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Supplemental Material to:

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Xenohormetic and anti-aging activity of secoiridoid polyphenols present in extra virgin olive oil: A new family of gerosuppressant agents

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Table 1. Gene transcripts differentially up-regulated (red) and down-regulated (green) in JIMT1 human breast cancer cells treated with the secoiridoids-rich EVOO-PE7 (2 μg/mL) for 6 h.

ID	Symbol	Entrez Gene Name	Fold Change
NM_005252	FOS	FBJ murine osteosarcoma viral oncogene homolog	20,027
NM_002422	MMP3	matrix metallopeptidase 3 (stromelysin 1, progelatinase)	17,034
NM_002166	ID2	inhibitor of DNA binding 2, dominant negative helix-loop-helix protein	16,740
NM_016084	RASD1	RAS, dexamethasone-induced 1	16,320
NM_002923	RGS2	regulator of G-protein signaling 2, 24kDa	15,296
NM_002155	HSPA6	heat shock 70kDa protein 6 (HSP70B')	15,182
NM_002421	MMP1	matrix metallopeptidase 1 (interstitial collagenase)	12,820
NM_001964	EGR1	early growth response 1	12,431
NM_015675	GADD45B	growth arrest and DNA-damage-inducible, beta	11,400
NM_006732	FOSB	FBJ murine osteosarcoma viral oncogene homolog B	11,064
NM_005985	SNAI1	snail homolog 1 (Drosophila)	9,328
NM_004024	ATF3	activating transcription factor 3	9,240
NM_182491	ZFAND2A	zinc finger, AN1-type domain 2A	7,763
NM_006705	GADD45G	growth arrest and DNA-damage-inducible, gamma	7,154
NM_052957	ACRC	acidic repeat containing	7,120
NM_001124	ADM	adrenomedullin	7,070
NM_000076	CDKN1C	cyclin-dependent kinase inhibitor 1C (p57, Kip2)	6,852
NM_004417	DUSP1	dual specificity phosphatase 1	6,611
NM_014330	PPP1R15A	protein phosphatase 1, regulatory (inhibitor) subunit 15A	6,260
NM_001901	CTGF	connective tissue growth factor	6,144
NM_018602	DNAJA4	DnaJ (Hsp40) homolog, subfamily A, member 4	6,120
NM_001965	EGR4	early growth response 4	5,885
NM_025237	SOST	sclerostin	5,817
NM_015193	ARC	activity-regulated cytoskeleton-associated protein	5,765
NM_005261	GEM	GTP binding protein overexpressed in skeletal muscle	5,731
NM_005618	DLL1	delta-like 1 (Drosophila)	5,673
NM_021127	PMAIP1	phorbol-12-myristate-13-acetate-induced protein 1	5,590
NR_003038	SNHG5	small nucleolar RNA host gene 5 (non-protein coding)	5,538

NM_002928	**RGS16**	regulator of G-protein signaling 16	5,480
NM_005168	**RND3**	Rho family GTPase 3	5,480
NM_003311	**PHLDA2**	pleckstrin homology-like domain, family A, member 2	5,013
BC001892	**C1ORF63**	chromosome 1 open reading frame 63	4,910
NM_005461	**MAFB**	v-maf musculoaponeurotic fibrosarcoma oncogene homolog B (avian)	4,753
NM_001924	**GADD45A**	growth arrest and DNA-damage-inducible, alpha	4,731
NM_013262	**MYLIP**	myosin regulatory light chain interacting protein	4,630
NM_007314	**ABL2**	v-abl Abelson murine leukemia viral oncogene homolog 2	4,567
NM_152608	**C1ORF55**	chromosome 1 open reading frame 55	4,516
NM_018088	**FAM90A1**	family with sequence similarity 90, member A1	4,500
NM_006889	**CD86**	CD86 molecule	4,403
NM_000584	**IL8**	interleukin 8	4,354
NM_005771	**DHRS9**	dehydrogenase/reductase (SDR family) member 9	4,318
AA593970	**MXD1**	MAX dimerization protein 1	4,318
NM_004165	**RRAD**	Ras-related associated with diabetes	4,310
NM_182597	**C7ORF53**	chromosome 7 open reading frame 53	4,245
NM_004083	**DDIT3**	DNA-damage-inducible transcript 3	4,225
NM_005853	**IRX5**	iroquois homeobox 5	4,205
NM_001300	**KLF6**	Kruppel-like factor 6	4,000
BC030138	**MED26**	mediator complex subunit 26	3,940
NM_014905	**GLS**	glutaminase	3,900
NM_000389	**CDKN1A**	cyclin-dependent kinase inhibitor 1A (p21, Cip1)	3,880
NM_006362	**NXF1**	nuclear RNA export factor 1	3,824
NM_018661	**DEFB103B**	defensin, beta 103B	3,813
NM_002970	**SAT1**	spermidine/spermine N1-acetyltransferase 1	3,790
NM_181726	**ANKRD37**	ankyrin repeat domain 37	3,778
NM_005842	**SPRY2**	sprouty homolog 2 (Drosophila)	3,771
NM_021724	**NR1D1**	nuclear receptor subfamily 1, group D, member 1	3,760
NM_006079	**CITED2**	Cbp/p300-interacting transactivator, with Glu/Asp-rich carboxy-terminal domain, 2	3,756
BC020539	**FNIP1**	folliculin interacting protein 1	3,751
NM_144660	**SAMD8**	sterile alpha motif domain containing 8	3,747
NM_013376	**SERTAD1**	SERTA domain containing 1	3,710
NM_013347	**RPA4**	replication protein A4, 30kDa	3,701
NM_004226	**STK17B**	serine/threonine kinase 17b	3,681
NM_012328	**DNAJB9**	DnaJ (Hsp40) homolog, subfamily B, member 9	3,655

