B*	2.58	2.70E-02	19	48
ENSG00000041353.10	*RAB27B*	-1.52	2.72E-02	549	361
ENSG00000268903.1	*AL627309.6*	2.24	2.72E-02	26	58
ENSG00000114395.10	*CYB561D2*	1.53	2.73E-02	133	204
ENSG00000130414.12	*NDUFA10*	1.77	2.74E-02	226	401
ENSG00000128610.12	*FEZF1*	1.87	2.74E-02	44	82
ENSG00000180822.11	*PSMG4*	1.78	2.75E-02	81	144
ENSG00000170190.16	*SLC16A5*	1.67	2.75E-02	99	165
ENSG00000277209.1	*RPPH1*	1.84	2.76E-02	51	94
ENSG00000078142.13	*PIK3C3*	-1.55	2.79E-02	482	311
ENSG00000267575.7	*AC006504.5*	-1.74	2.81E-02	234	134
ENSG00000170322.14	*NFRKB*	-2.03	2.84E-02	394	194
ENSG00000135549.15	*PKIB*	-1.78	2.85E-02	152	85
ENSG00000150764.14	*DIXDC1*	-2.04	2.86E-02	52	25
ENSG00000173064.13	*HECTD4*	1.57	2.88E-02	485	761
ENSG00000143819.12	*EPHX1*	2.20	2.89E-02	23	50
ENSG00000100288.19	*CHKB*	1.60	2.90E-02	82	131
ENSG00000177200.17	*CHD9*	-1.63	2.90E-02	248	152
ENSG00000236859.7	*NIFK-AS1*	1.73	2.91E-02	56	98
ENSG00000084764.12	*MAPRE3*	-1.91	2.91E-02	60	31
ENSG00000167637.17	*ZNF283*	-1.85	2.93E-02	115	62
ENSG00000121207.12	*LRAT*	-3.42	2.96E-02	22	6
ENSG00000264301.1	*LINC01444*	1.89	2.96E-02	30	56
ENSG00000171148.13	*TADA3*	1.61	2.98E-02	85	137
ENSG00000204599.14	*TRIM39*	-1.75	2.99E-02	171	98
ENSG00000107882.11	*SUFU*	1.63	2.99E-02	52	85
ENSG00000164161.10	*HHIP*	-1.68	3.04E-02	82	49
ENSG00000197077.13	*KIAA1671*	1.91	3.06E-02	134	256
ENSG00000163283.7	*ALPP*	2.41	3.08E-02	14	34
ENSG00000182272.12	*B4GALNT4*	2.18	3.08E-02	32	70
ENSG00000005810.18	*MYCBP2*	-1.63	3.12E-02	541	331
ENSG00000056277.16	*ZNF280C*	-1.94	3.14E-02	74	38
ENSG00000272502.1	*AC104958.2*	2.62	3.17E-02	10	27
ENSG00000152284.5	*TCF7L1*	-3.97	3.18E-02	18	5
ENSG00000260772.1	*AC012321.1*	1.61	3.20E-02	86	138
ENSG00000117054.13	*ACADM*	-1.98	3.20E-02	193	98
ENSG00000103194.15	*USP10*	-1.68	3.21E-02	142	85
ENSG00000170293.9	*CMTM8*	1.74	3.22E-02	42	72

ENSG00000175029.17	*CTBP2*	-1.86	3.22E-02	373	201
ENSG00000110713.17	*NUP98*	-2.51	3.25E-02	1228	490
ENSG00000229689.3	*AC009237.3*	1.66	3.25E-02	64	106
ENSG00000079263.19	*SP140*	1.58	3.27E-02	86	136
ENSG00000197217.13	*ENTPD4*	-1.63	3.27E-02	746	459
ENSG00000006015.17	*REX1BD*	1.74	3.29E-02	118	204
ENSG00000237298.10	*TTN-AS1*	-1.78	3.30E-02	85	47
ENSG00000231566.2	*LINC02595*	2.00	3.31E-02	22	45
ENSG00000149548.15	*CCDC15*	-1.60	3.31E-02	97	61
ENSG00000107960.11	*STN1*	1.80	3.36E-02	53	96
ENSG00000170522.9	*ELOVL6*	-1.66	3.36E-02	636	383
ENSG00000130751.10	*NPAS1*	2.10	3.36E-02	21	44
ENSG00000122507.21	*BBS9*	1.59	3.37E-02	67	107
ENSG00000161204.11	*ABCF3*	1.55	3.39E-02	158	244
ENSG00000170365.10	*SMAD1*	-1.56	3.39E-02	135	87
ENSG00000021762.20	*OSBPL5*	-1.69	3.39E-02	181	107
ENSG00000254004.7	*ZNF260*	-1.54	3.39E-02	194	126
