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Letter

DNA microarray analysis of fetal liver of C57BL/6J mice exposed to cadmium during gestation

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ABSTRACT — Cadmium (Cd) is a non-essential toxic metal widely distributed throughout the environment. Cd is reported to be toxic to the fetus, so we aimed to investigate changes in gene expression in the liver of fetal mice exposed to Cd during gestation. We exposed pregnant mice to Cd (5 mg/kg) and collected fetal livers to perform DNA microarray analysis. The expression of 1,669 genes was found to be increased more than 2.0-fold, while that of 194 genes was decreased less than 0.5-fold in fetal livers following Cd exposure during gestation. We categorized the Cd-changed genes in terms of cell cycle and cell proliferation, apoptosis, cell growth and differentiation, cellular defense, metabolism, transport, transcription, signal transduction, metal homeostasis, and ubiquitin proteasome system. These results provide useful information about fetal toxicity following gestational Cd exposure.

Key words: Cadmium, Gestational exposure, Fetal toxicity, DNA microarray

INTRODUCTION

Cadmium (Cd) is a non-essential toxic metal widely found throughout the environment. Humans are typically exposed to Cd on a daily basis from foodstuffs or tobacco, and such exposure has been shown to cause toxic effects in the liver, kidney, lung, bone, and reproductive tissues (Satoh *et al*., 2002). The risk for Cd toxicity is elevated during pregnancy. Previous epidemiological studies demonstrated that the maternal body burden of Cd is associated with low birth weight (Nishijo *et al*., 2004) and low birth height (Nishijo *et al*., 2002), while maternal Cd exposure during animal gestation is related to fetal death (Levin and Miller, 1980).

Despite these associations, the genes involved in Cd-induced fetal toxicity following gestational exposure have not been identified. Therefore, in the present study, we performed DNA microarray analysis of mouse fetal livers exposed to Cd during gestation to screen for the genes responsible for Cd fetal toxicity.

MATERIALS AND METHODS

Animal experiments

C57BL/6J mice were a generous gift from Dr. C. Tohyama (University of Tokyo, Japan). Animals were maintained at a controlled temperature and humidity with 12 hr/12 hr light/dark cycles, and given free access to rodent chow and water. All experiments were performed in accordance with the Guidelines for Animal Experiments of Gifu Pharmaceutical University. Nulliparous female mice aged 8 weeks were housed with one male of the same strain for 24 hr. After the mating period, females were separated from the males and housed individually in plastic cages from gestational day 1 (GD1). Dams were split into two groups: those receiving 5 mg Cd/kg (n = 5) and the control group (n = 4). Cd solution was prepared with $CdCl_2$ (2.5-hydrous powder, 99.9% purification; Wako Pure Chemical Industries, Osaka, Japan) in distillated water. A single dose of Cd solution was orally administrated daily to the pregnant mice from GD1 to GD18. The control group received distilled water for the same period by oral administration. On GD19, pregnant mice were deeply anesthetized with ether and fetal livers were removed. Fetal livers were pooled for each litter and

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samples were quick-frozen and stored at -80°C.

Extraction of total RNA

Total RNA was isolated from pooled fetal livers using the SV total RNA isolation system (Promega, Madison, WI, USA) according to the manufacturer's protocol.

DNA microarray analysis

Pooled total RNA (100 μg) was reverse transcribed into cDNA by Superscript II reverse transcriptase (Invitrogen, Grand Island, NY, USA) using Oligo (dT)12-18 primer (Invitrogen) and dNTP mix (Invitrogen) containing aminoallyl-dUTP (Ambion, Austin, TX, USA) in accordance with the manufacturer's instructions. cDNA from control and Cd-treated groups was labeled with fluorescent dyes Cy3 and Cy5 (Amersham Bioscience, Little Chalfont, UK), respectively. The mixture of labeled cDNA from control and Cd-treated groups was hybridized with an AceGene® Oligo Chip 30K (Hitachi Software, Kanagawa, Japan) using a Lucidea Slide-Pro (Amersham Bioscience). Oligonucleotide-based microarray slides used for the target gene search contained approximately 30,000 spots of mouse DNA. After hybridization, the slides were washed and scanned by the CRBIO™ IIe (Hitachi Software). The fluorescent intensity of the spots was measured for Cy3 and Cy5, and the induction ratio of each gene was calculated with DNA-SIS® Array, version 2.4 software (Hitachi Software). Information about each gene on the microarray slide was obtained from the NCBI database. Genes showing expression changes were categorized according to function by referring to the Gene Ontology database.

RESULTS AND DISCUSSION

We found that the expression of 1,669 genes was increased more than 2.0-fold, and the expression of 194 genes was decreased less than 0.5-fold in the fetal mouse liver following Cd exposure during gestation. The altered genes were categorized according to function by referring to the Gene Ontology database. The expression of 69 genes associated with the cell cycle and cell proliferation was increased, and that of five genes was decreased (Tables 1, 2). The expression of 49 genes related to apoptosis was increased, and that of eight genes was decreased (Tables 3, 4). The expression of 57 genes associated with cell growth and differentiation was increased, while that of nine genes was decreased (Tables 5, 6). The expression of 69 genes related to cellular defense was increased, compared with five genes that decreased in expression (Tables 7, 8). Ninety-two genes related to metabolism demonstrated increased expression, while 12 showed decreased expression (Tables 9, 10). Increased expression of 244 genes related to transport was observed, as well as decreased expression of 21 such genes (Tables 11, 12). The expression of 162 genes related to transcription was increased, and that of 19 genes was decreased (Tables 13, 14). Changes in signal transduction-associated genes were reflected by increased expression in 144 and decreased expression in 32 (Tables 15, 16). The expression of 34 genes related to metal homeostasis, including *Mt1*, was increased, while three such genes showed decreased expression (Tables 17, 18). Thirty-two genes related to the ubiquitin proteasome system showed increased expression, compared with three such genes that were decreased (Tables 19, 20). Other genes in the fetal liver changed by gestational Cd exposure are shown in Tables 21 and 22.

Amotl2 expression was found to be increased in the fetal liver of mice exposed to Cd during gestation (Table 21), which supports our earlier study that demonstrated higher *AMOTL2* expression in HK-2 human proximal tubular cells treated with Cd compared with untreated cells (Lee *et al*., 2013). The present study also observed increased expression of *Cdkn2b* (Table 1), *Pvrl3* (Table 21), and *Ugdh* (Table 11), and decreased expression of *Ptpru* (Table 22); the same changes were previously observed in the kidneys of mice exposed to Cd for 12 months (Tokumoto *et al*., 2013a). Similarly, we observed increased expression of *Srpr* (Table 11), *Wiz* (Table 17), *Jub* (Table 21), *Taldo1* (Table 9), *Oat* (Table 21), and *Ctbp1* (Table 9), and decreased expression of *Tcf20* (Table 14), which was previously seen in NRK-52E rat kidney epithelial cells treated with Cd (Tokumoto *et al*., 2011). The livers of mice exposed to Cd for 30 days were previously reported to have increased *Rpa2* expression and decreased *Tcf20* expression (Tokumoto *et al*., 2013b), and our current findings support these results (Tables 14 and 21).

Therefore, our present study identified several common genes that might be responsible for Cd fetal toxicity and that are involved in similar hepatic and renal toxicity pathways. These findings provide useful information for understanding Cd-induced gene alteration in the fetus.

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Conflict of interest---- The authors declare that there is no conflict of interest.