NM_198833	**SERPINB8**	serpin peptidase inhibitor, clade B (ovalbumin), member 8	3,635
NM_003733	**OASL**	2'-5'-oligoadenylate synthetase-like	3,625
NM_138440	**VASN**	vasorin	3,622
NM_000565	**IL6R**	interleukin 6 receptor	3,597
NM_003749	**IRS2**	insulin receptor substrate 2	3,587
NM_000067	**CA2**	carbonic anhydrase II	3,492
NM_004561	**OVOL1**	ovo-like 1(Drosophila)	3,491
NM_004418	**DUSP2**	dual specificity phosphatase 2	3,490
AK128645	**SDCBP**	syndecan binding protein (syntenin)	3,384
NM_015000	**STK38L**	serine/threonine kinase 38 like	3,368
NM_001885	**CRYAB**	crystallin, alpha B	3,345
BC020867	**SLC6A13**	solute carrier family 6 (neurotransmitter transporter, GABA), member 13	3,340
NM_002130	**HMGCS1**	3-hydroxy-3-methylglutaryl-CoA synthase 1 (soluble)	3,340
NM_016270	**KLF2**	Kruppel-like factor 2 (lung)	3,331
NM_001005217	**FRG2**	FSHD region gene 2	3,318
NM_016569	**TBX3**	T-box 3	3,290
NM_014851	**KLHL21**	kelch-like 21 (Drosophila)	3,288
NM_025201	**PLEKHO2**	pleckstrin homology domain containing, family O member 2	3,254
NM_002357	**MXD1**	MAX dimerization protein 1	3,250
NM_012323	**MAFF**	v-maf musculoaponeurotic fibrosarcoma oncogene homolog F (avian)	3,250
NM_014007	**ZBTB43**	zinc finger and BTB domain containing 43	3,234
NM_183376	**ARRDC4**	arrestin domain containing 4	3,209
NM_004419	**DUSP5**	dual specificity phosphatase 5	3,202
NM_152621	**SGMS2**	sphingomyelin synthase 2	3,174
NM_017664	**ANKRD10**	ankyrin repeat domain 10	3,156
NM_024616	**C3ORF52**	chromosome 3 open reading frame 52	3,151
NM_012118	**CCRN4L**	CCR4 carbon catabolite repression 4-like (S. cerevisiae)	3,145
NM_012342	**BAMBI**	BMP and activin membrane-bound inhibitor homolog (Xenopus laevis)	3,137
NM_003811	**TNFSF9**	tumor necrosis factor (ligand) superfamily, member 9	3,090
NM_001514	**GTF2B**	general transcription factor IIB	3,084
NM_025195	**TRIB1**	tribbles homolog 1 (Drosophila)	3,080
NM_203339	**CLU**	clusterin	3,079
NR_002578	**GAS5**	growth arrest-specific 5 (non-protein coding)	3,076
NM_053044	**HTRA3**	HtrA serine peptidase 3	3,057
NM_004364	**CEBPA**	CCAAT/enhancer binding protein (C/EBP), alpha	3,050

NM_004071	CLK1	CDC-like kinase 1	3,050
NM_002133	HMOX1	heme oxygenase (decycling) 1	3,040
NM_001946	DUSP6	dual specificity phosphatase 6	3,032
NM_020177	FEM1C	fem-1 homolog c (C. elegans)	3,030
NM_000861	HRH1	histamine receptor H1	3,030
NM_198219	ING1	inhibitor of growth family, member 1	3,013
NM_002135	NR4A1	nuclear receptor subfamily 4, group A, member 1	2,973
NM_015472	WWTR1	WW domain containing transcription regulator 1	2,930
NM_001731	BTG1	B-cell translocation gene 1, anti-proliferative	2,914
NM_001008540	CXCR4	chemokine (C-X-C motif) receptor 4	2,910
NM_006572	GNA13	guanine nucleotide binding protein (G protein), alpha 13	2,906
NM_152407	GRPEL2	GrpE-like 2, mitochondrial (E. coli)	2,894
NM_003516	HIST2H2AA3	histone cluster 2, H2aa3	2,880
NM_020127	TUFT1	tuftelin 1	2,877
NM_024640	YRDC	yrdC domain containing (E. coli)	2,871
NM_001006641	SLC25A25	solute carrier family 25 (mitochondrial carrier; phosphate carrier), member 25	2,869
XM_942822	LOC646626	hypothetical LOC646626	2,865
NM_013370	OSGIN1	oxidative stress induced growth inhibitor 1	2,857
NM_002632	PGF	placental growth factor	2,855
NM_025090	USP36	ubiquitin specific peptidase 36	2,855
NM_198261	RSRC2	arginine/serine-rich coiled-coil 2	2,850
AY513723	NCRNA00275	non-protein coding RNA 275	2,847
NM_024512	LRRC2	leucine rich repeat containing 2	2,846
NM_152758	YTHDF3	YTH domain family, member 3	2,818
NM_153607	C5ORF41	chromosome 5 open reading frame 41	2,814
NM_005104	BRD2	bromodomain containing 2	2,810
NM_001945	HBEGF	heparin-binding EGF-like growth factor	2,810
NM_006096	NDRG1	N-myc downstream regulated 1	2,808
NM_018700	TRIM36	tripartite motif-containing 36	2,800
NM_022818	MAP1LC3B	microtubule-associated protein 1 light chain 3 beta	2,780
NM_003463	PTP4A1	protein tyrosine phosphatase type IVA, member 1	2,780
NM_005524	HES1	hairy and enhancer of split 1, (Drosophila)	2,760
NM_182527	CABP7	calcium binding protein 7	2,752
NM_021979	HSPA2	heat shock 70kDa protein 2	2,743
NM_000399	EGR2	early growth response 2	2,742

