

Supplemental Material
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Table S1: Genes significantly regulated by chronic morphine in the mouse LC

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
100690_at	1.25	5E-07	M69200:Tyrosine hydroxylase
100407_at	1.2	3.5E-06	L38580:Galanin
99840_at	1.2	0.00005	AF026537:Mus musculus prodynorphin mRNA
97890_at	0.95	0	AW046181:serum/glucocorticoid regulated kinase, sgk
97458_at	0.65	0.002232	AI845935: karyopherin (importin) alpha 6, kpna6
101975_at	0.55	0.00009	Z12171:Dlk1-like homolog (Drosophila)
100600_at	0.55	0.001337	M58661:CD24a antigen
93797_g_at	0.45	0.001192	AW123952:ATPase, Na+/K+ transporting, alpha 1
93573_at	0.35	0.000251	V00835:Metallothionein 1
103460_at	0.35	0.00014	AI849939: HIF-1 responsive RTP801
94781_at	0.35	0.00078	V00714:Hemoglobin alpha, adult chain 1
97681_f_at	0.3	0.002233	J03953:Mouse, glutathione transferase GT9.3
93078_at	0.3	0.003476	X04653:Mouse mRNA for Ly-6 alloantigen (Ly-6E.1)
<i>Downregulated genes</i>			
96041_at	-1.1	0.999996	AB016424:Mus musculus rbm3 mRNA
99401_at	-1	0.998717	Y10725:M.musculus mRNA for protein kinase KIS

99425_at	-0.7	0.998179	X07888:M.musculus HMGCR gene
162171_f_at	-0.6	0.999738	AV363696:fibroblast growth factor receptor 2
97867_at	-0.5	0.999996	X83202:11beta-HSD1A
92899_at	-0.45	0.99999	D42051:Glutamate Decarboxylase
92944_at	-0.45	0.995825	AW048549:RIKEN cDNA 2900051M01 gene
97124_at	-0.45	0.99949	U42384:Fibroblast growth factor inducible 15
93005_at	-0.4	0.999674	D37792:Synaptotagmin 1
93994_at	-0.4	0.999826	AW212131:synaptonemal complex protein 3
102703_s_at	-0.4	0.999732	U48398:Aquaporin 4
99098_at	-0.3	0.996605	AW045533:farnesyl diphosphate synthetase, Fdps
100979_at	-0.3	0.994708	AW209763:Trif gene (zn finger protein)

Table S2: Genes significantly regulated by morphine withdrawal in the mouse LC

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
100690_at	1.25	5E-07	M69200:Tyrosine hydroxylase
160564_at	1	0.000428	X81627:M.musculus 24p3 gene, lipocalin2
94144_g_at	1	0	X02801:Glial fibrillary acidic protein
94297_at	0.85	0.000696	U16959:FK506 binding protein 5, 51 kDa
94143_at	0.8	0.000533	X02801:Glial fibrillary acidic protein
100407_at	0.75	0.000737	L38580:Galanin
93803_at	0.75	4.25E-05	AB007139:Psme3 gene for PA28 gamma subunit
100946_at	0.7	0.000046	AF109906:Mus musculus Heat shock protein 1B
92358_at	0.7	0.000422	U59230:Mus musculus mel (MEL91), nel-like 2 homolog
101975_at	0.65	0.000789	Z12171:Dlk1-like homolog (Drosophila)
103602_at	0.65	0.000351	D10210:Mus musculus Dao-1d, D-amino-acid oxidase
92180_at	0.6	0.001603	AI851599:EST
160362_at	0.6	5.75E-05	AW124835: methionine adenosyltransferase II, alpha
92202_g_at	0.55	0.003221	AI553024:EST sim. to promyelocyte leukemia Zn finger
92925_at	0.55	0.001217	M61007:CCAAT/enhancer binding protein (C/EBP), beta
96747_at	0.55	0.000008	AW121294:ras homolog gene family member U Arhu
160903_at	0.55	0.00146	U70210:TR2L, amyloid beta (A4) precursor protein-binding
94833_at	0.55	0.00005	M91380:Follistatin-like
162332_f_at	0.55	3.95E-05	AV091649: EST
97160_at	0.45	0.00005	X04017:cysteine-rich glycoprotein SPARC
100633_at	0.45	0.000112	AW124268:riken cDNA 2810484M10
101357_at	0.45	1.05E-05	X14971:Mouse mRNA for alpha-adaptin (A) Ap2a1
102636_at	0.45	0.002981	AF055666:Kinesin light chain 2

93285_at	0.45	1.05E-05	AI845584: dual specificity phosphatase 6
95340_at	0.45	0.000005	M93310:Mouse metallothionein-III gene
96254_at	0.45	0.000316	AB028272:hsp40 mRNA for heat shock protein 40
96953_at	0.45	0.00113	AW120786: chemokine (C-X-C motif) ligand 14 Cxcl14
101947_at	0.45	0.00464	AB028921:Mus musculus mRNA for NAKAP95
93134_at	0.45	0.003979	U62021:Neuronal pentraxin 1
93664_at	0.45	0.00094	X16645:Mouse mRNA for glial cell adhesion molecule
96677_at	0.45	0.000194	AI849566:RIKEN cDNA 2410195B05
96679_at	0.45	0.000117	AW120711: DnaJ (Hsp40) homolog subfamily B, member 9
93573_at	0.45	0.000347	V00835:Metallothionein 1
93976_at	0.4	0.000054	AI836686:calcium binding protein Cab39
99469_at	0.4	0.00645	AW121865: Pex6 peroxisomal biogenesis factor 6
104368_at	0.4	0.000062	U51204:Mus musculus APC-binding protein EB2
94161_at	0.4	0.000886	AF028009:Mus musculus protein kinase C epsilon (Pkcea)
96811_at	0.4	0.001131	AW049806:RIKEN cDNA 1700093E07
97387_at	0.4	0.00019	AI847879:DNA segment Chr 1 D1Bwg1363e
103900_at	0.35	0.003613	AW124150: centaurin, gamma 3, Centg3
104137_at	0.35	0.001677	X75927:ATP-binding cassette 2, Abca2
95036_at	0.35	0.001136	X73985:M.musculus mRNA for calretinin, calbindin 2
95040_at	0.35	0.000356	AI840810: programmed cell death 6 interacting protein
93078_at	0.35	0.000136	X04653:Mouse mRNA for Ly-6 alloantigen (Ly-6E.1)
99160_s_at	0.35	0.000004	AW227647:RIKEN cDNA 1110025J15
99161_at	0.35	1.75E-05	AI843359:RIKEN cDNA 1110025J15
101561_at	0.35	0.002749	K02236:Metallothionein 2
93875_at	0.3	0.013339	M12571:Heat shock protein, 70 kDa
100026_at	0.3	0.003065	U42443:Mus musculus MECA39 mRNA, Bcat1
102305_at	0.3	0.000712	AB016602:G-protein coupled receptor 37-like 1
102856_at	0.3	0.001591	AF047389:SRY-box containing gene 10, sox10
93496_at	0.3	0.001496	AI852098:RIKEN cDNA 1110059L23
98451_at	0.3	0.003222	AI843164: DnaJ (Hsp40) homolog, subfamily B, member 10