Table 1. Up-regulated genes related to cell cycle and cell proliferation in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_021399	*Bcl11b*	3.42	NM_138630	*Arhgap4*	2.34
NM_011835	*Katna1*	3.02	NM_009627	*Adm*	2.33
NM_023233	*Trim13*	2.96	NM_010798	*Mif*	2.33
NM_011806	*Dmtf1*	2.93	NM_007950	*Ereg*	2.32
NM_009353	*Terf2*	2.87	NM_009828	*Ccna2*	2.30
NM_027985	*Mad2l2*	2.86	NM_009791	*Calmbp1*	2.29
NM_028228	*Pinx1*	2.85	NM_011379	*Sipa1*	2.28
NM_009368	*Tgfb3*	2.83	NM_017464	*Nedd9*	2.28
NM_009352	*Terf1*	2.78	NM_016964	*Stag3*	2.26
NM_010690	*Lats1*	2.75	NM_007783	*Csk*	2.25
NM_023326	*Bmyc*	2.74	NM_007836	*Gadd45a*	2.25
NM_009465	*Axl*	2.70	NM_134092	*Mtbp*	2.24
NM_009379	*Thpo*	2.67	AF179996	*8-Sep*	2.21
NM_011200	*Ptp4a1*	2.66	NM_007671	*Cdkn2c*	2.20
NM_011408	*Slfn2*	2.65	NM_009772	*Bub1*	2.19
NM_016692	*Incenp*	2.58	NM_010509	*Ifnar2*	2.19
NM_016746	*Ccnc*	2.55	NM_009050	*Ret*	2.18
NM_021328	*Bin3*	2.55	NM_009875	*Cdkn1b*	2.18
NM_010208	*Fgr*	2.52	NM_011487	*Stat4*	2.16
NM_001081058	*Cdc2l5*	2.50	NM_008583	*Men1*	2.16
NM_009506	*Vegfc*	2.49	NM_011237	*Rad9*	2.16
NM_008059	*G0s2*	2.48	NM_011647	*Tsc2*	2.14
NM_011462	*Spin*	2.47	NM_015771	*Lats2*	2.13
NM_018830	*Asah2*	2.46	NM_022889	*Pes1*	2.13
NM_009516	*Wee1*	2.46	NM_010716	*Lig3*	2.12
NM_027764	*Rcbtb1*	2.44	NM_010757	*Mafk*	2.11
NM_020572	*Aurkc*	2.43	NM_010204	*Fgf6*	2.10
NM_009625	*Adcyap1*	2.42	NM_013538	*Cdca3*	2.10
NM_130860	*Cdk9*	2.40	NM_011601	*Tlm*	2.10
NM_011516	*Sycp1*	2.39	NM_025415	*Cks2*	2.07
NM_021515	*Ak1*	2.39	NM_138585	*Cherp*	2.06
NM_017461	*1-Sep*	2.38	NM_021409	*Pard6b*	2.05
NM_013636	*Ppp1cc*	2.37	NM_007670	*Cdkn2b*	2.04
NM_007934	*Enpep*	2.36	NM_023284	*Cdca1*	2.01
NM_009974	*Csnk2a2*	2.35			

Table 2. Down-regulated genes related to cell cycle and cell proliferation in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_016904	*Cks1*	0.417	NM_153599	*Cdk8*	0.453
NM_145851	*Cables2*	0.438	NM_175660	*Hist1h2ab*	0.460
NM_013625	*Pafah1b1*	0.450			

Table 3. Up-regulated genes related to apoptosis in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_013542	*Gzmb*	3.13	NM_001033126	*Tnfrsf7*	2.31
AF353993	*Bbp*	3.08	NM_016802	*Arha*	2.30
NM_009688	*Birc4*	2.87	NM_008234	*Hells*	2.30
NM_009163	*Sgpl1*	2.84	NM_007465	*Birc3*	2.26
NM_153552	*Thoc1*	2.78	NM_007466	*Api5*	2.25
NM_007609	*Casp4*	2.77	NM_023566	*Muc2*	2.24
NM_030750	*Sgpp1*	2.76	NM_009383	*Tial1*	2.22
NM_009472	*Unc5c*	2.72	NM_007828	*Dapk3*	2.22
NM_146001	*Hip1*	2.71	NM_007829	*Daxx*	2.21
NM_010100	*Edar*	2.69	NM_008798	*Pdcd1*	2.20
NM_007669	*Cdkn1a*	2.62	NM_009684	*Apaf1*	2.20
NM_028133	*Egln3*	2.58	NM_025778	*Bcl2l14*	2.15
NM_010202	*Fgf4*	2.55	NM_009068	*Ripk1*	2.14
NM_010164	*Eya1*	2.53	NM_019745	*Pdcd10*	2.11
NM_016688	*Pdcd7*	2.50	NM_007891	*E2f1*	2.10
NM_011632	*Traf3*	2.50	NM_133821	*Plekhe1*	2.08
NM_019955	*Ripk3*	2.47	NM_007544	*Bid*	2.08
NM_010431	*Hif1a*	2.46	NM_007955	*Ptprv*	2.08
NM_009736	*Bag1*	2.44	NM_023565	*Cse1l*	2.07
NM_009367	*Tgfb2*	2.44	NM_028283	*Uaca*	2.07
NM_020024	*Taf10*	2.40	NM_019464	*Sh3glb1*	2.07
NM_025680	*Ctnnbl1*	2.39	NM_009071	*Rock1*	2.05
NM_010830	*Msh6*	2.37	NM_007870	*Dnase1l3*	2.02
NM_008714	*Notch1*	2.36	NM_011641	*Trp63*	2.00
NM_010813	*Mnt*	2.34			

Table 4. Down-regulated genes related to apoptosis in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_020272	*Pik3cg*	0.244	NM_020275	*Tnfrsf10b*	0.472
NM_007523	*Bak1*	0.363	NM_029653	*Dapk1*	0.475
NM_023229	*Fastk*	0.400	NM_009743	*Bcl2l*	0.479
NM_175093	*Ifld2*	0.459	AF054611	*Mapk8ip*	0.485

Table 5. Up-regulated genes related to cell growth, differentiation, and development in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	*Gene Name*	Fold of change
NM_013865	*Ndr3*	3.28	NM_015748	*Slit1*	2.34
NM_016845	*Acrbp*	2.97	NM_001170561	*Sbf1*	2.33
NM_015800	*Crim1*	2.95	NM_028296	*Car10*	2.30
NM_007558	*Bmp8a*	2.90	NM_009574	*Zic2*	2.30
NM_008871	*Serpine1*	2.87	NM_028889	*Efhd1*	2.27
NM_009469	*Ulk1*	2.85	NM_011976	*Sema4g*	2.27
NM_019569	*Fscn3*	2.81	NM_011385	*Ski*	2.24
NM_021351	*Cryba4*	2.81	NM_030699	*Ntng1*	2.23
NM_010142	*Ephb2*	2.80	NM_018865	*Wisp1*	2.22
NM_008994	*Pxmp3*	2.78	NM_019685	*Ruvbl1*	2.20