NM_002341	**LTB**	lymphotoxin beta (TNF superfamily, member 3)	2,739
NM_014423	**AFF4**	AF4/FMR2 family, member 4	2,724
NM_001353	**AKR1C1**	aldo-keto reductase family 1, member C1	2,690
NM_000364	**TNNT2**	troponin T type 2 (cardiac)	2,682
NM_021065	**HIST1H2AD**	histone cluster 1, H2ad	2,680
NM_000361	**THBD**	thrombomodulin	2,674
NM_001657	**AREG**	amphiregulin	2,672
NM_014504	**RABGEF1**	RAB guanine nucleotide exchange factor (GEF) 1	2,670
NM_016530	**RAB8B**	RAB8B, member RAS oncogene family	2,658
NM_012234	**RYBP**	RING1 and YY1 binding protein	2,640
NM_021958	**HLX**	H2.0-like homeobox	2,618
NM_006260	**DNAJC3**	DnaJ (Hsp40) homolog, subfamily C, member 3	2,614
NM_025054	**VCPIP1**	valosin containing protein (p97)/p47 complex interacting protein 1	2,614
NM_021960	**MCL1**	myeloid cell leukemia sequence 1 (BCL2-related)	2,606
NM_001547	**IFIT2**	interferon-induced protein with tetratricopeptide repeats 2	2,600
NM_002089	**CXCL2**	chemokine (C-X-C motif) ligand 2	2,597
NM_005527	**HSPA1L**	heat shock 70kDa protein 1-like	2,595
NM_001967	**EIF4A2**	eukaryotic translation initiation factor 4A2	2,590
NM_007207	**DUSP10**	dual specificity phosphatase 10	2,580
NM_004521	**KIF5B**	kinesin family member 5B	2,579
NM_002514	**NOV**	nephroblastoma overexpressed gene	2,570
NM_014650	**ZNF432**	zinc finger protein 432	2,561
NM_021052	**HIST1H2AE**	histone cluster 1, H2ae	2,554
NM_173198	**NR4A3**	nuclear receptor subfamily 4, group A, member 3	2,551
NM_001356	**DDX3X**	DEAD (Asp-Glu-Ala-Asp) box polypeptide 3, X-linked	2,550
NM_033027	**CSRNP1**	cysteine-serine-rich nuclear protein 1	2,548
NM_001172	**ARG2**	arginase, type II	2,546
NM_032717	**AGPAT9**	1-acylglycerol-3-phosphate O-acyltransferase 9	2,541
NM_018064	**AKIRIN2**	akirin 2	2,540
NM_001955	**EDN1**	endothelin 1	2,540
BC007524	**SPAG9**	sperm associated antigen 9	2,537
AB065089	**RPS2**	ribosomal protein S2	2,536
NM_004281	**BAG3**	BCL2-associated athanogene 3	2,530
NM_001007245	**IFRD1**	interferon-related developmental regulator 1	2,530
NM_020307	**CCNL1**	cyclin L1	2,520

BC063383	**LOC400573**	hypothetical LOC400573	2,516
BC022205	**SNHG12**	small nucleolar RNA host gene 12 (non-protein coding)	2,512
NM_001012971	**C20ORF106**	chromosome 20 open reading frame 106	2,507
NM_020857	**VPS18**	vacuolar protein sorting 18 homolog (S. cerevisiae)	2,501
NM_022780	**RMND5A**	required for meiotic nuclear division 5 homolog A (S. cerevisiae)	2,500
NM_005204	**MAP3K8**	mitogen-activated protein kinase kinase kinase 8	2,498
NM_023940	**RASL11B**	RAS-like, family 11, member B	2,494
NM_024116	**TAF1D**	TATA box binding protein (TBP)-associated factor, RNA polymerase I, D, 41kDa	2,492
NM_014220	**TM4SF1**	transmembrane 4 L six family member 1	2,491
NM_002539	**ODC1**	ornithine decarboxylase 1	2,489
NM_002192	**INHBA**	inhibin, beta A	2,473
NM_003407	**ZFP36**	zinc finger protein 36, C3H type, homolog (mouse)	2,472
NM_016449	**C22ORF43**	chromosome 22 open reading frame 43	2,472
NM_006988	**ADAMTS1**	ADAM metallopeptidase with thrombospondin type 1 motif, 1	2,470
NM_002229	**JUNB**	jun B proto-oncogene	2,470
NM_003842	**TNFRSF10B**	tumor necrosis factor receptor superfamily, member 10b	2,467
NM_030627	**CPEB4**	cytoplasmic polyadenylation element binding protein 4	2,460
NM_001730	**KLF5**	Kruppel-like factor 5 (intestinal)	2,460
NM_199188	**LARP4**	La ribonucleoprotein domain family, member 4	2,460
NM_013453	**SPANXA1**	sperm protein associated with the nucleus, X-linked, family member A1	2,460
NM_000641	**IL11**	interleukin 11	2,457
NM_021237	**SELK**	selenoprotein K	2,457
NM_032199	**ARID5B**	AT rich interactive domain 5B (MRF1-like)	2,450
NM_021963	**NAP1L2**	nucleosome assembly protein 1-like 2	2,436
NM_003411	**ZFY**	zinc finger protein, Y-linked	2,435
NM_012204	**GTF3C4**	general transcription factor IIIC, polypeptide 4, 90kDa	2,434
NM_004235	**KLF4**	Kruppel-like factor 4 (gut)	2,433
NM_005570	**LMAN1**	lectin, mannose-binding, 1	2,431
NM_183013	**CREM**	cAMP responsive element modulator	2,430
NM_003597	**KLF11**	Kruppel-like factor 11	2,420
NM_020435	**GJC2**	gap junction protein, gamma 2, 47kDa	2,418
NM_134260	**RORA**	RAR-related orphan receptor A	2,413
NM_206907	**PRKAA1**	protein kinase, AMP-activated, alpha 1 catalytic subunit	2,410
NM_006072	**CCL26**	chemokine (C-C motif) ligand 26	2,410
NM_001235	**SERPINH1**	serpin peptidase inhibitor, clade H (heat shock protein 47), member 1, (collagen binding protein 1)	2,409