Downregulated genes

96041_at	-1.15	1	AB016424:rbm3, RNA binding motif protein 3
98967_at	-1	0.999999	U04827:brain fatty acid-binding protein (B-FABP) 7
X57349_5_at	-0.7	0.999708	X57349 M.musculus mRNA for transferrin receptor
160841_at	-0.6	0.999246	AW047343: D site albumin promoter binding protein Dbp
92558_at	-0.6	0.999986	M84487:Vascular cell adhesion molecule 1
92770_at	-0.55	0.996601	X66449:Calcyclin S100 calcium binding protein A6
97124_at	-0.55	0.999938	U42384:Fibroblast growth factor inducible 15
97560_at	-0.55	0.999992	AF037437:prosaposin gene, promoter and exon 1
102703_s_at	-0.55	0.999767	U48398:Aquaporin 4
160614_at	-0.55	0.998408	U92437:Phosphatase and tensin homolog
103550_at	-0.5	0.996662	U32329:Endothelin receptor type B
102696_s_at	-0.5	0.996968	AI747899:phosphatidylinositol transfer protein beta
92341_at	-0.5	0.996949	AF029791:b3GT2 gene
102768_i_at	-0.5	0.996937	AB016248:sterol-C5-desaturase
103550_at	-0.5	0.996662	U32329:Endothelin receptor type B
102768_i_at	-0.5	0.996905	AB016248:sterol-C5-desaturase
94854_g_at	-0.5	0.999876	U29055:Guanine nucleotide binding protein, beta 1
95661_at	-0.45	0.999994	L08115:CD9 antigen
94325_at	-0.45	0.995817	AW124932:3-hydroxy-3-methylglutaryl-CoenzA synthase 1
99098_at	-0.4	0.99999	AW045533: farnesyl diphosphate synthetase, Fdps
97948_at	-0.4	0.995486	M26391:Retinoblastoma 1
93090_at	-0.4	0.998407	M23362:Fibroblast growth factor receptor 2
92943_at	-0.4	0.988646	X57497:Glutamate receptor, ionotropic, AMPA1 (alpha 1)
93918_at	-0.35	0.994912	AA673500: TAF9 RNA polymerase II, (TBP)- factor 32 kDa
94853_at	-0.3	0.997888	U29055:Guanine nucleotide binding protein, beta 1

Table S3: Genes significantly regulated by chronic morphine in the rat LC

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
Z75029_s_at	1.9	0.000154	Z75029 R.norvegicus hsp70.2 mRNA for heat shock protein 70
rc_AA892801_at	1.85	0.000157	rc_AA892801 EST196604 eukaryotic translation elongation factor 2, Eef2
Y12517cnds_at	1.4	0.000385	Y12517cnds RNOMB5MIT mitochondrial isoform of cytochrome b5
J03624_at	1.2	0.000015	J03624 Rat galanin (a neuropeptide)
X60468mRNA_s_at	1.2	5.75E-05	X60468mRNA RRFE65G FE65 gene for adaptor protein
rc_AA892012_g_at	1.15	8.45E-05	rc_AA892012 EST195815 glutamate oxaloacetate transaminase 2
M10244_at	1.1	0.000002	M10244 Rat tyrosine hydroxylase mRNA
U81518_at	1.1	0.000332	U81518 urea transporter (UT3) mRNA solute carrier family 14, member 1
M74494_g_at	1.05	5E-07	M74494 Rat sodium/potassium ATPase alpha-1 subunit truncated isoform
AF028784cnds#1_s_at	1	5E-07	AF028784cnds#1 glial fibrillary acidic protein alpha (GFAP) gene
D90048exon_g_at	1	0.001715	D90048exon RATATPB2S Rat Na ⁺ , K ⁺ -ATPase (EC 3.6.1.3) beta2 subunit
rc_AA818970_s_at	1	5E-07	rc_AA818970 endothelin receptor type B
rc_AA875327_at	1	0.000001	rc_AA875327 EST similar to nucleolin-related protein NRP
S81353_s_at	1	0.000002	S81353 sulfated glycoprotein-1 prosaposin
L12407_at	0.95	2.95E-05	L12407 Rattus norvegicus dopamine beta-hydroxylase mRNA
rc_AI043796_s_at	0.95	0	rc_AI043796 solute carrier family 18, member 2, vesicular monoamine transporter
M24104_at	0.9	0.000001	M24104 Rat vesicle associated membrane protein (VAMP-1)
rc_AA892801_g_at	0.9	3.5E-06	rc_AA892801 EST196604 eukaryotic translation elongation factor 2, Eef2
AF093569mRNA#1_s_at	0.85	0.000211	AF093569mRNA#1 XLas protein (XLas) gene, partial cds; and unknown gene
D21869_s_at	0.85	0.000086	D21869 RATPFKM04 Rat mRNA for PKF-M (phosphofructokinase-M)
rc_AA818403_at	0.85	0.005668	rc_AA818403 EST similar to cytochrome P450 4F5 (CYP4F5)