Table 5. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	*Gene Name*	Fold of change
NM_016701	*Nes*	2.77	NM_011991	*Cops3*	2.19
NM_020604	*Jph1*	2.73	NM_009640	*Agpt*	2.18
NM_024291	*Ky*	2.72	NM_026131	*Pdlim7*	2.13
NM_011349	*Sema3f*	2.71	NM_023653	*Wnt2*	2.12
NM_019564	*Prss11*	2.65	NM_033565	*Laf4l*	2.11
NM_011248	*Robo3*	2.58	NM_016697	*Gpc3*	2.11
NM_172493	*Diap2*	2.55	NM_032002	*Nrg4*	2.10
NM_013658	*Sema4a*	2.53	NM_021383	*Rqcd1*	2.09
NM_013564	*Insl3*	2.50	NM_009396	*Tnfaip2*	2.09
NM_007548	*Prdm1*	2.49	NM_008206	*H2-Oa*	2.09
NM_009153	*Sema3b*	2.48	NM_026570	*Gas41*	2.08
NM_008742	*Ntf3*	2.47	NM_010563	*Ina*	2.08
NM_007553	*Bmp2*	2.44	NM_009388	*Tkt*	2.04
NM_009228	*Snta1*	2.41	NM_023317	*Nde1*	2.04
NM_027497	*Epc1*	2.39	NM_019754	*Tagln3*	2.03
NM_024431	*Morf4l1*	2.38	NM_007500	*Atoh1*	2.02
NM_010513	*Igf1r*	2.38	NM_013471	*Anxa4*	2.01
NM_010516	*Cyr61*	2.38	NM_011652	*Ttn*	2.01
NM_010950	*Numbl*	2.37			

Table 6. Down-regulated genes related to cell growth, differentiation, and development in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_144761	*Crygb*	0.239	NM_008520	*Ltbp3*	0.455
NM_145506	*Epb4.1l5*	0.330	NM_010111	*Efnb2*	0.464
NM_010279	*Gfra1*	0.436	NM_008342	*Igfbp2*	0.465
NM_010518	*Igfbp5*	0.446	NM_008398	*Itga7*	0.500
NM_013637	*Prm1*	0.450			

Table 7. Up-regulated genes related to cellular defense in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_030677	*Gpx2*	3.42	NM_010260	*Gbp2*	2.36
NM_011329	*Ccl1*	3.39	NM_030612	*AA408868*	2.35
NM_008533	*Ly78*	3.15	NM_008599	*Cxcl9*	2.34
NM_138648	*Olr1*	3.10	NM_026994	*Cryzl1*	2.33
NM_024198	*Gpx7*	3.03	NM_178628	*Spg3a*	2.33
NM_007642	*Cd28*	2.89	NM_011331	*Ccl12*	2.31
NM_011364	*Sh2d1a*	2.80	NM_008360	*Il18*	2.28
NM_009141	*Cxcl5*	2.76	NM_009127	*Scd1*	2.20
NM_011260	*Reg3g*	2.71	NM_007574	*C1qg*	2.20
NM_009417	*Tpo*	2.70	NM_010877	*Ncf2*	2.19
NM_010343	*Gpx5*	2.69	NM_015790	*Icosl*	2.18
NM_007851	*Defcr5*	2.65	NM_019450	*Il1f6*	2.17
NM_008518	*Ltb*	2.63	NM_009912	*Ccr1*	2.17
NM_023517	*Tnfsf13*	2.60	NM_009140	*Cxcl2*	2.15
NM_126166	*Tlr3*	2.59	NM_025316	*Ndufb5*	2.13

Table 7. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_010739	*Ly64*	2.58	NM_008622	*Mpv17*	2.11
NM_011347	*Selp*	2.57	NM_009114	*S100a9*	2.11
NM_008320	*Icsbp1*	2.54	NM_010819	*Clecsf8*	2.10
NM_025523	*Ndufc1*	2.53	NM_018763	*Chst2*	2.10
NM_019977	*Aldrl6*	2.53	NM_019418	*Tnfsf14*	2.10
NM_019728	*Defb4*	2.52	NM_013723	*Podxl*	2.09
NM_019944	*Hlxb9*	2.51	NM_027320	*Ifi35*	2.08
NM_007762	*Crhr1*	2.49	NM_009777	*C1qb*	2.07
NM_008337	*Ifng*	2.49	NM_009311	*Tac1*	2.07
NM_008699	*Nkx2-3*	2.48	NM_007946	*Epx*	2.06
AK006243	*Ndufa3*	2.47	NM_021364	*Clecsf5*	2.06
NM_010072	*Dpm1*	2.46	NM_019577	*Ccl24*	2.05
NM_009854	*Cd7*	2.43	NM_011604	*Tlr6*	2.04
NM_008361	*Il1b*	2.43	NM_008501	*Lif*	2.04
NM_007925	*Eln*	2.42	NM_028717	*Als2*	2.03
NM_019932	*Cxcl4*	2.42	NM_008823	*Pfc*	2.03
NM_054096	*Tirap*	2.41	NM_021319	*Pglyrpl*	2.02
NM_019507	*Tbx21*	2.41	NM_010369	*Gypa*	2.01
NM_001190325	*Igl-5*	2.37	NM_021396	*Pdcd1lg2*	2.01
NM_021283	*Il4*	2.37			

Table 8. Down-regulated genes related to cellular defense in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_010381	*H2-Ea*	0.275	NM_010382	*H2-Eb1*	0.496
NM_011691	*Vav1*	0.389	NM_007806	*Cyba*	0.498
NM_009857	*Cd8a*	0.442			

Table 9. Up-regulated genes related to metabolism in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_008537	*Amacr*	3.70	NM_031159	*Apobec1*	2.42
NM_053070	*Car7*	3.45	NM_008876	*Pld2*	2.42
NM_031202	*Tyrp1*	3.40	NM_021509	*Moxd1*	2.38
NM_027979	*Chit1*	3.13	NM_021460	*Lip1*	2.38
NM_001305982	*Coasy*	3.09	NM_025881	*Luc7l*	2.36
NM_011128	*Pnliprp2*	3.09	NM_011528	*Taldo1*	2.36
NM_026438	*Pyp*	3.09	NM_008875	*Pld1*	2.34
NM_008062	*G6pdx*	3.07	NM_023624	*Lrat*	2.34
NM_011704	*Vnn1*	3.04	NM_011224	*Pygm*	2.34
NM_009802	*Car6*	3.02	NM_145953	*Cth*	2.31
NM_010338	*Gpr37*	2.98	NM_030017	*Rdh12*	2.31
NM_008078	*Gad2*	2.98	NM_013792	*Naglu*	2.30
NM_022014	*Fn3k*	2.95	NM_008325	*Idua*	2.30
NM_025396	*Pgls*	2.84	NM_016722	*Galns*	2.29
NM_133653	*Mat1a*	2.79	NM_008292	*Hsd17b4*	2.29
NM_019811	*Acas2*	2.76	NM_022993	*Lrp10*	2.29
NM_022305	*B4galt1*	2.76	NM_008185	*Gstt1*	2.29