NM_053067	**UBQLN1**	ubiquilin 1	2,400
NM_001621	**AHR**	aryl hydrocarbon receptor	2,398
NM_006718	**PLAGL1**	pleiomorphic adenoma gene-like 1	2,395
NM_022117	**TSPYL2**	TSPY-like 2	2,394
NM_019116	**UBFD1**	ubiquitin family domain containing 1	2,390
AK002097	**FLJ11235**	hypothetical FLJ11235	2,390
NM_139160	**DEPDC7**	DEP domain containing 7	2,388
NM_018948	**ERRFI1**	ERBB receptor feedback inhibitor 1	2,388
NM_033514	**LIMS3**	LIM and senescent cell antigen-like domains 3	2,387
NM_015428	**ZNF473**	zinc finger protein 473	2,383
NM_025040	**ZNF614**	zinc finger protein 614	2,381
NM_020354	**ENTPD7**	ectonucleoside triphosphate diphosphohydrolase 7	2,380
NM_002268	**KPNA4**	karyopherin alpha 4 (importin alpha 3)	2,380
BC036699	**LOC654433**	hypothetical LOC654433	2,372
NM_005126	**NR1D2**	nuclear receptor subfamily 1, group D, member 2	2,362
NM_032895	**C17ORF91**	chromosome 17 open reading frame 91	2,357
NM_001100	**ACTA1**	actin, alpha 1, skeletal muscle	2,355
NM_000640	**IL13RA2**	interleukin 13 receptor, alpha 2	2,352
NM_005066	**SFPQ**	splicing factor proline/glutamine-rich	2,350
NM_003359	**UGDH**	UDP-glucose 6-dehydrogenase	2,340
NM_003338	**UBE2D1**	ubiquitin-conjugating enzyme E2D 1 (UBC4/5 homolog, yeast)	2,338
NM_014931	**PPP6R1**	protein phosphatase 6, regulatory subunit 1	2,333
NM_020651	**PELI1**	pellino homolog 1 (Drosophila)	2,331
NM_173354	**SIK1**	salt-inducible kinase 1	2,330
NM_175065	**HIST2H2AB**	histone cluster 2, H2ab	2,326
NM_170744	**UNC5B**	unc-5 homolog B (C. elegans)	2,324
BC038983	**USP36**	ubiquitin specific peptidase 36	2,322
NM_021217	**ZNF77**	zinc finger protein 77	2,318
NM_006644	**HSPH1**	heat shock 105kDa/110kDa protein 1	2,315
NM_012325	**MAPRE1**	microtubule-associated protein, RP/EB family, member 1	2,314
NM_002448	**MSX1**	msh homeobox 1	2,311
NM_006033	**LIPG**	lipase, endothelial	2,311
NM_004831	**MED26**	mediator complex subunit 26	2,305
NM_007039	**PTPN21**	protein tyrosine phosphatase, non-receptor type 21	2,304
NM_001321	**CSRP2**	cysteine and glycine-rich protein 2	2,304

NM_003533	**HIST1H3I**	histone cluster 1, H3i	2,302
NM_003745	**SOCS1**	suppressor of cytokine signaling 1	2,300
NM_004093	**EFNB2**	ephrin-B2	2,299
NM_022041	**GAN**	gigaxonin	2,297
NM_032145	**FBXO30**	F-box protein 30	2,295
NM_015394	**ZNF10**	zinc finger protein 10	2,293
AK090405	**KDM4B**	lysine (K)-specific demethylase 4B	2,291
NM_015723	**PNPLA8**	patatin-like phospholipase domain containing 8	2,290
NM_003655	**CBX4**	chromobox homolog 4	2,289
AI570240	**ERRFI1**	ERBB receptor feedback inhibitor 1	2,289
NM_002041	**GABPB1**	GA binding protein transcription factor, beta subunit 1	2,283
NM_004241	**JMJD1C**	jumonji domain containing 1C	2,280
NM_017798	**YTHDF1**	YTH domain family, member 1	2,278
NM_004040	**RHOB**	ras homolog gene family, member B	2,276
AK023803	**ARF1**	ADP-ribosylation factor 1	2,276
NM_025209	**EPC1**	enhancer of polycomb homolog 1 (Drosophila)	2,270
NM_014587	**SOX8**	SRY (sex determining region Y)-box 8	2,265
NM_018445	**SELS**	selenoprotein S	2,264
NM_006086	**TUBB3**	tubulin, beta 3	2,260
NM_015247	**CYLD**	cylindromatosis (turban tumor syndrome)	2,246
NM_198077	**C1ORF52**	chromosome 1 open reading frame 52	2,241
NM_007350	**PHLDA1**	pleckstrin homology-like domain, family A, member 1	2,240
NM_018169	**C12ORF35**	chromosome 12 open reading frame 35	2,239
NM_145254	**TMEM170A**	transmembrane protein 170A	2,237
NM_032596	**C9ORF24**	chromosome 9 open reading frame 24	2,231
NM_019891	**ERO1LB**	ERO1-like beta (S. cerevisiae)	2,230
NM_000214	**JAG1**	jagged 1	2,227
NM_006322	**TUBGCP3**	tubulin, gamma complex associated protein 3	2,225
NM_152699	**SENP5**	SUMO1/sentrin specific peptidase 5	2,222
NR_002307	**MSX2P**	msh homeobox 2 pseudogene 1	2,222
AK090585	**SNHG7**	small nucleolar RNA host gene 7 (non-protein coding)	2,220
NM_019600	**KIAA1370**	KIAA1370	2,220
AI652920	**BAMBI**	BMP and activin membrane-bound inhibitor homolog (Xenopus laevis)	2,216
NM_004864	**GDF15**	growth differentiation factor 15	2,214
NM_025106	**SPSB1**	splA/ryanodine receptor domain and SOCS box containing 1	2,210