L00603_at	0.8	0	L00603 Rat vesicular monoamine transporter mRNA solute carrier family 18, member 2
M24104_g_at	0.75	0.000832	M24104 Rat vesicle associated membrane protein (VAMP-1)
U20643mRNA#2_f_at	0.75	0.000342	U20643mRNA#2 RNU20643 Rattus norvegicus aldolase A gene
AB016161UTR#1_g_at	0.7	0.000167	AB016161UTR#1 Rattus norvegicus mRNA for GABAB receptor 1d
M32167_g_at	0.7	0.000288	M32167 Rat glioma-derived vascular endothelial cell growth factor mRNA
M58364_at	0.7	0.00035	M58364 Rat GTP cyclohydrolase I mRNA
rc_AA924326_s_at	0.65	4.5E-06	rc_AA924326 aldolase A
rc_AI231445_at	0.65	0.000017	rc_AI231445 EST228133 unr protein
M84648mRNA_s_at	0.6	0.000067	M84648mRNA RATAADC01 aromatic L-amino acid decarboxylase gene
AB016160_at	0.6	0	AB016160 Rattus norvegicus mRNA for GABAB receptor 1c
X63375exon_at	0.6	0.000255	X63375exon RRB1NKATP R.rattus gene for beta-1 subunit of Na,K-ATPase
E05646cds_s_at	0.55	0.003576	E05646cds cDNA encoding rat hippocampal cholinergic neurostimulating peptide,HCNP
L11930_at	0.55	0.000031	L11930 Rattus norvegicus cyclase-associated protein homologue (MCH1)
M28647_g_at	0.55	0.000005	M28647 RATNALPH1 Rattus norvegicus Na,K-ATPase alpha-1 subunit
M96601_at	0.55	0.001245	M96601 Rattus norvegicus taurine transporter mRNA, solute carrier family 6, member 6
rc_AI228738_s_at	0.55	6.45E-05	rc_AI228738 EST225433 FK506-binding protein 1a
S45812_s_at	0.55	5E-07	S45812 monoamine oxidase A
S68944_r_at	0.55	0.00738	S68944 Na+/Cl(-)-dependent neurotransmitter transporter [rats, brain, mRNA, 3762 nt]
U14007_at	0.55	0.001188	U14007 Rattus norvegicus aquaporin-4 water channel (AQP4)
AF028784mRNA#1_s_at	0.5	1.5E-06	AF028784mRNA#1 Rattus norvegicus glial fibrillary acidic protein alpha (GFAP)
D00688_s_at	0.5	0.000015	D00688 RATMAOA Rat monoamine oxidase A gene, complete cds
E00698cds_s_at	0.5	0.003901	E00698cds cDNA encoding rat gamma atrium natriuretic polypeptide gamma-rANP
X62875mRNA_at	0.5	0.000946	X62875mRNA RNHMGP1 R.norvegicus mRNA for High Mobility Group Protein I (Y)
U57500_s_at	0.45	0.003407	U57500 RNU57500 Rattus norvegicus protein tyrosine phosphatase alpha
Y13413_at	0.45	0.000606	Y13413 RNY13413 amyloid beta (A4) precursor protein-binding, family B, member 3
M32783cds_l_at	0.45	0.003399	M32783cds RATENKA3 Rat dynorphin gene, exon 3
rc_AA891054_at	0.45	0.002342	rc_AA891054 EST194857 similar to mucin 2 precursor
Y17295cds_s_at	0.45	0.003222	Y17295cds RNO17295 thiol-specific antioxidant protein (1-Cys peroxiredoxin)
rc_AA892797_at	0.4	0.003351	rc_AA892797 EST196600 phosphoglycerate kinase 1
rc_AI029183_s_at	0.4	0.000098	rc_AI029183 gap junction membrane channel protein alpha 1
X06832cds#2_s_at	0.35	0.002328	X06832cds#2 RNCHROMA Rat mRNA for prechromogranin A

rc_AA997614_s_at	0.3	0.00397	rc_AA997614 cytochrome P450, subfamily 51
Y09332cgs_s_at	0.3	0.000833	Y09332cgs RNCPPPIACT

Downregulated genes

U58857_at	-1.65	0.995988	U58857 maspin mRNA, serine (or cysteine) proteinase inhibitor, clade B, member 5
rc_AI639347_at	-0.7	0.99738	Rat mixed-tissue library Rattus norvegicus cDNA clone rx04496 3
U88324_g_at	-0.7	0.999999	U88324 RNU88324 Rattus norvegicus G protein beta1 subunit (rGb1)
rc_AA892616_at	-0.55	0.999926	rc_AA892616 EST196419 solute carrier family 13, member 3
rc_AI639272_at	-0.55	0.999486	Rat mixed-tissue library Rattus norvegicus cDNA clone rx03958 3
U67994_at	-0.55	0.999842	U67994 Rattus norvegicus DNA primase small subunit mRNA
X54400_r_at	-0.55	0.997783	X54400 Rat mRNA for hepatocyte growth factor
D82074_at	-0.5	0.997678	D82074 RATBHF1MA neurogenic differentiation 1, neuroD1
rc_AI102868_g_at	-0.5	0.99998	rc_AI102868 EST212157 phosphoserine aminotransferase
X57573_at	-0.45	1	X57573 Rat mRNA for glutamic acid decarboxylase
U88324_at	-0.45	0.999999	U88324 RNU88324 Rattus norvegicus G protein beta1 subunit (rGb1)
rc_AA686164_at	-0.4	0.998228	rc_AA686164 EST109401 similar to dendritic cell protein
rc_AI014135_g_at	-0.4	0.999889	rc_AI014135 EST207690
rc_AA891859_at	-0.35	0.99993	rc_AA891859 EST195662
rc_AI070521_s_at	-0.35	0.999997	rc_AI070521 unr protein
rc_AI103498_at	-0.35	0.996936	rc_AI103498 EST212787 ribosomal protein L5
rc_AI229407_at	-0.3	0.9938	rc_AI229407 EST226102 tyrosine 3-monooxygenase/tryptophan 5-monooxygenase protein theta
U08256_at	-0.3	0.997045	U08256 Rattus norvegicus Sprague-Dawley glutamate receptor delta-2
M15191_s_at	-0.3	0.999883	M15191_S_AT M15191 Rat beta-tachykinin (substance P)