Table 9. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_001172055	*Dhrs6*	2.75	NM_007433	*Akp5*	2.28
NM_026408	*Sncaip*	2.72	NM_008866	*Lypla1*	2.26
NM_009949	*Cpt2*	2.71	NM_145569	*Mat2a*	2.26
NM_019477	*Acsl4*	2.69	NM_026644	*Agpat4*	2.25
NM_019676	*Plcd*	2.66	NM_031201	*Tsta3*	2.25
NM_013463	*Gla*	2.65	NM_013761	*Srr*	2.24
NM_134075	*Gmpr2*	2.64	NM_018757	*Nme6*	2.24
NM_024188	*Oxct*	2.63	NM_009230	*Soat1*	2.24
AF178429	*AV071179*	2.62	NM_023175	*D16Ertd502e*	2.23
NM_013556	*Hprt*	2.62	NM_009171	*Shmt1*	2.20
NM_133900	*Psph*	2.62	NM_028072	*Sulf2*	2.19
NM_010952	*Oaz2*	2.59	NM_016772	*Ech1*	2.19
NM_177823	*Ubash3a*	2.59	NM_008291	*Hsd17b3*	2.18
NM_011961	*Plod2*	2.58	NM_023697	*Rdh14*	2.16
NM_009409	*Top2b*	2.57	NM_016672	*Ddc*	2.16
NM_017465	*Sult2b1*	2.57	NM_013784	*Pign*	2.16
NM_018870	*Pgam2*	2.56	NM_033320	*Glce*	2.15
NM_025337	*Akr7a5*	2.55	NM_022033	*Oxct2a*	2.15
NM_013502	*Ctbp1*	2.54	NM_028803	*Gbe1*	2.15
NM_053184	*Ugt2a1*	2.53	NM_010362	*Gsto1*	2.12
NM_020271	*Pdxp*	2.52	NM_015804	*Atp11a*	2.11
NM_019957	*Dnase2b*	2.52	NM_008079	*Galc*	2.11
NM_138595	*Gldc*	2.49	NM_025295	*Btd*	2.08
NM_173047	*Cbr3*	2.49	NM_027406	*Fthfd*	2.06
NM_019878	*Sult1b1*	2.49	NM_010422	*Hexb*	2.06
NM_025522	*Dhrs7*	2.45	NM_008077	*Gad1*	2.04
NM_133198	*Pygl*	2.44	NM_011514	*Suv39h1*	2.03
NM_025922	*Itpa*	2.44	NM_009286	*Sth2*	2.03
NM_013624	*Otog*	2.43	NM_027924	*Pdgfd*	2.03

Table 10. Down-regulated genes related to metabolism in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_134079	*Adk*	0.226	NM_013847	*Gcat*	0.434
NM_016807	*Sdcbp*	0.309	NM_010893	*Neu1*	0.462
NM_178389	*Gale*	0.343	NM_024243	*Fuca*	0.462
NM_134188	*Mte1*	0.401	NM_008745	*Ntrk2*	0.464
NM_007512	*Atpi*	0.423	NM_010233	*Fn1*	0.481
NM_134246	*Pte2a*	0.429	NM_008000	*Fert2*	0.487

Table 11. Up-regulated genes related to transport in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	*Gene Name*	Fold of change
NM_011743	*Zfp106*	3.47	NM_008999	*Rab23*	2.39
NM_011388	*Slc10a2*	3.41	NM_016792	*Txnl*	2.38
NM_032397	*Kcnn1*	3.30	NM_019430	*Cacng3*	2.38
NM_021520	*Slc28a2*	3.25	NM_011539	*Tbxas1*	2.38
NM_021291	*Slc7a9*	3.20	NM_013716	*G3bp*	2.38
NM_025535	*Sara2*	3.19	NM_023537	*Rab3b*	2.37
NM_029638	*Abp1*	3.16	NM_007873	*Doc2b*	2.37
NM_023348	*Snap29*	3.14	NM_008069	*Gabrb1*	2.36
NM_139229	*Cog8*	3.11	NM_016858	*Rab33b*	2.36
NM_029394	*Snx24*	3.11	NM_011795	*C1qrf*	2.35
NM_024412	*Clcnk1*	3.11	NM_010276	*Gem*	2.35
NM_019659	*Kcnj1*	3.09	NM_010472	*Hrb*	2.35
NM_033444	*Clic1*	3.07	NM_008948	*Psmc3*	2.34
NM_153155	*C1ql*	3.06	NM_021492	*Ap3b2*	2.34
NM_020574	*Kcne3*	3.05	NM_008097	*Gcdh*	2.33
NM_178703	*Slc6a1*	3.04	NM_010760	*Magoh*	2.33
NM_019792	*Cyp3a25*	3.03	NM_011598	*Fabp9*	2.32
NM_028011	*Srcasm*	3.01	NM_024414	*Stx1b2*	2.32
NM_008467	*Kpna4*	3.00	NM_021329	*Rangnrf*	2.32
NM_025505	*Blzf1*	2.97	NM_176844	*Chrna5*	2.32
NM_011878	*Tiam2*	2.97	NM_013569	*Kcnh2*	2.31
NM_024448	*Rab12*	2.96	NM_008244	*Hgs*	2.31
AB006034	*Cyp27b1*	2.94	NM_011075	*Abcb1b*	2.30
NM_009996	*Cyp24a1*	2.94	NM_015751	*Abce1*	2.30
NM_019931	*Kcnd3*	2.93	NM_133950	*Kdelr1*	2.30
NM_001163011	*Mup1*	2.92	NM_011254	*Rbp1*	2.30
NM_007899	*Ecm1*	2.92	NM_021536	*Arht1*	2.30
NM_010349	*Grik2*	2.91	NM_145559	*Slc2a9*	2.29
NM_026887	*Ap1s2*	2.89	NM_009579	*Slc30a1*	2.29
NM_025807	*Slc16a9*	2.89	NM_013885	*Clic4*	2.29
NM_010595	*Kcna1*	2.87	NM_027881	*Osbpl3*	2.29
NM_027915	*Ap2b1*	2.87	NM_023732	*Abcb6*	2.28
NM_008642	*Mttp*	2.87	NM_009944	*Cox7a1*	2.28
NM_007503	*Fxyd2*	2.85	NM_011591	*Timm17b*	2.28
NM_011325	*Scnn1b*	2.85	NM_007824	*Cyp7a1*	2.27
NM_009198	*Slc17a1*	2.84	NM_144593	*Rhebl1*	2.27
NM_133199	*Scn4a*	2.84	NM_029158	*Cnbp2*	2.26
NM_011773	*Slc30a3*	2.83	NM_031251	*Ctns*	2.26
NM_011256	*Pitpnm2*	2.80	NM_009728	*Atp10a*	2.26
NM_011396	*Slc22a5*	2.79	NM_029019	*Stard6*	2.25
NM_026532	*Nutf2*	2.79	NM_023134	*Sftpa*	2.25
NM_011322	*Scn1b*	2.78	NM_016801	*Stx1a*	2.25
NM_010298	*Glrb*	2.78	NM_009604	*Chrng*	2.25
NM_016703	*Preb*	2.77	NM_011076	*Abcb1a*	2.25
NM_009603	*Chrne*	2.76	NM_031261	*Fthl17*	2.24
NM_019432	*Pr1*	2.76	NM_020599	*Rlbp1*	2.24
NM_019722	*Arl2*	2.76	NM_025381	*Atp6v1f*	2.24
NM_022813	*Scamp2*	2.76	NM_001081056	*Xpot*	2.24
NM_026678	*Blvra*	2.76	NM_022317	*Slc28a3*	2.23