ENSG00000254806.5	*SYS1-DBNDD2*	3.15	3.40E-02	10	31
ENSG00000196517.11	*SLC6A9*	2.34	3.40E-02	15	34
ENSG00000274070.2	*CASTOR2*	1.65	3.40E-02	104	172
ENSG00000181450.18	*ZNF678*	-1.58	3.43E-02	137	87
ENSG00000204301.6	*NOTCH4*	3.47	3.46E-02	5	17
ENSG00000153975.10	*ZUP1*	-1.58	3.48E-02	142	90
ENSG00000179743.4	*AL450998.2*	2.27	3.49E-02	15	34
ENSG00000265479.6	*DTX2P1-UPK3BP1-PMS2P11*	1.64	3.49E-02	77	125
ENSG00000130762.15	*ARHGEF16*	-2.94	3.49E-02	30	10
ENSG00000105516.11	*DBP*	2.52	3.50E-02	14	35
ENSG00000177951.17	*BET1L*	1.74	3.50E-02	69	120
ENSG00000134352.20	*IL6ST*	-2.47	3.50E-02	201	81
ENSG00000251369.8	*ZNF550*	1.73	3.50E-02	58	100
ENSG00000104154.7	*SLC30A4*	-1.75	3.52E-02	77	44
ENSG00000073670.14	*ADAM11*	-2.31	3.52E-02	44	19
ENSG00000111596.12	*CNOT2*	-1.54	3.55E-02	213	139
ENSG00000235194.9	*PPP1R3E*	1.58	3.56E-02	85	135
ENSG00000182141.10	*ZNF708*	-1.89	3.57E-02	76	40
ENSG00000138398.16	*PPIG*	2.20	3.57E-02	33	72
ENSG00000130338.13	*TULP4*	-1.55	3.59E-02	353	228
ENSG00000197744.5	*PTMAP2*	2.58	3.60E-02	11	28
ENSG00000111731.12	*C2CD5*	-1.84	3.62E-02	347	189
ENSG00000180448.10	*ARHGAP45*	1.57	3.62E-02	167	263

ENSG00000115687.13	*PASK*	1.62	3.64E-02	80	130
ENSG00000170962.13	*PDGFD*	-2.58	3.65E-02	29	11
ENSG00000260401.1	*AP002761.4*	10.16	3.67E-02	15	153
ENSG00000150593.18	*PDCD4*	-1.60	3.72E-02	416	260
ENSG00000125510.17	*OPRL1*	2.87	3.73E-02	7	20
ENSG00000258655.2	*ARHGAP5-AS1*	1.75	3.73E-02	44	78
ENSG00000135164.18	*DMTF1*	-1.61	3.74E-02	234	146
ENSG00000163803.13	*PLB1*	1.68	3.74E-02	72	121
ENSG00000169891.18	*REPS2*	-1.69	3.74E-02	211	125
ENSG00000168300.14	*PCMTD1*	-1.68	3.76E-02	172	103
ENSG00000136603.14	*SKIL*	-1.65	3.78E-02	205	124
ENSG00000205659.10	*LIN52*	-3.48	3.78E-02	23	6
ENSG00000150275.18	*PCDH15*	-4.50	3.81E-02	17	4
ENSG00000264278.1	*ZNF236-DT*	3.84	3.81E-02	5	19
ENSG00000151917.18	*BEND6*	2.15	3.81E-02	24	52
ENSG00000119314.15	*PTBP3*	-5.80	3.82E-02	55	10
ENSG00000132388.12	*UBE2G1*	-1.95	3.84E-02	160	82
ENSG00000103056.12	*SMPD3*	-5.19	3.84E-02	18	3
ENSG00000042317.17	*SPATA7*	1.94	3.85E-02	27	53
ENSG00000155085.15	*AK9*	-2.21	3.85E-02	52	23
ENSG00000101751.10	*POLI*	-2.06	3.86E-02	74	36
ENSG00000080200.10	*CRYBG3*	-1.84	3.86E-02	477	259
ENSG00000127528.5	*KLF2*	2.05	3.87E-02	26	54
ENSG00000137857.17	*DUOX1*	-1.99	3.87E-02	67	33
ENSG00000140939.14	*NOL3*	1.60	3.89E-02	81	130
ENSG00000239704.11	*CDRT4*	2.67	3.89E-02	17	46
ENSG00000153233.13	*PTPRR*	-2.96	3.91E-02	22	7
ENSG00000090924.15	*PLEKHG2*	1.61	3.93E-02	417	671
ENSG00000156453.13	*PCDH1*	1.92	3.95E-02	31	59
ENSG00000130707.18	*ASS1*	1.82	3.95E-02	44	80
ENSG00000035115.22	*SH3YL1*	-1.63	3.95E-02	123	76