NM_002641	PIGA	phosphatidylinositol glycan anchor biosynthesis, class A	2,209
S72869	CCDC6	coiled-coil domain containing 6	2,209
NM_152829	TES	testis derived transcript (3 LIM domains)	2,205
NM_175839	SMOX	spermine oxidase	2,202
NM_001002233	RAB11FIP1	RAB11 family interacting protein 1 (class I)	2,199
NM_003629	PIK3R3	phosphoinositide-3-kinase, regulatory subunit 3 (gamma)	2,196
NM_024700	SNIP1	Smad nuclear interacting protein 1	2,192
NM_138800	TRIM43	tripartite motif-containing 43	2,191
NM_016006	ABHD5	abhydrolase domain containing 5	2,188
NM_206866	BACH1	BTB and CNC homology 1, basic leucine zipper transcription factor 1	2,186
NM_003537	HIST1H3B	histone cluster 1, H3b	2,183
NM_006832	FERMT2	fermitin family member 2	2,181
NM_000574	CD55	CD55 molecule, decay accelerating factor for complement (Cromer blood group)	2,180
NM_005345	HSPA1A	heat shock 70kDa protein 1A	2,180
NM_016120	RLIM	ring finger protein, LIM domain interacting	2,180
NM_015046	SETX	senataxin	2,180
NM_005994	TBX2	T-box 2	2,179
NM_144606	FLCN	folliculin	2,174
NM_004582	RABGGTB	Rab geranylgeranyltransferase, beta subunit	2,170
NM_032829	C12ORF34	chromosome 12 open reading frame 34	2,167
NM_022826	MARCH7	membrane-associated ring finger (C3HC4) 7	2,161
NM_024708	ASB7	ankyrin repeat and SOCS box-containing 7	2,160
NM_007034	DNAJB4	DnaJ (Hsp40) homolog, subfamily B, member 4	2,160
NM_005749	TOB1	transducer of ERBB2, 1	2,158
NM_006912	RIT1	Ras-like without CAAX 1	2,157
BG980953	SERPINH1	serpin peptidase inhibitor, clade H (heat shock protein 47), member 1, (collagen binding protein 1)	2,154
NM_004947	DOCK3	dedicator of cytokinesis 3	2,154
NM_017447	C21ORF91	chromosome 21 open reading frame 91	2,150
NM_194285	SPTY2D1	SPT2, Suppressor of Ty, domain containing 1 (S. cerevisiae)	2,149
NM_138459	NUS1	nuclear undecaprenyl pyrophosphate synthase 1 homolog (S. cerevisiae)	2,146
BU731317	HSPA8	heat shock 70kDa protein 8	2,146
NM_006504	PTPRE	protein tyrosine phosphatase, receptor type, E	2,145
NM_018143	KLHL11	kelch-like 11 (Drosophila)	2,144
NM_001032281	TFPI	tissue factor pathway inhibitor (lipoprotein-associated coagulation inhibitor)	2,144
NM_015092	SMG1	SMG1 homolog, phosphatidylinositol 3-kinase-related kinase (C. elegans)	2,144

NM_005238	**ETS1**	v-ets erythroblastosis virus E26 oncogene homolog 1 (avian)	2,142
NM_003622	**PPFIBP1**	PTPRF interacting protein, binding protein 1 (liprin beta 1)	2,141
NM_015683	**ARRDC2**	arrestin domain containing 2	2,140
NM_006007	**ZFAND5**	zinc finger, AN1-type domain 5	2,140
NM_017633	**FAM46A**	family with sequence similarity 46, member A	2,139
NM_004420	**DUSP8**	dual specificity phosphatase 8	2,139
NM_012421	**RLF**	rearranged L-myc fusion	2,138
NM_005156	**ROD1**	ROD1 regulator of differentiation 1 (S. pombe)	2,137
CR622681	**FLJ43663**	hypothetical LOC378805	2,137
NM_007076	**FICD**	FIC domain containing	2,137
NM_006186	**NR4A2**	nuclear receptor subfamily 4, group A, member 2	2,132
NM_012238	**SIRT1**	sirtuin 1	2,130
NM_001005464	**HIST2H3A**	histone cluster 2, H3a	2,130
NM_015277	**NEDD4L**	neural precursor cell expressed, developmentally down-regulated 4-like	2,130
NM_006241	**PPP1R2**	protein phosphatase 1, regulatory (inhibitor) subunit 2	2,130
NM_006425	**SLU7**	SLU7 splicing factor homolog (S. cerevisiae)	2,128
NM_015161	**ARL6IP1**	ADP-ribosylation factor-like 6 interacting protein 1	2,128
NM_012110	**CHIC2**	cysteine-rich hydrophobic domain 2	2,127
NM_133496	**SLC30A7**	solute carrier family 30 (zinc transporter), member 7	2,126
NM_000958	**PTGER4**	prostaglandin E receptor 4 (subtype EP4)	2,125
NM_014997	**KLHDC10**	kelch domain containing 10	2,125
NM_004405	**DLX2**	distal-less homeobox 2	2,123
NM_181453	**GCC2**	GRIP and coiled-coil domain containing 2	2,120
NM_005054	**RGPD5**	RANBP2-like and GRIP domain containing 5	2,117
NM_152718	**VWCE**	von Willebrand factor C and EGF domains	2,113
NM_015866	**PRDM2**	PR domain containing 2, with ZNF domain	2,111
NM_033083	**EAF1**	ELL associated factor 1	2,110
NM_004429	**EFNB1**	ephrin-B1	2,110
NM_020801	**ARRDC3**	arrestin domain containing 3	2,109
BC000527	**EWSR1**	Ewing sarcoma breakpoint region 1	2,103
NM_012257	**HBP1**	HMG-box transcription factor 1	2,099
NM_014395	**DAPP1**	dual adaptor of phosphotyrosine and 3-phosphoinositides	2,098
NM_017548	**CDV3**	CDV3 homolog (mouse)	2,098
NM_001008394	**EID3**	EP300 interacting inhibitor of differentiation 3	2,097
NM_032417	**SPANXD**	SPANX family, member D	2,094