Table 11. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	*Gene Name*	Fold of change
NM_021789	*Trappc4*	2.75	NM_031194	*Slc22a8*	2.22
NM_133225	*Acbd3*	2.75	NM_019761	*Nxt1*	2.22
NM_019692	*Rit2*	2.75	NM_008430	*Kcnk1*	2.22
NM_009004	*Kif20a*	2.75	NM_009466	*Ugdh*	2.21
NM_021375	*Rhbg*	2.74	NM_029466	*Arl8*	2.21
NM_027889	*Vps11*	2.74	NM_008070	*Gabrb2*	2.21
NM_025914	*Actr6*	2.74	NM_027398	*Kcnip1*	2.21
NM_009320	*Slc6a6*	2.73	NM_007515	*Slc7a3*	2.20
NM_024439	*H47*	2.73	NM_019566	*Arhg*	2.20
NM_026180	*Abcg8*	2.73	NM_026677	*Rab13*	2.20
NM_026130	*Srpr*	2.73	NM_028388	*Ndufv2*	2.20
NM_010586	*Itpr5*	2.72	NM_007389	*Chrna1*	2.20
NM_007819	*Cyp3a13*	2.71	NM_024287	*Rab6*	2.20
NM_019741	*Slc2a5*	2.71	NM_007760	*Crat*	2.20
NM_020270	*Scamp5*	2.70	NM_016857	*Exoc7*	2.19
NM_021530	*Slc4a8*	2.69	NM_008227	*Hcn3*	2.19
NM_008428	*Kcnj8*	2.68	NM_001081048	*Slc25a18*	2.19
NM_021471	*Slco1c1*	2.67	NM_007582	*Cacng1*	2.18
NM_028052	*Synpr*	2.67	NM_028711	*Slc25a27*	2.18
NM_019923	*Itpr2*	2.66	NM_021879	*p*	2.18
NM_009405	*Tnni2*	2.65	NM_023671	*Clns1a*	2.17
NM_031195	*Msr1*	2.65	NM_011485	*Star*	2.17
NM_026298	*Wim*	2.65	NM_011027	*P2rx7*	2.17
NM_001081049	*Mll*	2.63	NM_028064	*Slc39a4*	2.17
NM_010600	*Kcnh1*	2.63	NM_001160139	*Kcnq5*	2.16
NM_030556	*Slc19a3*	2.63	NM_026200	*Kcnv1*	2.16
NM_009203	*Slc22a12*	2.63	NM_027439	*Atp6ap2*	2.15
NM_008165	*Gria1*	2.62	NM_021710	*Ap4s1*	2.15
NM_011405	*Slc7a7*	2.61	NM_008998	*Rab17*	2.15
NM_013900	*Mfi2*	2.59	NM_008172	*Grin2d*	2.14
NM_008031	*Fmr1*	2.59	NM_019510	*Trpc3*	2.14
NM_026468	*Atp5g2*	2.59	NM_007618	*Serpina6*	2.14
NM_019720	*AW049681*	2.59	NM_016755	*Atp5j*	2.13
NM_025826	*Acadsb*	2.58	NM_009306	*Syt1*	2.13
NM_030888	*C1qtnf3*	2.57	NM_009928	*Col15a1*	2.13
NM_008076	*Gabrr2*	2.56	NM_030683	*Slc14a2*	2.13
NM_001081084	*Cubn*	2.55	NM_021415	*Cacna1h*	2.13
NM_013415	*Atp1b2*	2.54	NM_009005	*Rab7*	2.13
NM_010354	*Gsn*	2.54	NM_007382	*Acadm*	2.12
NM_031173	*Cacnb1*	2.53	NM_009720	*Atox1*	2.12
NM_008072	*Gabrd*	2.53	NM_013454	*Abca1*	2.11
NM_011504	*Stxbp3*	2.53	NM_008713	*Nos3*	2.11
NM_029673	*Immt*	2.52	NM_029505	*Ap3m2*	2.11
NM_008423	*Kcnd1*	2.52	NM_016752	*Slc35b1*	2.11
NM_008600	*Mip*	2.51	NM_007885	*Slc26a2*	2.11
NM_028942	*Slco6c1*	2.51	NM_007807	*Cybb*	2.10
NM_009994	*Cyp1b1*	2.50	NM_027862	*Atp5h*	2.10
NM_019701	*Clcnkb*	2.50	NM_019696	*Cpxm1*	2.08
NM_018804	*Syt11*	2.50	NM_010215	*Il4i1*	2.08

Table 11. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	*Gene Name*	Fold of change
NM_013790	*Abcc5*	2.50	NM_053204	*Rab6ip2*	2.08
NM_023214	*Slc30a7*	2.49	NM_008596	*Mg29*	2.07
NM_029655	*Snx7*	2.49	NM_009941	*Cox4i1*	2.07
NM_008418	*Kcna3*	2.48	NM_022992	*Arl6ip5*	2.07
NM_009659	*Alox12b*	2.48	NM_138660	*Casc3*	2.07
NM_024458	*Pdc*	2.48	NM_009395	*Tnfaip1*	2.07
NM_008997	*Rab11b*	2.48	NM_011389	*Slc12a1*	2.06
NM_019758	*Mtch2*	2.47	NM_007457	*Ap1s1*	2.05
NM_030239	*Abcg3*	2.47	NM_010250	*Gabra1*	2.05
NM_029600	*Abcc3*	2.47	NM_013635	*Sypl*	2.05
NM_007810	*Cyp19a1*	2.46	NM_021284	*Kras2*	2.05
NM_021370	*Accn5*	2.46	NM_126165	*Vps4a*	2.04
NM_027008	*Kctd5*	2.45	NM_019415	*Slc12a3*	2.04
NM_011310	*S100a3*	2.45	NM_026610	*Ndufb4*	2.04
NM_007480	*Arf5*	2.45	NM_026998	*Snx6*	2.03
NM_008851	*Pitpnm*	2.44	NM_013895	*Timm9*	2.03
NM_023126	*Rab8a*	2.44	NM_152220	*Stx3*	2.03
NM_021544	*Scn5a*	2.43	NM_007825	*Cyp7b1*	2.03
NM_021547	*Stard3*	2.43	NM_133969	*Cyp4v3*	2.03
NM_028238	*Rab38*	2.42	NM_028712	*Rap2b*	2.01
NM_018768	*Stx8*	2.41	NM_009134	*Scn10a*	2.01
NM_023743	*Eif4enif1*	2.40	NM_027352	*Gorasp2*	2.01
NM_009942	*Cox5b*	2.39	NM_025573	*Sfrs9*	2.00
NM_019502	*Fxc1*	2.39	NM_010599	*Kcnab3*	2.00

Table 12. Down-regulated genes related to transport in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_080467	*Atp6v0a4*	0.331	NM_009931	*Col4a1*	0.452
NM_009930	*Col3a1*	0.349	NM_011403	*Slc4a1*	0.453
NM_025823	*Pcyox1*	0.384	NM_007823	*Cyp4b1*	0.455
NM_001081097	*Grik3*	0.393	NM_133189	*Cacng7*	0.486
NM_007854	*Slc29a2*	0.395	NM_133254	*Slc5a2*	0.486
NM_022327	*Ralb*	0.408	NM_138955	*Abcg4*	0.489
NM_018762	*Gp9*	0.428	NM_011436	*Sorl1*	0.492
NM_148944	*Chrnb4*	0.431	NM_007506	*Atp5g1*	0.494
NM_007742	*Col1a1*	0.433	NM_013683	*Tap1*	0.495
NM_028247	*Slc16a10*	0.444	NM_019552	*Abcb10*	0.499
NM_026553	*Yif1*	0.444			