Table S4: Genes significantly regulated by morphine withdrawal in the rat LC

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
rc_AI176456_at	1.75	0	rc_AI176456 EST220041 MT2 metallothionein II
L16764_s_at	1.65	0.000003	L16764 RATHSP70A heat shock protein 70 (HSP70) mRNA, complete cds
rc_AA875032_at	1.25	0.000037	rc_AA875032 EST
rc_AI014135_g_at	1.2	3.5E-06	rc_AI014135 EST207690
rc_AI102562_at	1.1	0.004641	rc_AI102562 EST211851 metallothionein, Mt1A
rc_AI172247_at	1.05	0.00139	rc_AI172247 EST218247 xanthine dehydrogenase
L01624_at	1	5E-07	L01624 Rattus norvegicus serum and glucocorticoid-regulated kinase (sgk)
Z75029_s_at	1	0.000578	Z75029 R.norvegicus hsp70.2 mRNA for heat shock protein 70
M55534mRNA_s_at	0.95	0	M55534mRNA Rat alpha-crystallin B chain mRNA
L19998_at	0.9	0.000063	L19998 Rat minoxidil sulfotransferase mRNA
S80118_s_at	0.85	0.003613	S80118 nude [rats, C57BL/6J, mRNA Partial, 2415 nt]
AF034898_f_at	0.8	0.006492	AF034898 Rattus norvegicus olfactory receptor-like protein (SCR D-2) gene
L12407_at	0.8	5E-07	L12407 Rattus norvegicus dopamine beta-hydroxylase
AF034899_r_at	0.75	0.00171	AF034899 Rattus norvegicus olfactory receptor-like protein (SCR D-9) gene
L23148_g_at	0.75	0.003288	L23148 Rattus norvegicus inhibitor of DNA-binding, splice variant Id1.25,
M63282_at	0.75	0.00518	M63282 Rat leucine zipper protein mRNA, Atf3 activating transcription factor 3
rc_AA875531_s_at	0.75	0.000132	rc_AA875531 EST
U75405UTR#1_f_at	0.75	0.000051	U75405UTR#1 RNU75405 Rattus norvegicus alpha 1 type I collagen
X60351cds_s_at	0.75	6.65E-05	X60351cds RRENSABC R.rattus mRNA for alpha B-crystallin
AF028784cds#1_s_at	0.65	0.000783	AF028784cds#1 Rattus norvegicus glial fibrillary acidic protein alpha (GFAP)
K01934mRNA#2_at	0.65	0.000004	K01934mRNA#2 thyroid hormone responsive SPOT14 homolog
M10244_at	0.65	0.000003	M10244 Rat tyrosine hydroxylase mRNA

M11794cds#2_f_at	0.65	0.000425	M11794cds#2 RATMT12C Rat metallothionein-1 gene
U25967_at	0.65	0.000132	U25967 Rattus norvegicus Arix1 homeodomain protein mRNA
X89697cds_at	0.65	0.000131	X89697cds RNTPCR07P R.norvegicus mRNA for TPCR07 protein
L19998_g_at	0.65	6.55E-05	L19998 Rat minoxidil sulfotransferase mRNA
X54400_r_at	0.65	0.001102	X54400 Rat mRNA for hepatocyte growth factor
Y13223cds_at	0.65	0.00115	Y13223cds RNNORTRAN Rattus norvegicus mRNA for norepinephrine transporter
U49062_at	0.6	0.000009	U49062 Rattus norvegicus heat sle antigen CD24 antigen
X62952_at	0.6	0.000001	X62952 R.norvegicus mRNA for vimentin
AF023087_s_at	0.6	0.003056	AF023087 Rattus norvegicus nerve growth factor induced factor A, early growth response 1
U75397UTR#1_s_at	0.6	0.000694	U75397UTR#1 RNKROX2 Rattus norvegicus Krox-24 mRNA
X84039_at	0.6	0.001036	X84039 R.norvegicus mRNA for lumican
J03624_at	0.55	3.5E-06	J03624 Rat galanin (a neuropeptide) mRNA
M94555_at	0.55	0.00198	M94555 Rat neuromedin U mRNA
rc_AA892154_at	0.55	0.004187	rc_AA892154 EST195957
rc_AI180410_i_at	0.55	0.00854	rc_AI180410 EST224155 prolactin-like protein C1
S81478_s_at	0.55	0.001359	S81478 3CH134/CL100 PTPase=oxidative stress-inducible protein tyrosine phosphatase
U49062_g_at	0.55	0.000127	U49062 Rattus norvegicus heat sle antigen CD24 antigen
AF028784mRNA#1_s_at	0.5	0.000267	AF028784mRNA#1 Rattus norvegicus glial fibrillary acidic protein alpha (GFAP)
AF038388_at	0.5	0.004006	AF038388 Rattus norvegicus actin-filament binding protein Frabin mRNA
M33648_g_at	0.5	0.00012	M33648 Rat mitochondrial 3-hydroxy-3-methylglutaryl-CoA synthase
rc_AA900769_s_at	0.5	0.006201	rc_AA900769 smooth muscle alpha-actin
rc_AI043796_s_at	0.5	0.000288	rc_AI043796 solute carrier family 18 member 2
rc_AI112391_s_at	0.5	0.004217	rc_AI112391 protein tyrosine phosphatase, non-receptor type 1
rc_AI638990_at	0.5	0.006627	Rat mixed-tissue library Rattus norvegicus cDNA clone rx01208 3
rc_AI639305_at	0.5	0.000217	Rat mixed-tissue library Rattus norvegicus cDNA clone rx00657 3
rc_AI232012_at	0.45	0.000347	rc_AI232012 EST228700 similar to NADH dehydrogenase (ubiquinone) 1 alpha
S68135_s_at	0.45	0.000325	S68135 GLUT1=glucose transporter 1, solute carrier family 2, member 1
D00688_s_at	0.45	0.000832	D00688 RATMAOA Rat monoamine oxidase A gene
rc_AA892128_at	0.45	0.003815	rc_AA892128 EST195931
rc_AA925506_s_at	0.45	0.001361	rc_AA925506 guanine nucleotide binding protein gamma 7
L29573_s_at	0.4	0.000344	L29573 RATNOREPIN Rat NaCl-dependent norepinephrine transporter mRNA

rc_AI012030_at	0.4	0.001703	rc_AI012030 EST206481 matrix Gla protein
rc_AI104012_g_at	0.4	0.003577	rc_AI104012 EST213301 dual-specificity tyrosine-phosphorylation regulated kinase 1A
rc_AI236601_at	0.4	0.000048	rc_AI236601 EST233163 highly similar to heatshock protein 105 kDa, 100 kDa and 110 kDa
S79304_s_at	0.4	0.002585	S79304 cytochrome oxidase subunit I, Ser-tRNA
X53231_at	0.4	0.000381	X53231 Rat mRNA for preoptic regulatory factor-1 (PORF-1)
D12498_s_at	0.35	0.000509	D12498 RATFGFR1 Rat mRNA for FGF receptor-1
H32189_s_at	0.35	0.001496	H32189 EST107045 glutathione S-transferase, mu 1
M13979_at	0.35	0.000457	M13979 Rat brain glucose-transporter protein
rc_AA799645_at	0.35	0.001048	rc_AA799645 EST189142 FXYP domain-containing ion transport regulator 1
rc_AI137856_s_at	0.35	0.001268	rc_AI137856 P450 (cytochrome oxidoreductase)
rc_AI639058_s_at	0.3	0.004135	Rat mixed-tissue library Rattus norvegicus cDNA clone rx04826 3 similar to Nedd4