ENSG00000070759.17	*TESK2*	1.75	3.96E-02	44	77
ENSG00000179967.11	*PPP1R14BP3*	2.73	3.99E-02	11	29
ENSG00000243789.11	*JMJD7*	1.82	4.00E-02	52	95
ENSG00000120868.13	*APAF1*	1.84	4.01E-02	172	317
ENSG00000171462.15	*DLK2*	1.69	4.04E-02	47	79
ENSG00000116117.18	*PARD3B*	-1.54	4.04E-02	189	122
ENSG00000146233.8	*CYP39A1*	2.67	4.04E-02	12	31
ENSG00000180229.12	*HERC2P3*	-2.83	4.05E-02	62	22
ENSG00000263753.8	*LINC00667*	-1.91	4.06E-02	85	45
ENSG00000249087.7	*ZNF436-AS1*	2.50	4.06E-02	17	44
ENSG00000173013.6	*CCDC96*	1.98	4.07E-02	25	50

ENSG00000151292.17	*CSNK1G3*	-1.65	4.08E-02	382	231
ENSG00000116885.18	*OSCP1*	3.22	4.10E-02	12	37
ENSG00000123473.15	*STIL*	-1.53	4.13E-02	243	159
ENSG00000130720.13	*FIBCD1*	2.28	4.13E-02	52	118
ENSG00000138688.15	*KIAA1109*	-2.13	4.16E-02	144	67
ENSG00000278709.2	*NKILA*	4.06	4.19E-02	4	17
ENSG00000136149.6	*RPL13AP25*	2.30	4.20E-02	16	36
ENSG00000285407.1	*AL033530.1*	2.75	4.24E-02	8	23
ENSG00000186523.14	*FAM86B1*	-1.83	4.24E-02	72	40
ENSG00000085721.12	*RRN3*	-3.55	4.24E-02	40	11
ENSG00000123342.16	*MMP19*	-2.51	4.26E-02	61	24
ENSG00000270344.3	*POC1B-AS1*	2.68	4.28E-02	10	27
ENSG00000089775.11	*ZBTB25*	1.99	4.28E-02	21	42
ENSG00000177854.8	*TMEM187*	2.04	4.31E-02	21	44
ENSG00000138286.15	*FAM149B1*	1.73	4.31E-02	36	62
ENSG00000160785.13	*SLC25A44*	-1.94	4.32E-02	138	71
ENSG00000128604.20	*IRF5*	3.29	4.34E-02	7	23
ENSG00000100104.13	*SRRD*	-1.54	4.34E-02	473	307
ENSG00000100629.17	*CEP128*	-1.70	4.36E-02	124	73
ENSG00000123104.12	*ITPR2*	-1.57	4.39E-02	510	325
ENSG00000179630.11	*LACC1*	-1.80	4.39E-02	85	47
ENSG00000091844.8	*RGS17*	-1.84	4.40E-02	69	38
ENSG00000184517.12	*ZFP1*	-1.56	4.41E-02	144	92
ENSG00000168453.15	*HR*	2.30	4.43E-02	27	62
ENSG00000204177.10	*BMS1P1*	-1.82	4.47E-02	100	55
ENSG00000060749.15	*QSER1*	-5.84	4.49E-02	21	4
ENSG00000109381.19	*ELF2*	-1.60	4.50E-02	238	149
ENSG00000085832.17	*EPS15*	-1.75	4.50E-02	478	273
ENSG00000154914.17	*USP43*	-1.64	4.56E-02	97	59
ENSG00000131495.8	*NDUFA2*	1.72	4.59E-02	49	84
ENSG00000134954.14	*ETS1*	-2.99	4.60E-02	53	18
ENSG00000144395.18	*CCDC150*	-1.72	4.61E-02	93	54
ENSG00000235823.3	*OLMALINC*	2.74	4.62E-02	8	23
ENSG00000187699.10	*C2orf88*	-2.29	4.63E-02	52	23
ENSG00000184378.3	*ACTRT3*	-2.24	4.65E-02	37	17
ENSG00000171806.12	*METTL18*	-1.53	4.72E-02	90	58
ENSG00000220793.5	*RPL21P119*	3.24	4.72E-02	8	26
ENSG00000157657.14	*ZNF618*	-1.52	4.75E-02	254	167
ENSG00000133250.14	*ZNF414*	1.65	4.75E-02	66	108
ENSG00000188542.9	*DUSP28*	2.74	4.77E-02	8	22
ENSG00000128805.14	*ARHGAP22*	-1.53	4.78E-02	157	102
ENSG00000079435.10	*LIPE*	-1.55	4.79E-02	107	69
ENSG00000214113.10	*LYRM4*	1.90	4.81E-02	26	50

ENSG00000108370.17	*RGS9*	1.68	4.83E-02	89	149