Table 13. Up-regulated genes related to transcription in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_010789	*Meis1*	3.37	NM_029999	*Lbh*	2.39
NM_007498	*Atf3*	3.34	NM_023672	*Ssbp3*	2.39
NM_007924	*Ell*	3.30	NM_011603	*Tbpl1*	2.38
NM_053254	*Tle6*	3.29	NM_013744	*Zfp354b*	2.38
NM_007959	*Etsrp71*	3.23	NM_027139	*Taf9*	2.38
NM_007471	*App*	3.15	NM_008499	*Lhx5*	2.37
NM_007855	*Twist2*	3.10	NM_025307	*Nrbf2*	2.37
NM_027326	*Mllt3*	3.02	NM_011294	*Rpo2tc1*	2.36
NM_013926	*Cbx8*	2.96	NM_010467	*Hoxd1*	2.35
NM_053170	*Trim33*	2.95	NM_023729	*Gasz*	2.34
NM_013476	*Ar*	2.92	NM_145632	*Polr2h*	2.34
NM_009234	*Sox11*	2.89	NM_009322	*Tbr1*	2.34
NM_008692	*Nfyc*	2.89	NM_007880	*Arid3a*	2.33
NM_145831	*Dmrt2*	2.89	NM_130893	*Scrt1*	2.33
NM_018809	*Ptf1a*	2.88	NM_010452	*Hoxa3*	2.33
NM_010894	*Neurod1*	2.88	NM_019660	*Mycbp*	2.32
NM_010136	*Eomes*	2.86	NM_020005	*Pcaf*	2.32
NM_011551	*Ubtf*	2.85	NM_053213	*Mad3*	2.32
NM_020584	*Terf2ip*	2.83	NM_028245	*Zfp131*	2.31
NM_011037	*Pax2*	2.83	NM_009116	*Prrx2*	2.31
NM_011541	*Tcea1*	2.81	NM_010919	*Nkx2-2*	2.31
NM_021318	*Fhl5*	2.80	NM_010574	*Irx2*	2.30
NM_019460	*Sfmbt1*	2.79	NM_019994	*Garnl1*	2.30
NM_016793	*Zfp98*	2.76	NM_013519	*Foxc2*	2.30
NM_009578	*Zfpn1a1*	2.76	NM_133971	*Ankrd10*	2.30
NM_013827	*Mtf2*	2.75	NM_010426	*Foxf1a*	2.29
NM_011658	*Twist1*	2.75	NM_026496	*Tcfcp2l3*	2.28
NM_011499	*Strap*	2.75	NM_028041	*Ddx54*	2.28
NM_027949	*Phf7*	2.75	NM_011307	*Rxrip110*	2.27
NM_020483	*Hcngp*	2.75	NM_008652	*Mybl2*	2.27
NM_010692	*Lbx2h*	2.74	NM_008566	*Mcm5*	2.26
NM_020558	*C1d*	2.74	NM_010938	*Nrf1*	2.26
NM_013874	*Neud4*	2.74	NM_025891	*Smarcd3*	2.24
NM_011584	*Nr1d2*	2.73	NM_007615	*Catns*	2.24
NM_175303	*Sall4*	2.73	NM_009547	*Zfp161*	2.23
NM_008735	*Nrip1*	2.71	NM_016861	*Pdlim1*	2.23
NM_020255	*Scand1*	2.70	NM_008393	*Irx3*	2.21
NM_010158	*Khdrbs3*	2.70	NM_054039	*Foxp3*	2.20
NM_130869	*Og2x*	2.68	NM_008543	*Madh7*	2.20
NM_013665	*Shox2*	2.68	NM_008271	*Hoxc5*	2.19
NM_028709	*Btbd11*	2.66	NM_013720	*Mga*	2.19
NM_013915	*Zfp238*	2.65	NM_174852	*Phf12*	2.18
NM_010151	*Nr2f1*	2.65	NM_009360	*Tfam*	2.18
NM_178280	*Sall3*	2.65	NM_011550	*Tcfl4*	2.18
NM_010592	*Jund1*	2.65	NM_181650	*Prdm4*	2.17
NM_008274	*Hoxd12*	2.64	NM_026107	*Zfp535*	2.17
NM_010420	*Hesx1*	2.64	NM_008506	*Lmyc1*	2.17
NM_008900	*Pou3f3*	2.64	NM_010118	*Egr2*	2.17
NM_010909	*Nfkbil1*	2.61	NM_011813	*Fiz1*	2.17

Table 13. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_008684	*Neo1*	2.59	NM_023814	*Tbx18*	2.16
NM_016967	*Olig2*	2.58	NM_027485	*Crsp7*	2.16
NM_008950	*Psmc5*	2.58	NM_011605	*Tmpo*	2.16
NM_011136	*Pou2af1*	2.56	NM_015758	*Foxe3*	2.15
NM_010895	*Neurod2*	2.56	NM_008899	*Pou3f2*	2.15
NM_027547	*Prdm5*	2.56	NM_008657	*Myf6*	2.14
NM_011980	*Zfp146*	2.55	NM_008716	*Notch3*	2.13
NM_207671	*Zfp318*	2.55	NM_025444	*Taf13*	2.13
NM_009541	*Zfp100*	2.54	NM_008849	*Pit1*	2.12
NM_009545	*Rnf110*	2.53	NM_023755	*Tcfcp2l1*	2.11
NM_010832	*Msl31*	2.52	NM_008260	*Foxa3*	2.11
NM_017373	*Nfil3*	2.50	NM_008262	*Onecut1*	2.10
NM_013684	*Tbp*	2.50	NM_027347	*Crsp3*	2.10
NM_017375	*Ostf1*	2.50	NM_023472	*Ankra2*	2.08
NM_009122	*Satb1*	2.49	NM_010449	*Hoxa1*	2.08
NM_011600	*Tle4*	2.49	NM_011850	*Nr0b2*	2.08
NM_021901	*Tlx1*	2.48	NM_009123	*Nkx1-2*	2.07
NM_008814	*Ipf1*	2.48	NM_009108	*Nr1h4*	2.07
NM_024124	*Hdac9*	2.47	NM_009550	*Zfp2*	2.06
NM_001042499	*Rabl3*	2.46	NM_028868	*Cxxc1*	2.05
NM_026374	*Ilf2*	2.46	NM_022009	*Fliih*	2.05
NM_011021	*Otp*	2.45	NM_178392	*Snapc1*	2.05
NM_011565	*Tead2*	2.44	NM_030690	*Rai14*	2.05
NM_026383	*Pnrc2*	2.44	NM_011935	*Esrrg*	2.05
NM_019791	*Maged1*	2.44	NM_033652	*Lmx1a*	2.04
NM_011066	*Per2*	2.44	NM_010836	*Msx3*	2.04
NM_009329	*Zfp354a*	2.43	NM_010057	*Dlx6*	2.03
NM_010445	*Hmx1*	2.42	NM_008700	*Nkx2-5*	2.03
NM_021462	*Mknk2*	2.42	NM_183248	*Nkx6-2*	2.03
NM_023907	*Foxi1*	2.42	NM_028932	*Eaf1*	2.03
NM_027689	*Rfx4*	2.41	NM_019446	*Barhl1*	2.02
NM_013672	*Sp1*	2.41	NM_011135	*Cnot7*	2.02

Table 14. Down-regulated genes related to transcription in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_001114140	*Tcf20*	0.160	NM_011605	*Tmpo*	0.399
NM_010446	*Foxa2*	0.232	NM_011547	*Tcfap2a*	0.410
NM_201644	*Ugt1a12*	0.325	NM_008252	*Hmgb2*	0.435
NM_013601	*Msx2*	0.343	NM_183298	*Foxe1*	0.452
NM_008265	*Hoxa4*	0.369	NM_009554	*Zfp37*	0.452
NM_010127	*Pou6f1*	0.378	NM_007531	*Bcap37*	0.457
NM_010226	*Fkhl18*	0.381	NM_010212	*Fhl2*	0.458
NM_010365	*Gtf2i*	0.387	NM_011419	*Jarid1d*	0.495
NM_011278	*Rnf4*	0.389	NM_011139	*Pou2f3*	0.498
NM_009343	*Phf1*	0.392			