Downregulated genes

D26307cds_at	-1.05	0.994873	D26307cds RATJUND Rat jun-D gene
rc_AA800566_at	-0.75	0.999651	rc_AA800566 EST190063
rc_AA800790_at	-0.7	0.999696	rc_AA800790 EST190287
rc_AA800882_g_at	-0.65	0.998003	rc_AA800882 EST190379
M96601_at	-0.65	0.999818	M96601 Rattus norvegicus taurine transporter solute carrier family 6, member 6
U60578cds_s_at	-0.65	0.999985	U60578cds RNCAI18 Rattus norvegicus carbonic anhydrase II gene
AF036761_g_at	-0.6	0.999989	AF036761 Rattus norvegicus stearyl-CoA desaturase 2 mRNA
rc_AA800763_at	-0.55	0.995132	rc_AA800763 EST190260
rc_AA800850_at	-0.55	0.999963	rc_AA800850 EST190347
rc_AI012275_at	-0.55	0.999984	rc_AI012275 EST206726 developmentally regulated protein TPO1
rc_AA799406_at	-0.5	0.999387	rc_AA799406 EST188903
rc_AA800673_at	-0.5	0.999809	rc_AA800673 EST190170
rc_AA800787_at	-0.5	0.999918	rc_AA800787 EST190284 transferrin
rc_AA800912_g_at	-0.5	0.996195	rc_AA800912 EST190409 general transcription factor II I repeat domain containing 1
rc_AA875275_at	-0.5	0.999808	rc_AA875275 EST
rc_AA894204_at	-0.5	0.999137	rc_AA894204 EST198007 similar to sideroflexin 4
rc_AA925762_at	-0.5	0.99766	rc_AA925762 myristoylated alanine rich protein kinase C substrate, Marcks

rc_AA925762_at	-0.5	0.99766	rc_AA925762 myristoylated alanine rich protein kinase C substrate, Marcks
rc_AA800794_at	-0.45	0.999996	rc_AA800794 EST190291 similar to zinc-finger protein HT2A
rc_AI180442_at	-0.45	0.999797	rc_AI180442 EST224188 farenstyl diphosphate synthase
rc_AI638955_at	-0.45	0.99861	Rat mixed-tissue library Rattus norvegicus cDNA clone rx03289 3
S75730_at	-0.45	0.999998	S75730 stearoyl-CoA desaturase 2 SCD2 homolog
rc_AI177683_at	-0.45	0.99963	rc_AI177683 EST221324 hnRNP protein
AF036761_at	-0.4	1	AF036761 Rattus norvegicus stearoyl-CoA desaturase 2 mRNA
M17412_at	-0.4	0.999456	M17412 Rat growth and transformation-dependent protein
rc_AA799672_s_at	-0.4	0.999878	rc_AA799672 EST189169 ribosomal protein L6
rc_AA926149_g_at	-0.4	0.999481	rc_AA926149 Catalase, Cat
rc_AI232374_g_at	-0.4	0.999987	rc_AI232374 EST229062 histone H1-O
S65355_at	-0.4	0.99921	S65355 nonselective-type endothelin receptor [rats, brain, mRNA, 2018 nt]
U67994_at	-0.4	0.999217	U67994 Rattus norvegicus DNA primase small subunit mRNA
L27867_at	-0.35	0.999319	L27867 Rattus norvegicus neurexophilin 1
M28648_s_at	-0.35	0.999551	M28648 RATNALPH2 Rattus norvegicus Na,K-ATPase alpha-3 subunit
rc_AA800029_at	-0.35	0.999657	rc_AA800029 EST189526 similar to T14792
rc_AA800712_at	-0.35	0.994387	rc_AA800712 EST190209 sim. to high mobility group protein 20B BRCA2-associated factor 35
rc_AA800719_at	-0.35	0.992916	rc_AA800719 EST190216
rc_AA894089_s_at	-0.35	0.998406	rc_AA894089 EST197892 protein carrying RING-H2, Neurodap1
S65355_g_at	-0.35	0.997246	S65355 nonselective-type endothelin receptor [rats, brain, mRNA, 2018 nt]
U02096_at	-0.35	0.999829	U02096 Rattus norvegicus Sprague Dawley fatty acid binding protein mRNA
U17697_s_at	-0.35	0.999159	U17697 RNU17697 Rattus norvegicus lanosterol 14-alpha-demethylase mRNA
M99485_at	-0.3	0.999521	M99485 Rattus norvegicus myelin/oligodendrocyte glycoprotein (MOG) gene
U16845_at	-0.3	0.998237	U16845 Rattus norvegicus neurotrimin mRNA

Table S4: Genes significantly regulated by chronic morphine in the mouse VTA

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
94694_at	1.45	0.000928	M69196:Proprotein convertase subtilisin/kexin type 1
97890_at	1.25	5E-07	AW046181:serum/glucocorticoid regulated kinase sgk
104149_at	0.6	0.000302	AI642048:nuclear factor of kappa light chain gene enhancer in B-cells inhibitor alpha
96020_at	0.55	0.002874	M22531:Mouse complement C1q B chain mRNA
92502_at	0.45	0.000696	X95504:M.musculus mRNA for zinc finger protein pleiomorphic adenoma gene-like 1
97787_at	0.45	0.002126	AJ238309:Mus musculus mRNA for dopamine transporter
98562_at	0.45	0.000959	X58861:Complement component 1, q subcomponent, alpha polypeptide
94821_at	0.4	0.000168	AW123880:X-box binding protein 1
160074_at	0.4	0.000009	AF071068:Mus musculus aromatic-L-amino-acid decarboxylase
160330_at	0.35	0.000172	AW122453:cysteine and histidine rich domain (CHORD) containing zinc binding protein 1
161070_at	0.35	0.000719	AI851250: sprouty protein with EVH domain 2 related sequence
93872_at	0.35	0.002071	AF014117:Mus musculus GDNF receptor alpha (GDNFR-alpha)
98543_at	0.35	0.000022	AJ223208:Mus musculus mRNA for cathepsin S
103275_at	0.3	1.5E-06	U13836:vacuolar adenosine triphosphatase subunit Ac116 ATPase transporting
93664_at	0.3	0.001122	X16645:Mouse mRNA for glial cell adhesion molecule (AMOG) ATPase transporting
<i>Downregulated genes</i>			
96041_at	-1.45	1	AB016424:Mus musculus rbm3
98511_at	-0.75	0.998315	L17076:HnRNP-associated with lethal yellow Raly
100927_at	-0.55	0.999987	U28960:Phospholipid transfer protein
92770_at	-0.55	0.999827	X66449:Calcyclin S100 calcium binding protein A6