ENSG00000165392.10	*WRN*	-2.10	4.84E-02	113	54
ENSG00000222033.1	*LINC01124*	1.96	4.84E-02	22	42
ENSG00000168803.15	*ADAL*	-1.70	4.85E-02	86	51
ENSG00000173275.13	*ZNF449*	-1.91	4.88E-02	58	30
ENSG00000230082.1	*PRRT3-AS1*	2.00	4.89E-02	27	55
ENSG00000138071.13	*ACTR2*	-2.03	4.89E-02	73	36
ENSG00000112293.15	*GPLD1*	-2.49	4.89E-02	25	10
ENSG00000104081.14	*BMF*	-4.60	4.95E-02	20	4
ENSG00000110756.17	*HPS5*	-1.58	4.97E-02	488	310
ENSG00000267303.1	*AC011511.4*	526.98	4.98E-02	0	78
ENSG00000139971.15	*ARMH4*	-1.86	5.00E-02	86	46
ENSG00000240370.6	*RPL13P5*	1.64	5.03E-02	48	79
ENSG00000234465.11	*PINLYP*	-2.27	5.07E-02	34	15
ENSG00000213859.6	*KCTD11*	4.83	5.07E-02	11	52
ENSG00000137860.12	*SLC28A2*	4.72	5.09E-02	4	17
ENSG00000062822.14	*POLD1*	1.66	5.10E-02	141	234
ENSG00000242732.4	*RTL5*	-1.74	5.10E-02	96	55
ENSG00000274180.1	*NATD1*	-1.63	5.10E-02	87	53
ENSG00000198814.12	*GK*	-1.80	5.11E-02	79	44
ENSG00000021574.12	*SPAST*	-2.46	5.13E-02	133	54
ENSG00000165511.6	*C10orf25*	-1.96	5.14E-02	47	24
ENSG00000258017.2	*AC011603.2*	2.22	5.15E-02	25	55
ENSG00000180616.9	*SSTR2*	-2.12	5.15E-02	40	19
ENSG00000143545.9	*RAB13*	1.79	5.16E-02	29	52
ENSG00000186352.9	*ANKRD37*	1.70	5.16E-02	43	73
ENSG00000242474.3	*AC093627.5*	1.72	5.16E-02	57	97
ENSG00000136068.14	*FLNB*	-1.96	5.16E-02	8745	4471
ENSG00000113140.11	*SPARC*	3.73	5.22E-02	12	46
ENSG00000187922.14	*LCN10*	2.66	5.22E-02	9	25
ENSG00000148950.11	*IMMP1L*	1.67	5.23E-02	63	105
ENSG00000100968.14	*NFATC4*	3.94	5.23E-02	4	17
ENSG00000135951.15	*TSGA10*	2.28	5.26E-02	13	29
ENSG00000170633.16	*RNF34*	1.86	5.28E-02	114	213
ENSG00000111907.21	*TPD52L1*	-1.66	5.31E-02	123	74
ENSG00000008382.15	*MPND*	2.17	5.31E-02	32	70
ENSG00000227081.5	*AC005912.1*	1.58	5.31E-02	53	84
ENSG00000138756.17	*BMP2K*	-1.99	5.35E-02	59	30
ENSG00000205885.7	*C1RL-AS1*	-2.16	5.39E-02	33	15
ENSG00000280351.2	*AC127496.7*	1.85	5.41E-02	28	52
ENSG00000163781.14	*TOPBP1*	-1.63	5.42E-02	957	587
ENSG00000258555.6	*SPECC1L-ADORA2A*	-4.51	5.42E-02	41	9

ENSG00000167447.12	*SMG8*	-3.47	5.42E-02	65	19
ENSG00000186318.16	*BACE1*	-2.21	5.42E-02	169	76
ENSG00000145725.19	*PPIP5K2*	-1.55	5.44E-02	598	385
ENSG00000143434.15	*SEMA6C*	-4.61	5.45E-02	20	4
ENSG00000198105.14	*ZNF248*	-2.61	5.46E-02	70	27
ENSG00000143375.15	*CGN*	-2.13	5.46E-02	82	39
ENSG00000020922.12	*MRE11*	-1.89	5.57E-02	181	96
ENSG00000213719.8	*CLIC1*	2.39	5.60E-02	38	90
ENSG00000100767.16	*PAPLN*	2.38	5.62E-02	11	25
ENSG00000105613.10	*MAST1*	1.98	5.62E-02	23	45
ENSG00000162368.13	*CMPK1*	-4.72	5.62E-02	21	4
ENSG00000251602.7	*AL928654.1*	2.01	5.62E-02	27	54
ENSG00000276850.5	*AC245041.2*	1.79	5.64E-02	27	48