NM_152342	CDYL2	chromodomain protein, Y-like 2	2,094
NM_016040	TMED5	transmembrane emp24 protein transport domain containing 5	2,093
NM_003534	HIST1H3G	histone cluster 1, H3g	2,091
NM_000331	SAA1	serum amyloid A1	2,091
NM_032793	MFSD2A	major facilitator superfamily domain containing 2A	2,088
NM_001011713	NAA30	N(alpha)-acetyltransferase 30, NatC catalytic subunit	2,085
NM_020933	ZNF317	zinc finger protein 317	2,083
NM_173582	PGM2L1	phosphoglucomutase 2-like 1	2,081
NM_020119	ZC3HAV1	zinc finger CCCH-type, antiviral 1	2,080
NM_015368	PANX1	pannexin 1	2,080
NM_032228	FAR1	fatty acyl CoA reductase 1	2,080
NM_002852	PTX3	pentraxin 3, long	2,080
NM_018456	EAF2	ELL associated factor 2	2,079
NM_006577	B3GNT2	UDP-GlcNAc:betaGal beta-1,3-N-acetylglucosaminyltransferase 2	2,079
NM_001040440	CCDC112	coiled-coil domain containing 112	2,078
X90978	RUNX1	runt-related transcription factor 1	2,075
NM_002184	IL6ST	interleukin 6 signal transducer (gp130, oncostatin M receptor)	2,074
NM_006509	RELB	v-rel reticuloendotheliosis viral oncogene homolog B	2,073
NM_014999	RAB21	RAB21, member RAS oncogene family	2,073
NM_144653	NACC2	NACC family member 2, BEN and BTB (POZ) domain containing	2,068
NM_017709	FAM46C	family with sequence similarity 46, member C	2,067
NM_002090	CXCL3	chemokine (C-X-C motif) ligand 3	2,067
NM_013360	ZNF222	zinc finger protein 222	2,065
AK125902	QSER1	glutamine and serine rich 1	2,059
NM_016379	VCX3A	variable charge, X-linked 3A	2,059
NM_002061	GCLM	glutamate-cysteine ligase, modifier subunit	2,056
NM_013452	VCX	variable charge, X-linked	2,056
NM_003531	HIST1H3C	histone cluster 1, H3c	2,054
NM_016378	VCX2	variable charge, X-linked 2	2,053
NM_004926	ZFP36L1	zinc finger protein 36, C3H type-like 1	2,049
BC011923	RBM33	RNA binding motif protein 33	2,049
NM_015878	AZIN1	antizyme inhibitor 1	2,044
NR_003098	SNHG1	small nucleolar RNA host gene 1 (non-protein coding)	2,042
NM_020414	DDX24	DEAD (Asp-Glu-Ala-Asp) box polypeptide 24	2,040
NM_178815	ARL5B	ADP-ribosylation factor-like 5B	2,040

NM_021599	**ADAMTS2**	ADAM metallopeptidase with thrombospondin type 1 motif, 2	2,040
NM_002065	**GLUL**	glutamate-ammonia ligase	2,039
NM_138771	**CCDC126**	coiled-coil domain containing 126	2,038
NM_002167	**ID3**	inhibitor of DNA binding 3, dominant negative helix-loop-helix protein	2,038
NM_001197	**BIK**	BCL2-interacting killer (apoptosis-inducing)	2,038
NM_006275	**SRSF6**	serine/arginine-rich splicing factor 6	2,036
NM_032505	**KBTBD8**	kelch repeat and BTB (POZ) domain containing 8	2,036
NM_005078	**TLE3**	transducin-like enhancer of split 3 (E(sp1) homolog, Drosophila)	2,036
NM_182580	**CYB561D1**	cytochrome b-561 domain containing 1	2,034
NM_203411	**TMEM88**	transmembrane protein 88	2,032
NM_003290	**TPM4**	tropomyosin 4	2,030
NM_018047	**RBM22**	RNA binding motif protein 22	2,030
NM_007355	**HSP90AB1**	heat shock protein 90kDa alpha (cytosolic), class B member 1	2,027
NM_015633	**FGFR1OP2**	FGFR1 oncogene partner 2	2,026
NM_032315	**SLC25A33**	solute carrier family 25, member 33	2,026
NM_003799	**RNMT**	RNA (guanine-7-) methyltransferase	2,022
NM_003921	**BCL10**	B-cell CLL/lymphoma 10	2,022
NM_020390	**EIF5A2**	eukaryotic translation initiation factor 5A2	2,021
NM_001025366	**VEGFA**	vascular endothelial growth factor A	2,020
NM_016605	**FAM53C**	family with sequence similarity 53, member C	2,020
NM_144975	**SLFN5**	schlafen family member 5	2,018
NM_058241	**CCNT2**	cyclin T2	2,018
NM_024018	**BTN2A3**	butyrophilin, subfamily 2, member A3	2,018
BF475893	**TRIB1**	tribbles homolog 1 (Drosophila)	2,015
NM_014701	**SECISBP2L**	SECIS binding protein 2-like	2,013
NM_005470	**ABI1**	abl-interactor 1	2,010
NM_003543	**HIST1H4H**	histone cluster 1, H4h	2,009
NM_005335	**HCLS1**	hematopoietic cell-specific Lyn substrate 1	2,008
NM_004907	**IER2**	immediate early response 2	2,007
NM_001558	**IL10RA**	interleukin 10 receptor, alpha	2,006
NM_002359	**MAFG**	v-maf musculoaponeurotic fibrosarcoma oncogene homolog G (avian)	2,005
NM_021968	**HIST1H4J**	histone cluster 1, H4j	2,004
NM_020755	**SERINC1**	serine incorporator 1	2,004
NM_058229	**FBXO32**	F-box protein 32	2,002
NM_021945	**SLC22A23**	solute carrier family 22, member 23	2,001