93284_at	-0.55	0.999921	D78135:Mus musculus mRNA for CIRP cold induced RNA binding protein
98967_at	-0.55	0.999928	U04827:Mus musculus brain fatty acid-binding protein (B-FABP) 7
102703_at	-0.45	0.999927	U48398:Aquaporin 4
161270_at	-0.45	0.999482	AV319920: hypothetical protein LOC269796
94056_at	-0.45	0.998944	M21285:Stearoyl-coenzyme A desaturase 1
97383_at	-0.45	0.999991	AI848623:solute carrier family 6 neurotransmitter transporter taurine member 6
99098_at	-0.45	0.999976	AW045533:farnesyl diphosphate synthase Fdps
97867_at	-0.45	0.999921	X83202:M.musculus mRNA for 11beta-hydroxysteroid dehydrogenase/carbonyl reductase
93182_at	-0.4	0.997598	L08074:NK6 transcription factor related locus2
102196_at	-0.35	0.99678	U37413:Guanine nucleotide binding protein, alpha 11
94377_at	-0.35	0.993211	AI854793:guanine nucleotide binding protein (G protein), gamma 11
96065_at	-0.35	0.998918	D88769:Mus musculus mRNA for latexin

Table S5: Genes significantly regulated by morphine withdrawal in the mouse VTA

Note: p-values of 0 are < 0.000001

Affymetrix ID	log2ratio exp/cont	p-value	Gene
<i>Upregulated genes</i>			
102763_at	2.55	0.000007	AF064748:Mus musculus S3-12 mRNA
103087_at	2.3	0.000099	L02331:Sulfotransferase, phenol preferring 1
98067_at	1.5	0.000006	U09507:Cyclin-dependent kinase inhibitor 1A (P21)
94881_at	1.15	0.000649	AW048937:cyclin dependent kinase inhibitor 1A (P21) Cdkn1a
104498_at	1.1	0.000133	AF093257:Mus musculus homer-1a mRNA, complete cds
97890_at	0.95	0	AW046181: serum/glucocorticoid regulated kinase Sgk
92202_g_at	0.9	0.000001	A1553024:EST similar to zn finger protein
93583_s_at	0.7	0.004673	V00817:Mouse germ line gene fragment for mu-immunoglobulin C-terminus (secreted form)
100946_at	0.65	0.00004	AF109906: heat shock protein 1B
94288_at	0.65	0.003351	J03482:Mouse histone H1 gene
94297_at	0.65	0.000043	U16959:FK506 binding protein 5, 51 kDa
101554_at	0.5	0.004188	U57524:Mus musculus I kappa B alpha gene
102049_at	0.5	0.001767	AJ001418:Mus musculus mRNA for pyruvate dehydrogenase kinase-like protein
162011_f_at	0.5	0.002667	AV246963: ras homolog gene family member U
93875_at	0.5	0.00057	M12571:Heat shock protein, 70 kDa 3 Hspa1a
103460_at	0.45	0	A1849939:HIF-1 responsive RTP801
95034_f_at	0.45	0.007152	AW212243:importin 4
96747_at	0.45	0.000063	AW121294:ras homolog gene family member U
101561_at	0.4	0.000015	K02236:Metallothionein 2
103562_f_at	0.4	0.000739	M26005:Mouse endogenous retrovirus truncated gag protein
104032_at	0.4	0.002991	A1850087: IMAGE 5137303
104194_at	0.4	0.000002	AF082567:Mus musculus hephaestin (heph)
160320_at	0.4	0.000739	U58883:Mus musculus c-Cbl associated protein CAP sorbin and SH3 domain containing 1

160320_at	0.4	0.000739	U58883:Mus musculus c-Cbl associated protein CAP sorbin and SH3 domain containing 1
161817_f_at	0.35	0.000419	AV376312:RIKEN cDNA 4930422J18
100440_f_at	0.3	0.002667	U76758:Ankyrin 1, erythroid
93592_at	0.3	0.000074	X82648:M.musculus mRNA for apolipoprotein D

Downregulated genes

98967_at	-1.05	0.999977	U04827:Mus musculus brain fatty acid-binding protein (B-FABP)
97760_at	-1	0.999552	M21041:Microtubule-associated protein 2
92433_at	-0.85	0.995144	AF067180:Kinesin heavy chain member 5C
94377_at	-0.8	0.997081	AI854793:guanine nucleotide binding protein G protein gamma 11
104249_g_at	-0.75	0.999996	AW227650: RIKEN cDNA 0610038P07
104168_at	-0.7	0.993935	AA791742:ARP2 actin-related protein 2
100927_at	-0.65	0.999873	U28960:Phospholipid transfer protein
102703_s_at	-0.65	0.999580	U48398:Aquaporin 4
96041_at	-0.65	1	AB016424:Mus musculus rbm3 mRNA
98872_at	-0.65	0.999879	U48896:UDP-glucuronosyltransferase 8
102704_at	-0.6	0.999999	U88623:Aquaporin 4
92642_at	-0.6	0.999988	M25944:Mouse carbonic anhydrase II (CAII)
93511_at	-0.6	0.996945	L38971:Integral membrane protein 2A
98004_at	-0.6	0.999734	M63554:Mus musculus inhibitor protein of cAMP-dependent protein kinase
160539_at	-0.55	0.999547	X66091:M.musculus ASF splicing factor arginine/serine rich 1 sfrs
92943_at	-0.55	0.999963	X57497:Glutamate receptor, ionotropic, AMPA1 (alpha 1)
93507_at	-0.55	0.999217	X62622:Tissue inhibitor of metalloproteinase 2
93664_at	-0.55	0.999872	X16645:Mouse mRNA for glial cell adhesion molecule (AMOG) ATPase
96065_at	-0.55	0.999696	D88769:Mus musculus mRNA for latexin
98490_at	-0.55	0.999846	AA822412: RIKEN cDNA 2610313E07
99149_at	-0.55	0.999996	AI851230: RIKEN cDNA 2310035M22
101966_s_at	-0.5	0.998126	AF037206:Mus musculus RING zinc finger protein (Rzf)
94325_at	-0.5	0.999796	AW124932: 3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1
95288_i_at	-0.5	0.998751	AA189811: RIKEN cDNA C330012F17