ENSG00000110888.17	*CAPRIN2*	-1.59	5.67E-02	786	493
ENSG00000047410.14	*TPR*	-1.78	5.67E-02	2039	1145
ENSG00000284461.2	*AC027644.4*	-2.72	5.67E-02	40	15
ENSG00000128346.11	*C22orf23*	2.60	5.69E-02	9	24
ENSG00000255769.7	*GOLGA2P10*	-1.52	5.70E-02	104	69
ENSG00000161912.18	*ADCY10P1*	4.36	5.75E-02	4	18
ENSG00000100603.13	*SNW1*	-1.55	5.80E-02	449	291
ENSG00000196465.10	*MYL6B*	1.56	5.82E-02	78	122
ENSG00000117411.16	*B4GALT2*	1.75	5.83E-02	94	165
ENSG00000119414.11	*PPP6C*	-1.83	5.90E-02	90	49
ENSG00000117013.17	*KCNQ4*	-1.97	5.91E-02	55	28
ENSG00000187243.16	*MAGED4B*	2.47	5.92E-02	31	76
ENSG00000117114.19	*ADGRL2*	6.27	5.92E-02	4	25
ENSG00000148219.16	*ASTN2*	1.65	5.93E-02	47	78
ENSG00000183648.10	*NDUFB1*	1.55	5.93E-02	95	148
ENSG00000116984.13	*MTR*	-2.18	5.95E-02	1005	461
ENSG00000183018.9	*SPNS2*	-1.91	5.96E-02	45	23
ENSG00000092931.11	*MFSD11*	-1.69	5.97E-02	122	73
ENSG00000134242.16	*PTPN22*	-3.51	5.98E-02	22	6
ENSG00000130699.18	*TAF4*	-5.65	5.98E-02	30	5
ENSG00000236671.9	*PRKG1-AS1*	-2.97	5.98E-02	21	7
ENSG00000203778.8	*FAM229B*	1.66	5.98E-02	38	63
ENSG00000284707.2	*AC079781.5*	1.63	6.01E-02	60	98
ENSG00000175787.17	*ZNF169*	-2.03	6.02E-02	43	21
ENSG00000144579.7	*CTDSP1*	1.67	6.05E-02	38	64
ENSG00000186908.14	*ZDHHC17*	-2.16	6.06E-02	52	24
ENSG00000273117.1	*AC144652.1*	2.12	6.08E-02	18	38
ENSG00000197566.10	*ZNF624*	-2.06	6.09E-02	37	18
ENSG00000109705.8	*NKX3-2*	1.72	6.09E-02	33	56
ENSG00000132570.14	*PCBD2*	1.99	6.09E-02	41	81

ENSG00000168890.14	*TMEM150A*	1.55	6.10E-02	72	111
ENSG00000158352.15	*SHROOM4*	2.44	6.12E-02	13	31
ENSG00000131196.17	*NFATC1*	1.55	6.14E-02	64	99
ENSG00000159263.16	*SIM2*	-2.57	6.22E-02	41	16
ENSG00000130529.16	*TRPM4*	1.65	6.22E-02	47	77
ENSG00000115419.12	*GLS*	-2.31	6.22E-02	67	29
ENSG00000276248.1	*AL442125.1*	-2.11	6.24E-02	38	18
ENSG00000123106.10	*CCDC91*	-1.61	6.25E-02	188	117
ENSG00000287023.1	*AC018978.1*	-2.73	6.25E-02	24	9
ENSG00000145349.17	*CAMK2D*	-1.73	6.31E-02	333	193
ENSG00000196275.14	*GTF2IRD2*	2.27	6.33E-02	31	70
ENSG00000109670.16	*FBXW7*	-1.57	6.33E-02	264	169
ENSG00000163491.16	*NEK10*	-2.63	6.34E-02	26	10
ENSG00000167721.10	*TSR1*	-1.80	6.34E-02	58	32
ENSG00000163463.11	*KRTCAP2*	1.83	6.35E-02	35	64
ENSG00000106125.14	*MINDY4*	1.65	6.35E-02	37	61
ENSG00000106701.12	*FSD1L*	-1.84	6.36E-02	131	71
ENSG00000178177.15	*LCORL*	-1.54	6.39E-02	193	125
ENSG00000102103.16	*PQBP1*	1.58	6.41E-02	105	166
ENSG00000204060.7	*FOXO6*	2.29	6.42E-02	10	24
ENSG00000138639.18	*ARHGAP24*	-1.77	6.44E-02	154	87
ENSG00000120662.16	*MTRF1*	-1.83	6.46E-02	76	42
ENSG00000175556.17	*LONRF3*	-1.57	6.48E-02	131	83
ENSG00000090857.13	*PDPR*	-2.08	6.48E-02	36	17
ENSG00000142102.16	*PGGHG*	-1.56	6.49E-02	107	69