NM_005266	**GJA5**	gap junction protein, alpha 5, 40kDa	-2,002
NM_002764	**PRPS1**	phosphoribosyl pyrophosphate synthetase 1	-2,003
NM_182513	**SPC24**	SPC24, NDC80 kinetochore complex component, homolog (S. cerevisiae)	-2,005
NM_021824	**NIF3L1**	NIF3 NGG1 interacting factor 3-like 1 (S. pombe)	-2,008
NM_020190	**OLFML3**	olfactomedin-like 3	-2,012
NM_032015	**RNF26**	ring finger protein 26	-2,014
NM_032637	**SKP2**	S-phase kinase-associated protein 2 (p45)	-2,017
NM_021643	**TRIB2**	tribbles homolog 2 (Drosophila)	-2,019
CR594281	**METTL3**	methyltransferase like 3	-2,024
NM_005502	**ABCA1**	ATP-binding cassette, sub-family A (ABC1), member 1	-2,025
NM_032831	**ORAI2**	ORAI calcium release-activated calcium modulator 2	-2,029
NM_005374	**MPP2**	membrane protein, palmitoylated 2 (MAGUK p55 subfamily member 2)	-2,036
NM_002034	**FUT5**	fucosyltransferase 5 (alpha (1,3) fucosyltransferase)	-2,037
NM_003119	**SPG7**	spastic paraplegia 7 (pure and complicated autosomal recessive)	-2,040
NM_006455	**LEPREL4**	leprecan-like 4	-2,041
NM_005576	**LOXL1**	lysyl oxidase-like 1	-2,046
NM_198580	**SLC27A1**	solute carrier family 27 (fatty acid transporter), member 1	-2,048
NM_000481	**AMT**	aminomethyltransferase	-2,048
NM_152308	**C16ORF75**	chromosome 16 open reading frame 75	-2,050
NM_005951	**MT1H**	metallothionein 1H	-2,050
NM_022167	**XYLT2**	xylosyltransferase II	-2,057
BC004287	**ZNF704**	zinc finger protein 704	-2,061
NM_021137	**TNFAIP1**	tumor necrosis factor, alpha-induced protein 1 (endothelial)	-2,064
NM_173508	**SLC35F3**	solute carrier family 35, member F3	-2,064
AF495725	**SLC25A37**	solute carrier family 25, member 37	-2,067
NM_030641	**APOL6**	apolipoprotein L, 6	-2,069
NM_006876	**B3GNT1**	UDP-GlcNAc:betaGal beta-1,3-N-acetylglucosaminyltransferase 1	-2,073
NM_004990	**MARS**	methionyl-tRNA synthetase	-2,087
NM_014897	**ZNF652**	zinc finger protein 652	-2,089
NM_000190	**HMBS**	hydroxymethylbilane synthase	-2,090
NM_207446	**FAM174B**	family with sequence similarity 174, member B	-2,103
NM_021198	**CTDSP1**	CTD (carboxy-terminal domain, RNA polymerase II, polypeptide A) small phosphatase 1	-2,107
NM_145294	**WDR90**	WD repeat domain 90	-2,119
NR_002791	**EMX2OS**	EMX2 opposite strand (non-protein coding)	-2,121
NM_138375	**CABLES1**	Cdk5 and Abl enzyme substrate 1	-2,125

NM_032854	**CORO6**	coronin 6	-2,127
AK098787	**PLEKHA2**	pleckstrin homology domain containing, family A (phosphoinositide binding specific) member 2	-2,135
NM_004613	**TGM2**	transglutaminase 2 (C polypeptide, protein-glutamine-gamma-glutamyltransferase)	-2,140
NM_000930	**PLAT**	plasminogen activator, tissue	-2,140
NM_017712	**PGPEP1**	pyroglutamyl-peptidase I	-2,142
NM_006113	**VAV3**	vav 3 guanine nucleotide exchange factor	-2,145
AK023606	**ADAMTSL4**	ADAMTS-like 4	-2,146
NM_001567	**INPPL1**	inositol polyphosphate phosphatase-like 1	-2,148
NM_000149	**FUT3**	fucosyltransferase 3 (galactoside 3(4)-L-fucosyltransferase, Lewis blood group)	-2,159
NM_057161	**KLHDC3**	kelch domain containing 3	-2,160
NM_181832	**NF2**	neurofibromin 2 (merlin)	-2,163
NM_005952	**MT1X**	metallothionein 1X	-2,170
NM_176798	**P2RY6**	pyrimidinergic receptor P2Y, G-protein coupled, 6	-2,178
NM_005325	**HIST1H1A**	histone cluster 1, H1a	-2,179
NM_005479	**FRAT1**	frequently rearranged in advanced T-cell lymphomas	-2,179
NM_138370	**PKDCC**	protein kinase domain containing, cytoplasmic homolog (mouse)	-2,182
NM_175617	**MT1E**	metallothionein 1E	-2,192
NM_005434	**MALL**	mal, T-cell differentiation protein-like	-2,192
NM_032883	**TOX2**	TOX high mobility group box family member 2	-2,194
NM_175709	**CBX7**	chromobox homolog 7	-2,194
X97261	**MT1L**	metallothionein 1L (gene/pseudogene)	-2,206
AL359605	**LOC100131199**	transmembrane protein 178-like	-2,211
NM_018205	**LRRC20**	leucine rich repeat containing 20	-2,228
NM_002692	**POLE2**	polymerase (DNA directed), epsilon 2 (p59 subunit)	-2,237
NM_138768	**MYEOV**	myeloma overexpressed (in a subset of t(11;14) positive multiple myelomas)	-2,241
NM_001874	**CPM**	carboxypeptidase M	-2,250
NM_001039651	**C6ORF26**	chromosome 6 open reading frame 26	-2,254
NM_005322	**HIST1H1B**	histone cluster 1, H1b	-2,272
NM_005397	**PODXL**	podocalyxin-like	-2,274
NM_005947	**MT1B**	metallothionein 1B	-2,304
NM_001001522	**TAGLN**	transgelin	-2,309
NM_000693	**ALDH1A3**	aldehyde dehydrogenase 1 family, member A3	-2,309
AK056534	**LOC145757**	hypothetical LOC145757	-2,314