93868_at	-0.45	0.999197	AL021127: NAD (P) dependent steroid dehydrogenase-like Nsdhl
93994_at	-0.45	0.996385	AW212131: synaptonemal complex protein 3
96011_at	-0.45	0.998126	AB009275:Mus musculus gene for matrin3
96583_s_at	-0.45	0.998944	AF053473:Mus musculus kinesin heavy chain mRNA Kif5a
98521_at	-0.45	0.99978	AI847972: vesicle-associated membrane protein 3 Vamp3
99102_at	-0.45	0.999151	U67874:Ubiquitin specific protease 9, X chromosome
99515_at	-0.45	0.994141	AW046293: adaptor-related protein complex 2, beta 1
160189_at	-0.4	0.995379	AI843747:RIKEN cDNA 4933436C10
160597_at	-0.4	0.995947	AW047450:DNA segment Chr 1 ERATO Doi 622, expressed
93954_at	-0.4	0.996046	AF020339:Mus musculus soluble guanylate cyclase beta-1 subunit (GC-S-beta-1)
96249_at	-0.4	0.997902	AW122105:selenoprotein
103471_at	-0.35	0.999837	AI194333:RIKEN cDNA 4432405K22
92585_at	-0.35	0.993611	L02526:Protein kinase, mitogen activated, kinase 1, p45 Map2k1
93055_at	-0.35	0.998737	AW049376:RIKEN cDNA 1110054N06
95431_at	-0.35	0.999164	AA623426: DNA segment, Chr 16, Indiana University medical 22 expressed
96313_at	-0.35	0.99888	L20899:RAS protein-specific guanine nucleotide-releasing factor 1
96948_at	-0.35	0.999928	AI845337:quininoid dihydropteridine reductase
97491_at	-0.35	0.999807	AW123032: RIKEN cDNA 2610003J05
99577_at	-0.35	0.993724	M57647:Mouse mast cell growth factor (MGF) kit ligand
103736_at	-0.3	0.997816	AI837786:RIKEN cDNA 1100001C18
99098_at	-0.3	0.999995	AW045533: farnesyl-diphosphate synthetase

Table S6. Examples of Morphine-Regulated Genes in the LC and VTA Previously Implicated in Morphine Action

Gene	Regulated after chronic morphine/withdrawal	LC/VTA
<i>Genes known to be altered by morphine or involved in responses to morphine:</i>		
Dopamine β hydroxylase	\uparrow CM, MW	LC
Galanin	\uparrow CM, MW	LC
Tyrosine hydroxylase	\uparrow CM, MW	LC
Heat shock protein 70	\uparrow CM, MW	LC, VTA
GFAP	\uparrow CM, MW	LC
Aromatic-L-amino-acid decarboxylase	\uparrow CM	LC, VTA
Dynorphin	\uparrow CM	LC
Endothelin receptor	\uparrow CM	LC
Na ⁺ /K ⁺ ATPase	\uparrow CM	LC
Monoamine oxidase A	\uparrow CM, MW	LC
Metallothionein 1	\uparrow CM	LC
GABA B receptor	\uparrow CM	LC
GDNF receptor α	\uparrow CM	VTA
Dopamine transporter	\uparrow CM	VTA
G-protein β 1	\downarrow CM, MW	LC
Glutamic acid decarboxylase	\downarrow CM	LC
Substance P	\downarrow CM	LC
Metallothionein 2	\uparrow MW	LC, VTA
Norepinephrine transporter	\uparrow MW	LC
Krox-24	\uparrow MW	LC
Heat shock protein 40	\uparrow MW	LC
Heat shock protein 1B	\uparrow MW	LC, VTA
Minoxidil sulfotransferase	\uparrow MW	LC
Heat shock protein 105	\uparrow MW	LC
Preoptic regulatory factor	\uparrow MW	LC
Alpha crystalline B chain	\uparrow MW	LC
Protein kinase C ϵ	\uparrow MW	LC
I kappa B α	\uparrow MW	VTA
Homer 1A	\uparrow MW	VTA
JunD	\downarrow MW	LC
GluR1	\downarrow MW	LC, VTA
Catalase	\downarrow MW	LC
Inhibitor of PKA	\downarrow MW	VTA
Map kinase 1	\downarrow MW	VTA

The table lists those genes that we identified in our study to be regulated by chronic morphine (CM) or morphine withdrawal (MW) in the LC or VTA, which have also been previously described as being involved in morphine dependence under various treatment paradigms and in various brain regions. GFAP, glial fibrillary acidic protein; GluR1, AMPA glutamate receptor subunit.