ENSG00000178184.16	*PARD6G*	-2.58	6.49E-02	28	11
ENSG00000225138.8	*SLC9A3-AS1*	1.74	6.53E-02	42	74
ENSG00000131480.9	*AOC2*	1.72	6.56E-02	36	62
ENSG00000140450.9	*ARRDC4*	-1.95	6.56E-02	41	21
ENSG00000148773.14	*MKI67*	-1.58	6.56E-02	11715	7425
ENSG00000092929.11	*UNC13D*	-1.62	6.57E-02	237	146
ENSG00000171219.9	*CDC42BPG*	1.83	6.61E-02	27	50
ENSG00000180917.17	*CMTR2*	-3.65	6.61E-02	32	9
ENSG00000265690.7	*AC074143.1*	1.95	6.61E-02	20	40
ENSG00000100030.14	*MAPK1*	-2.05	6.64E-02	100	49
ENSG00000260912.1	*AL158206.1*	-2.08	6.65E-02	32	15
ENSG00000162769.13	*FLVCR1*	-1.52	6.71E-02	245	161
ENSG00000149403.12	*GRIK4*	-3.85	6.74E-02	29	7
ENSG00000159128.14	*IFNGR2*	-2.61	6.74E-02	49	19
ENSG00000212694.8	*LINC01089*	1.63	6.76E-02	40	66
ENSG00000136492.8	*BRIP1*	-2.32	6.77E-02	73	31
ENSG00000115421.13	*PAPOLG*	-1.64	6.78E-02	271	165
ENSG00000133138.20	*TBC1D8B*	-1.94	6.82E-02	53	27

ENSG00000163590.14	*PPM1L*	-1.59	6.84E-02	74	47
ENSG00000198929.13	*NOS1AP*	-1.99	6.84E-02	69	34
ENSG00000118257.16	*NRP2*	-1.68	6.85E-02	185	110
ENSG00000179277.9	*MEIS3P1*	-1.83	6.89E-02	78	43
ENSG00000101343.14	*CRNKL1*	2.22	6.93E-02	17	37
ENSG00000183128.7	*CALHM3*	2.49	6.94E-02	12	29
ENSG00000135119.14	*RNFT2*	4.37	7.02E-02	4	18
ENSG00000165521.15	*EML5*	-4.99	7.03E-02	25	5
ENSG00000169621.10	*APLF*	-2.05	7.03E-02	60	29
ENSG00000167635.11	*ZNF146*	-2.56	7.06E-02	54	21
ENSG00000282393.1	*AC016588.2*	-1.61	7.07E-02	71	44
ENSG00000102984.15	*ZNF821*	1.67	7.08E-02	33	55
ENSG00000264772.6	*AC016876.2*	1.53	7.09E-02	118	181
ENSG00000145390.11	*USP53*	-5.02	7.13E-02	58	12
ENSG00000124116.19	*WFDC3*	2.92	7.16E-02	8	23
ENSG00000114529.12	*C3orf52*	-3.92	7.19E-02	30	8
ENSG00000164961.16	*WASHC5*	-1.53	7.21E-02	400	261
ENSG00000244219.7	*TMEM225B*	2.20	7.23E-02	12	27
ENSG00000181381.13	*DDX60L*	-1.75	7.25E-02	184	105
ENSG00000255248.9	*MIR100HG*	-1.58	7.26E-02	307	194
ENSG00000184986.11	*TMEM121*	2.84	7.26E-02	9	25
ENSG00000204314.12	*PRRT1*	2.35	7.27E-02	12	28
ENSG00000160613.13	*PCSK7*	-1.58	7.29E-02	387	245
ENSG00000150893.11	*FREM2*	-1.80	7.30E-02	81	45
ENSG00000143344.15	*RGL1*	-2.15	7.35E-02	202	94
ENSG00000125611.15	*CHCHD5*	2.11	7.44E-02	21	45
ENSG00000135124.14	*P2RX4*	-5.06	7.45E-02	20	4
ENSG00000100321.15	*SYNGR1*	-3.95	7.47E-02	24	6
ENSG00000175352.11	*NRIP3*	2.90	7.62E-02	6	17
ENSG00000181284.3	*TMEM102*	1.65	7.64E-02	39	64
ENSG00000269837.1	*IPO5P1*	1.61	7.64E-02	50	80
ENSG00000279822.1	*AC016397.2*	-2.22	7.65E-02	26	12
ENSG00000283761.1	*AC118553.2*	-2.26	7.65E-02	50	22
ENSG00000073756.12	*PTGS2*	3.91	7.67E-02	20	79
ENSG00000177181.15	*RIMKLA*	2.87	7.73E-02	7	19
ENSG00000133858.16	*ZFC3H1*	-1.57	7.74E-02	127	81