NM_001067	**TOP2A**	topoisomerase (DNA) II alpha 170kDa	-2,317
NM_005730	**CTDSP2**	CTD (carboxy-terminal domain, RNA polymerase II, polypeptide A) small phosphatase 2	-2,323
NM_005950	**MT1G**	metallothionein 1G	-2,326
NM_000674	**ADORA1**	adenosine A1 receptor	-2,359
NM_005071	**SLC1A6**	solute carrier family 1 (high affinity aspartate/glutamate transporter), member 6	-2,368
NM_015346	**ZFYVE26**	zinc finger, FYVE domain containing 26	-2,370
NM_017637	**BNC2**	basonuclin 2	-2,411
NM_000430	**PAFAH1B1**	platelet-activating factor acetylhydrolase 1b, regulatory subunit 1 (45kDa)	-2,449
NM_018706	**DHTKD1**	dehydrogenase E1 and transketolase domain containing 1	-2,522
NM_153840	**GPR110**	G protein-coupled receptor 110	-2,611
NM_032865	**TNS4**	tensin 4	-2,686
AK022110	**GPX8**	glutathione peroxidase 8 (putative)	-2,695
NM_005566	**LDHA**	lactate dehydrogenase A	-2,716
AK095678	**LOC151009**	hypothetical LOC151009	-2,745
NM_015035	**ZHX3**	zinc fingers and homeoboxes 3	-2,818
NM_002318	**LOXL2**	lysyl oxidase-like 2	-3,160

Table 2. Significantly over-represented biological processes in the whole transcriptome signature of EVOO secoiridoids-treated human breast cancer cells

Gene Expression	Significantly Over-represented BIOLOGICAL PROCESS	ES
Down-regulated		
EVOO-PE7	Hexose Catabolic Process	1.63
	Cell Cycle (M phase)	1.30
	Cellular Component Assembly	1.20
	Cellular Metabolic Process	1.05
	Cellular Carbohydrate Metabolic Process	1.00
	Regulation of Cell Adhesion	1.00
	DNA Metabolic Process	1.00
Up-regulated		
EVOO-PE7	Developmental Process	9.16
	Positive Regulation of Biological Process	8.17
	Biological Regulation (Regulation of Gene Expression)	7.68
	Biopolymer Metabolic Process	7.16
	Negative Regulation of Biological Process (Transcription)	6.68
	Response to Stress	6.33
	Regulation of Cell Cycle	6.17
	Organ Morphogenesis	5.73
	Response to Chemical Stimulus (Unfolded Protein)	5.31
	Regulation of Cell Differentiation (Hemopoiesis)	3.87
	Regulation of Biological Quality (Cell Growth/Cell Size)	3.62
	Positive Regulation of Metabolic Process (Transcription)	3.41
	Regulation of a Molecular Function (MAP Kinase Activity)	3.04
	Regulation of Apoptosis (Induction of Cell Death)	2.73
	Response to Wounding	2.59
	Embrionic Pattern Specification (Tube Development)	2.53
	Chromatin Assembly	2.45
	Muscle Development (Myoblast Differentiation)	2.34
	Nitric Oxide Biosynthetic Process	2.34
	Signal Transduction	2.14
	Post-Translational Protein Modification (Ubiquitin)	2.09
	Reproduction (Gamete Generation)	1.98
	Embrionic Pattern Specification (Cell Fate Commitment)	1.85
	Tissue Development (Epidermis)	1.84
	Tube Development (Lung)	1.74
	Regulation of Body Fluid Levels (Hemostasis)	1.72
	Lymphocyte Differentiation (T cell activation)	1.58
	Mast Cell Cytokine Production	1.57
	Cell Migration	1.56
	Cell Activation (B cell activation)	1.48
	Protein Ubiquitination	1.37
	Skeletal Development (Bone Remodeling)	1.28
	Negative Regulation of Phosphorylation (Lymphocyte Activation)	1.27
	Inflammatory Response	1.09
	Protein Digestion (Collagen Catabolic Process)	1.07
	Negative Regulation of Hormone Secretion	1.06
	mRNA Metabolic Process	1.00
	Polyamine Metabolic Process	1.00

DAVID (Database for Annotation, Visualization and Integrated Discovery) provides tools and statistical methods for discovering enriched processes and pathways within diverse and disparate gene lists. We used the DAVID functional annotation tool, which provides Gene Ontology (GO) term enrichment analysis, to highlight the most relevant GO terms associated with the gene list generated by treatment of JIMT1 breast cancer cells with EVOO secoiridoids. We used extended annotation coverage that not only included GO terms but also protein-protein interactions, disease associations, bio-pathways, gene functional summaries, gene tissue expression, and relevant literature. Gene functional classifications of EVOO secoiridoid-responsive gene expression changes in human breast cancer cells were evaluated in terms of enrichment scores (for each gene cluster), which were calculated as the geometric mean of all the enrichment p-values (EASE [ES] scores) for each annotation term associated with the gene members in the group. The geometric mean is a relative score instead of an absolute p-value, and therefore, minus log transformation is applied on the average p-values. A higher score for a group indicates that the gene members in the group are involved in more important (enriched) terms and, consequently, more attention should be given to them. An enrichment score of 1.3 is equivalent to non-log scale 0.5. Thus, more attention should be given to groups with scores ≥1.3.