Table S7. Gene Expression Changes Verified by Quantitative RT/PCR

Gene	Regulation	Fold change PCR	Fold change array	P-value PCR	P-value array
<i>Genes regulated by chronic morphine in the LC:</i>					
Tyrosine hydroxylase	↑	3.5	2.4	0.034535	5E-07
Prodynorphin	↑	2.8	2.3	0.001984	0.00005
Na ⁺ /K ⁺ ATPase	↑	2.5	1.4	0.000418	0.001192
CD24 antigen	↑	1.6	1.5	0.005887	0.001337
SGK	↑	1.3	2.0	0.004856	1E-07
Glutamate decarboxylase	↓	1.8	1.4	0.001215	0.000001
Aquaporin 4	↓	1.3	1.3	0.016033	0.000268
<i>Genes regulated by morphine withdrawal in the LC:</i>					
Tyrosine hydroxylase	↑	2.7	2.4	0.001787	5E-07
GFAP	↑	2.4	2.0	0.007702	0.000533
FK506 binding protein 5	↑	1.6	1.8	0.002494	0.000696
Brain fatty acid binding protein	↓	2.7	2.0	0.001906	0.000001
Rbm 3	↓	2.2	2.2	0.004936	0.000001
Endothelin receptor B	↓	1.4	1.4	0.022073	0.003338
Aquaporin 4	↓	1.4	1.5	0.040370	0.000233
G-protein β 1	↓	1.3	1.4	0.005094	0.002112
<i>Genes regulated by chronic morphine in the VTA:</i>					
SGK	↑	1.5	2.4	0.010056	5E-07
Rbm3	↓	3.8	2.7	0.000480	0.000001
Raly	↓	2.6	1.7	0.008579	0.001685
Aquaporin 4	↓	1.8	1.3	0.013884	0.000073
<i>Genes regulated by morphine withdrawal in the VTA:</i>					
FK506 binding protein 5	↑	3.4	1.6	0.001886	0.000043
SGK	↑	2.8	2.0	0.024400	1E-07
Brain fatty acid binding protein	↓	3.4	2.0	0.000155	0.000023
Microtubule associated protein 2	↓	2.0	2.0	0.001520	0.000448
Aquaporin 4	↓	1.6	1.6	0.001805	0.000420
GluR1	↓	1.4	1.4	0.001697	0.000037

Several genes were chosen from the lists of regulated genes for real-time PCR confirmation. Samples were run in duplicate and significance was determined by t-test ($P < 0.05$). SGK, serum glucocorticoid regulated kinase; Rbm 3, RNA binding motif protein 3; see other Tables for other abbreviations.

Table S8A. Functional Classification of Genes Regulated by Chronic Morphine in the LC

Mouse	Rat
Cell signaling	
Serum/glucocorticoid regulated kinase Protein kinase KIS	Protein tyrosine phosphatase alpha Hippocampal neurostimulating peptide Eucaryotic translation elongation factor 2 G protein beta 1 subunit
Neurotransmitter biochemistry/receptors	
Prodynorphin Galatin Tyrosine hydroxylase Glutamic acid decarboxylase	Prodynorphin Galatin Tyrosine hydroxylase Dopamine beta-hydroxylase Aromatic L-amino acid decarboxylase GABA B receptor 1D GABA B receptor 1C Monoamine oxidase A Na ⁺ /Cl ⁻ dependent neurotransmitter transporter Endothelin receptor B Glutamic acid decarboxylase Glutamate receptor delta-2 Tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein theta Substance P GluR1
Vesicle transport/synaptic transmission	
Synaptotagmin 1	Vesicular monoamine transporter Vesicle associated membrane protein 1
Cell growth/differentiation	
Fibroblast growth factor receptor 2 Fibroblast growth factor inducible 15	Glioma-derived vascular endothelial growth factor FE65 protein Hepatocyte growth factor Neurogenic differentiation 1
Immune/stress response	
CD24A antigen Lymphocyte antigen 6 complex	Heat shock protein 70 FK506 binding protein 1a

Metallothionein 1
HIF-1 responsive RTP801

Cell adhesion and motility

Delta-like1 homolog

Glial fibrillary acidic protein alpha
Myelin/oligodendrocyte glycoprotein

Ion channels/ion exchange

ATPase, Na⁺/K⁺ alpha 1

ATPase, Na⁺/K⁺ alpha 1
ATPase, Na⁺/K⁺ beta 1
ATPase, Na⁺/K⁺ beta 2
Gap junction membrane channel protein alpha 1

*Upregulated genes are in RED

*Downregulated genes are in BLUE

Table S8B. Functional Classification of Genes Regulated by Morphine Withdrawal in the LC

Mouse	Rat
Cell signaling	
CCAAT/enhancer binding protein beta1	Serum glucocorticoid regulated kinase
Ras homolog gene family member U	Activating transcription factor 3
Dual specificity phosphatase 6	Protein tyrosine phosphatase 1
Calcium binding protein 39	Guanine nucleotide binding protein gamma 7
Protein kinase C epsilon	Krox-24
ATP-binding cassette 2	protein tyrosine phosphatase non-receptor type 16
Centaurin gamma 3	
Guanine nucleotide binding protein beta 1	
S100 calcium binding protein A6	
Neurotransmitter biochemistry/receptors	
Galanin	Galanin
Tyrosine hydroxylase	Tyrosine hydroxylase
G-protein coupled receptor 37-like 1	Dopamine beta-hydroxylase
Transferrin receptor	Norepinephrine transporter
Endothelin receptor type B	Monoamine oxidase A
	Neuromedin U
	Prodynorphin
	Non selective type endothelin receptor
Vesicle transport/synaptic transmission	
Neuronal pentraxin	Alpha B-crystallin
	Transferrin
	Myristolated alanine-rich C-kinase substrate
	Neuroexophilin 1
Cell growth/differentiation	
Fibroblast growth factor inducible 15	Hepatocyte growth factor
	Nerve growth factor induced factor A
	Fibroblast growth factor receptor 1
	Jun D
	Rat growth and transformation-dependent protein
	Developmentally regulated protein TPO1

Immune/stress response

Heat shock protein 1 B	Heat shock protein 70
Metallothionein-1	Metallothionein-1
Metallothionein-2	Metallothionein-2
Metallothionein-3	CD24 antigen
Heat shock protein 40	Oxidative stress induced protein tyrosine phosphatase
Chemokine ligand	Similar to heat shock protein 105 KD
DNAJ heat shock protein 40 homolog B9	
DNAJ heat shock protein 40 homolog B10	
Heat shock protein 70	
Programmed cell death 6 interacting protein	
FK506 binding protein 5	

Cell adhesion and motility

Glial fibrillary acidic protein	Glial fibrillary acidic protein
Kinesin light chain 2	Alpha B-crystallin
Glial cell adhesion molecule	Collagen alpha 1 type 1
	Actin filament binding protein
	Alpha actin
	Matrix Gla protein
	Vimentin
	Frabin

Ion channels/ion exchange

Na⁺/K⁺ ATPase alpha 3

*Upregulated genes are in RED

*Downregulated genes are in BLUE

Functional categorization of genes regulated in the LC of mice and rats following chronic morphine (Table 5A) or morphine withdrawal (Table 5B). Genes that were found to be significantly regulated ($P < 0.01$) in duplicate arrays in the LC of both species were clustered into functional categories based on Affymetrix gene ontology (www.affymetrix.com), KEGG (www.genome.ad.jp/kegg/), GenMAPP (www.GenMAPP.org), and sequence and literature searches.