ENSG00000281501.1	*SEPSECS-AS1*	2.31	7.76E-02	17	39
ENSG00000183354.12	*KIAA2026*	-1.58	7.80E-02	144	91
ENSG00000272316.1	*AL021368.2*	-1.69	7.85E-02	53	31
ENSG00000155974.12	*GRIP1*	-2.87	7.85E-02	72	25
ENSG00000239282.7	*CASTOR1*	4.95	7.86E-02	5	27
ENSG00000253873.6	*PCDHGA11*	-2.22	7.86E-02	27	12
ENSG00000121749.15	*TBC1D15*	-1.54	7.87E-02	191	124

ENSG00000259332.3	*ST20-MTHFS*	2.09	7.87E-02	19	39
ENSG00000198203.10	*SULT1C2*	3.37	7.94E-02	6	21
ENSG00000071575.11	*TRIB2*	1.87	7.95E-02	62	117
ENSG00000227345.8	*PARG*	-1.76	7.98E-02	128	73
ENSG00000154114.12	*TBCEL*	-1.66	8.01E-02	328	198
ENSG00000223768.2	*LINC00205*	289.38	8.01E-02	0	43
ENSG00000229638.1	*RPL4P4*	2.26	8.06E-02	12	26
ENSG00000130589.16	*HELZ2*	2.02	8.12E-02	120	243
ENSG00000221990.4	*EXOC3-AS1*	1.63	8.13E-02	38	61
ENSG00000111215.12	*PRR4*	3.14	8.16E-02	5	16
ENSG00000163993.7	*S100P*	2.25	8.16E-02	16	36
ENSG00000115963.13	*RND3*	-2.50	8.18E-02	134	54
ENSG00000112561.18	*TFEB*	3.46	8.18E-02	17	57
ENSG00000185347.17	*TEDC1*	1.59	8.20E-02	97	155
ENSG00000256664.1	*AC025423.2*	-3.79	8.21E-02	38	10
ENSG00000106333.13	*PCOLCE*	1.73	8.31E-02	40	70
ENSG00000258441.1	*LINC00641*	-1.76	8.33E-02	203	115
ENSG00000132881.12	*CPLANE2*	2.25	8.34E-02	14	31
ENSG00000128564.7	*VGF*	1.70	8.34E-02	37	63
ENSG00000277147.6	*LINC00869*	2.37	8.34E-02	13	30
ENSG00000146574.15	*CCZ1B*	3.47	8.34E-02	23	78
ENSG00000241634.1	*AC069499.1*	-2.80	8.35E-02	16	6
ENSG00000065328.16	*MCM10*	-7.81	8.35E-02	314	40
ENSG00000177822.8	*TENM3-AS1*	1.82	8.36E-02	28	50
ENSG00000160219.12	*GAB3*	2.58	8.38E-02	7	19
ENSG00000287431.1	*AC027601.6*	1.69	8.40E-02	34	58
ENSG00000259439.2	*LINC01833*	2.53	8.40E-02	9	22
ENSG00000184588.18	*PDE4B*	1.71	8.41E-02	33	56
ENSG00000109458.8	*GAB1*	-3.62	8.45E-02	48	13
ENSG00000015568.13	*RGPD5*	-1.85	8.48E-02	170	92
ENSG00000272410.5	*AC022384.1*	-2.32	8.49E-02	103	44
ENSG00000070831.17	*CDC42*	-1.73	8.49E-02	200	115
ENSG00000241697.5	*TMEFF1*	-5.63	8.51E-02	21	4
ENSG00000263934.4	*SNORD3A*	2.36	8.51E-02	15	36
ENSG00000272221.1	*AL645933.2*	1.95	8.53E-02	17	32
ENSG00000231925.11	*TAPBP*	-2.30	8.53E-02	66	29
ENSG00000073150.14	*PANX2*	1.96	8.56E-02	18	35
ENSG00000186205.13	*MTARC1*	-1.93	8.56E-02	113	58
ENSG00000166263.13	*STXBP4*	-1.81	8.57E-02	224	124
ENSG00000267740.5	*AC024592.3*	2.68	8.58E-02	8	21
ENSG00000065268.10	*WDR18*	1.61	8.60E-02	55	88
ENSG00000168152.13	*THAP9*	-2.42	8.60E-02	37	15
ENSG00000171174.15	*RBKS*	1.70	8.63E-02	33	56

ENSG00000154608.14	*CEP170P1*	-2.67	8.64E-02	25	9
ENSG00000104936.17	*DMPK*	1.54	8.64E-02	142	218
ENSG00000172954.13	*LCLAT1*	-4.10	8.71E-02	19	5
ENSG00000268575.1	*AL031282.2*	-1.63	8.72E-02	81	50