Table 15. Up-regulated genes related to signal transduction in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_011113	*Plaur*	3.40	NM_009920	*Cnil*	2.45
NM_025609	*Map3k7ip1*	3.34	NM_008368	*Il2rb*	2.45
NM_009314	*Tacr2*	3.33	NM_146611	*MOR171-16*	2.45
NM_007560	*Bmpr1b*	3.23	NM_008809	*Pdgfrb*	2.44
NM_015742	*Myo9b*	3.22	NM_027763	*Treml1*	2.44
NM_009706	*Arhgap5*	3.16	NM_031873	*Tas1r2*	2.43
NM_025658	*Ms4a4d*	3.16	NM_146798	*MOR163-1*	2.43
NM_023121	*Gngt2*	3.14	NM_146745	*MOR171-12*	2.42
NM_007641	*Ms4a1*	3.13	NM_007781	*Csf2rb2*	2.42
NM_054040	*Tulp4*	3.12	NM_007407	*Adcyap1r1*	2.41
NM_013530	*Gnb3*	3.06	NM_007726	*Cnr1*	2.41
NM_007721	*Gpr2*	3.05	NM_008315	*Htr7*	2.39
NM_013487	*Cd3d*	3.00	NM_010320	*Gng8*	2.39
NM_009063	*Rgs5*	2.99	NM_020265	*Dkk2*	2.38
NM_010301	*Gna11*	2.98	NM_012003	*Cops7a*	2.37
NM_013767	*Csnk1e*	2.94	NM_009290	*Wnt8a*	2.37
NM_011943	*Map2k6*	2.94	NM_020598	*Olfr17*	2.37
NM_013523	*Fshr*	2.92	NM_008308	*Htr1a*	2.37
NM_008058	*Fzd8*	2.92	NM_007420	*Adrb2*	2.36
NM_019476	*Olfr159*	2.92	NM_206897	*Olfr6*	2.34
NM_027677	*Gpr39*	2.91	NM_008043	*Frat1*	2.33
NM_022012	*Map3k11*	2.91	NM_008141	*Gnat2*	2.33
NM_019958	*Rgs17*	2.90	NM_015759	*Fgd3*	2.32
NM_021368	*Ors16*	2.90	NM_007865	*Dll1*	2.31
NM_007764	*Crkl*	2.90	NM_011798	*Xcr1*	2.29
NM_025758	*Asb17*	2.88	NM_033269	*Chrm3*	2.29
NM_027571	*P2ry12*	2.88	NM_008965	*Ptger4*	2.27
NM_028450	*Gulp1*	2.86	NM_007538	*Opn1sw*	2.27
NM_010200	*Fgf13*	2.84	NM_013619	*Olfr67*	2.25
NM_008174	*Grm8*	2.84	NM_010102	*Edg6*	2.25
NM_025285	*Stmn2*	2.82	NM_008762	*Olfr15*	2.24
NM_133485	*Ppp1r14c*	2.82	NM_009518	*Wnt10a*	2.23
NM_146746	*MOR171-11*	2.82	NM_021280	*Plcg1*	2.23
NM_007863	*Mpp3*	2.81	NM_021381	*Gpr73*	2.23
NM_022881	*Rgs18*	2.77	NM_147074	*Ors19*	2.23
NM_009759	*Bmx*	2.77	NM_021457	*Fzd1*	2.22
NM_010203	*Fgf5*	2.75	NM_009539	*Zap70*	2.20
NM_019492	*Rgs3*	2.75	NM_145066	*Gpr85*	2.20
NM_080557	*Snx4*	2.74	NM_011925	*Cd97*	2.19
NM_019653	*Wsb1*	2.72	NM_009962	*Gpr44*	2.19
NM_020501	*Tas2r105*	2.71	NM_029716	*Chn1*	2.18
NM_021892	*Rfrp*	2.71	NM_021921	*Mapk8ip2*	2.18
NM_010569	*Invs*	2.70	NM_032399	*Gpr87*	2.17
NM_021391	*Ppp1r1a*	2.70	NM_010254	*Galr2*	2.17
NM_011682	*Utrn*	2.68	NM_146614	*MOR171-13*	2.14
NM_027965	*Gpr160*	2.64	NM_026446	*Rgs19*	2.13
NM_019933	*Ptpn4*	2.64	NM_028736	*Grip1*	2.13
NM_009939	*Cops2*	2.64	NM_009168	*Shd*	2.13
NM_020510	*Fzd2*	2.61	NM_021609	*Ccbp2*	2.11

Table 15. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_019917	*V2r1b*	2.60	NM_007577	*C5r1*	2.10
NM_020621	*P2ry4*	2.60	NM_011718	*Wnt10b*	2.09
NM_007780	*Csf2rb1*	2.59	NM_011529	*Tank*	2.09
NM_007427	*Agrp*	2.59	NM_019404	*Avpr2*	2.09
NM_013867	*Bcar3*	2.58	NM_009519	*Wnt11*	2.08
NM_011756	*Zfp36*	2.57	NM_009848	*Entpd1*	2.08
NM_013521	*Fpr1*	2.57	NM_008356	*Il13ra2*	2.08
NM_008488	*Arhgef1*	2.57	NM_007720	*Ccr8*	2.07
NM_028724	*Rin2*	2.55	NM_010437	*Hivep2*	2.05
NM_018884	*Semcap3*	2.55	NM_146456	*MOR256-29*	2.05
NM_008140	*Gnat1*	2.55	NM_007718	*Ccr1l1*	2.04
NM_019677	*Plcb1*	2.52	NM_008805	*Pde6a*	2.04
NM_011924	*Avpr1b*	2.52	NM_008507	*Lnk*	2.03
NM_030712	*Cxcr6*	2.51	NM_010130	*Emr1*	2.03
NM_011083	*Pik3c2a*	2.51	NM_011268	*Rgs9*	2.02
NM_009835	*Ccr6*	2.50	NM_007395	*Acvr1b*	2.02
NM_031380	*Fstl3*	2.50	NM_007878	*Drd4*	2.02
NM_013912	*Apln*	2.48	NM_009827	*Cckar*	2.02
NM_011941	*Mapkbp1*	2.48	NM_011104	*Prkce*	2.02
NM_010341	*Gpr66*	2.48	NM_009914	*Ccr3*	2.01
NM_008747	*Ntsr2*	2.47	NM_001003685	*Ghrhr*	2.01
NM_009216	*Sstr1*	2.46	NM_008154	*Gpr3*	2.01
NM_007974	*F2rl1*	2.46	NM_008151	*Gpr12*	2.01

Table 16. Down-regulated genes related to signal transduction in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_146420	*MOR106-3*	0.159	NM_010342	*Gpr7*	0.444
NM_146322	*MOR183-8*	0.221	NM_146777	*MOR110-2*	0.445
NM_009630	*Adora2a*	0.350	NM_146902	*MOR233-3*	0.449
NM_146658	*MOR177-4*	0.351	NM_207154	*MOR179-4*	0.451
NM_080856	*Asb14*	0.354	NM_146827	*MOR162-1*	0.455
NM_026270	*Akt1s1*	0.371	NM_146904	*Olfr72*	0.456
NM_009487	*V2r11*	0.378	NM_011634	*Traip*	0.456
NM_172285	*Plcg2*	0.401	NM_146989	*MOR127-1*	0.462
NM_145848	*V1re13*	0.412	NM_008763	*Olfr16*	0.470
NM_146879	*MOR275-1*	0.415	NM_146270	*MOR267-16*	0.478
NM_146378	*MOR114-11*	0.417	NM_146840	*MOR42-1*	0.481
NM_146402	*MOR245-7*	0.423	NM_147077	*MOR13-2*	0.482
NM_146934	*Olfr46*	0.426	NM_020510	*Fzd2*	0.485
NM_146329	*MOR13-6*	0.439	NM_146576	*MOR120-1*	0.489
NM_013523	*Fshr*	0.442	NM_010589	*Jak3*	0.494
NM_207153	*MOR275-5*	0.443	NM_008312	*Htr2c*	0.496