ENSG00000160838.14	*LRRC71*	-3.26	8.72E-02	17	5
ENSG00000198373.12	*WWP2*	1.73	8.73E-02	93	162
ENSG00000230537.2	*AL158071.3*	4.00	8.75E-02	4	17
ENSG00000259583.3	*AC015712.2*	-2.57	8.76E-02	28	11
ENSG00000223509.8	*AC135983.2*	-1.69	8.79E-02	69	40
ENSG00000165240.20	*ATP7A*	-2.27	8.79E-02	67	29
ENSG00000254206.5	*NPIPB11*	1.54	8.80E-02	54	84
ENSG00000133835.16	*HSD17B4*	1.82	8.83E-02	103	187
ENSG00000143409.15	*MINDY1*	1.55	8.84E-02	49	76
ENSG00000106460.19	*TMEM106B*	2.22	8.85E-02	23	51
ENSG00000140254.12	*DUOXA1*	-3.38	8.86E-02	27	8
ENSG00000126709.15	*IFI6*	1.58	8.86E-02	50	79
ENSG00000164841.5	*TMEM74*	-1.95	8.87E-02	38	20
ENSG00000112599.9	*GUCA1B*	2.45	8.95E-02	11	27
ENSG00000181222.16	*POLR2A*	-2.73	8.95E-02	24	9
ENSG00000143578.16	*CREB3L4*	1.58	8.95E-02	67	106
ENSG00000165929.13	*TC2N*	-2.30	8.95E-02	24	11
ENSG00000166741.7	*NNMT*	1.77	8.97E-02	28	49
ENSG00000272686.1	*AC006333.2*	1.62	9.00E-02	42	68
ENSG00000070495.14	*JMJD6*	-1.54	9.05E-02	175	114
ENSG00000134982.17	*APC*	239.43	9.20E-02	0	35
ENSG00000164331.10	*ANKRA2*	1.56	9.21E-02	69	107
ENSG00000144445.17	*KANSL1L*	-1.54	9.29E-02	149	97
ENSG00000253729.7	*PRKDC*	-1.68	9.31E-02	286	170
ENSG00000134452.19	*FBH1*	-1.64	9.31E-02	198	120
ENSG00000175216.15	*CKAP5*	-1.72	9.31E-02	5739	3329
ENSG00000179222.17	*MAGED1*	1.57	9.32E-02	125	196
ENSG00000047578.13	*KIAA0556*	-2.08	9.35E-02	38	18
ENSG00000072506.12	*HSD17B10*	1.59	9.35E-02	52	82
ENSG00000149231.14	*CCDC82*	-1.56	9.35E-02	372	238
ENSG00000156172.6	*C8orf37*	-1.74	9.36E-02	55	32
ENSG00000107951.14	*MTPAP*	-1.87	9.36E-02	53	28
ENSG00000174938.14	*SEZ6L2*	2.29	9.43E-02	33	75
ENSG00000165072.10	*MAMDC2*	-1.68	9.44E-02	48	28
ENSG00000240771.8	*ARHGEF25*	3.09	9.44E-02	6	19
ENSG00000288398.1	*AL109627.1*	1.92	9.49E-02	22	42
ENSG00000069812.11	*HES2*	1.57	9.49E-02	61	95
ENSG00000279348.1	*AC012513.3*	-1.55	9.49E-02	95	61
ENSG00000156970.12	*BUB1B*	-1.73	9.52E-02	64	37

ENSG00000187953.10	*PMS2CL*	1.53	9.53E-02	108	165
ENSG00000135679.25	*MDM2*	1.71	9.53E-02	63	107
ENSG00000162591.16	*MEGF6*	-7.84	9.54E-02	117	15
ENSG00000171723.15	*GPHN*	-2.42	9.57E-02	24	10
ENSG00000258920.1	*FOXN3-AS1*	1.92	9.64E-02	17	33
ENSG00000139880.19	*CDH24*	1.54	9.68E-02	149	230
ENSG00000118263.15	*KLF7*	1.72	9.72E-02	54	92
ENSG00000169955.7	*ZNF747*	1.55	9.81E-02	69	108
ENSG00000131323.14	*TRAF3*	-3.72	9.84E-02	75	20
ENSG00000130640.13	*TUBGCP2*	2.38	9.86E-02	53	126
ENSG00000234618.1	*RPSAP9*	3.05	9.87E-02	6	19
ENSG00000187554.14	*TLR5*	-2.75	9.88E-02	16	6
ENSG00000149782.11	*PLCB3*	1.71	9.93E-02	119	204
ENSG00000196437.12	*ZNF569*	-1.54	9.93E-02	116	75
ENSG00000156411.9	*ATP5MPL*	1.68	9.96E-02	40	67
ENSG00000104164.11	*BLOC1S6*	-2.20	9.96E-02	49	22