Table 17. Up-regulated genes related to metal homeostasis in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_028031	*Hip14l*	3.43	NM_172121	*Zc3hdc3*	2.48
NM_133738	*Antxr2*	2.76	NM_023266	*Zfp120*	2.47
NM_019831	*Zfp261*	2.72	NM_019969	*Plag1*	2.47
NM_011746	*Mkrn3*	2.71	NM_025428	*Zdhhc12*	2.46
NM_028379	*Zdhhc4*	2.71	NM_020594	*Fliz1*	2.45
NM_008631	*Mt4*	2.62	NM_030684	*Trim34*	2.43
NM_133228	*Zfp72*	2.60	NM_009551	*Zfp216*	2.43
NM_024256	*B3Gat3*	2.59	NM_008114	*Gfi1b*	2.37
NM_028356	*Zfp50*	2.59	NM_212438	*Wiz*	2.37
NM_011231	*Rabggtb*	2.56	NM_030706	*Trim2*	2.36
NM_031172	*Trim17*	2.56	NM_053166	*Trim7*	2.33
NM_026796	*Smyd2*	2.55	NM_024231	*Zfpl1*	2.31
NM_013866	*Zfp385*	2.52	NM_018880	*Trim3*	2.31
NM_013602	*Mt1*	2.51	NM_020267	*Trim44*	2.15
NM_029104	*Zmynd17*	2.50	NM_026856	*D5Ertd689e*	2.13
NM_207176	*Tes*	2.49	NM_030219	*Trim42*	2.13
NM_011845	*Mid2*	2.49	NM_026021	*Zmynd19*	2.12

Table 18. Down-regulated genes related to metal homeostasis in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_025920	*Thap4*	0.286	NM_021253	*Trim39*	0.447
NM_053100	*Trim8*	0.412			

Table 19. Up-regulated genes related to the ubiquitin-proteasome system in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene name	Fold of change	Accession Number	Gene name	Fold of change
NM_011670	*Uchl1*	3.20	NM_011787	*Amfr*	2.38
NM_023738	*Ube1l*	2.94	NM_008948	*Psmc3*	2.34
NM_025770	*Apg10l*	2.92	NM_008947	*Psmc1*	2.29
NM_023224	*Cblc*	2.91	NM_019748	*Uble1a*	2.26
NM_021313	*Rnf25*	2.82	NM_010797	*Mid1*	2.24
NM_011909	*Usp18*	2.82	NM_027804	*Usp19*	2.24
NM_016786	*Hip2*	2.78	NM_015821	*Fbxl8*	2.22
NM_013907	*Fbxw4*	2.68	NM_145628	*Usp11*	2.21
NM_021522	*Usp14*	2.65	NM_015822	*Fbxl3a*	2.2
NM_008950	*Psmc5*	2.58	NM_019803	*Ube2g2*	2.19
NM_018812	*Pias3*	2.53	NM_013890	*Fbxw2*	2.17
NM_010727	*Lnx1*	2.53	NM_021360	*Cul2*	2.16
NM_011543	*Skp1a*	2.48	NM_026557	*Zfp363*	2.09
NM_133247	*Usp33*	2.43	NM_009172	*Siah1a*	2.09
NM_133777	*Ube2s*	2.43	NM_008569	*Anapc1*	2.05
NM_009462	*Usp10*	2.40	NM_023137	*Ubd*	2.01

Table 20. Down-regulated genes related to the ubiquitin-proteasome system in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_080428	*Fbxw7*	0.48	NM_011664	*Ubb*	0.49
NM_019639	*Ubc*	0.49			

Table 21. Other up-regulated genes in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_019764	*Amotl2*	3.58	NM_007864	*Dlgh4*	2.40
NM_146279	*MOR224-12*	3.55	NM_019419	*Arl6ip1*	2.40
NM_027022	*Cklfsf2a*	3.53	NM_026826	*Mrps18c*	2.39
NM_010167	*Eya4*	3.48	NM_010443	*Hmox2*	2.39
NM_054080	*Akr1c20*	3.48	NM_008610	*Mmp2*	2.39
NM_010863	*Myo1b*	3.41	NM_028639	*Ttc7*	2.39
NM_025691	*Srp72*	3.39	NM_024182	*Riok3*	2.39
NM_009278	*Ssb*	3.37	NM_009378	*Thbd*	2.39
NM_021339	*Cdon*	3.35	NM_007944	*Eps15-rs*	2.39
NM_017722	*Trmt1*	3.32	NM_008405	*Itgb2l*	2.39
NM_019924	*Rps6ka4*	3.31	NM_010833	*Msn*	2.39
NM_019837	*Nudt3*	3.30	NM_053069	*Apg5l*	2.39
NM_080639	*Timp4*	3.24	NM_029355	*Prlpn*	2.39
NM_017389	*Ear4*	3.23	NM_013845	*Ror1*	2.39
NM_012045	*Pla2g2f*	3.22	NM_026309	*Lsm3*	2.38
NM_016859	*Bysl*	3.20	NM_011986	*Ncdn*	2.38
NM_023115	*Pcdh15*	3.20	NM_008970	*Pthlh*	2.38
NM_018805	*Hs3st3b*	3.20	NM_013896	*Timm10*	2.38
NM_025875	*Rbm8*	3.19	NM_008485	*Lamc2*	2.38
NM_015836	*Wars2*	3.18	NM_029692	*Upp2*	2.38
NM_009810	*Casp3*	3.17	NM_009746	*Bcl7c*	2.38
NM_007786	*Csnk*	3.17	NM_007685	*Cfc1*	2.38
NM_027974	*Efhc1*	3.14	NM_019578	*Extl1*	2.38
NM_019428	*Rnasep2*	3.14	NM_008856	*Prkch*	2.38
NM_009621	*Adamts1*	3.14	NM_007882	*Dsc3*	2.38
NM_030691	*Igsf6*	3.13	NM_028930	*Tmc5*	2.38
NM_008027	*Flot1*	3.13	NM_008301	*Hspa2*	2.37
NM_021508	*Myoz1*	3.12	NM_001081274	*Pgd*	2.37
NM_008715	*Ddx26*	3.11	NM_027545	*Cwf19l2*	2.37
NM_018755	*Pgcp*	3.11	NM_016675	*Cldn2*	2.37
NM_009052	*Rex3*	3.11	NM_007403	*Adam8*	2.37
NM_025304	*Lcmt1*	3.10	NM_028153	*Eml2*	2.37
NM_010829	*Msh3*	3.10	Y12713	*Erv4*	2.37
NM_021504	*Ngly1*	3.08	NM_031187	*Mcpt7*	2.37
NM_010181	*Fbn2*	3.08	NM_013675	*Spnb1*	2.36
NM_016779	*Dmp1*	3.08	NM_027726	*Dlg5*	2.36
NM_027513	*Nup205*	3.07	NM_138682	*Lrrc4*	2.36
NM_010771	*Matr3*	3.06	NM_007734	*Col4a3*	2.36
NM_016782	*Cntnap1*	3.04	NM_009177	*Siat4a*	2.36
NM_025597	*Ndufb3*	3.03	NM_010084	*Adam18*	2.36
NM_029810	*Nt5c2*	3.03	NM_028608	*Glipr1*	2.36
NM_145535	*Sdcbp2*	3.03	NM_011851	*Nt5e*	2.36

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_025975	*Tcte1l*	3.02	NM_008897	*Pon3*	2.35
NM_030059	*Cst11*	3.02	NM_026768	*Mrps18a*	2.35
NM_007653	*Cd63*	3.01	NM_019800	*Acp6*	2.35
NM_028860	*Mtmr3*	3.01	NM_007853	*Degs*	2.35
NM_009988	*Cxadr*	3.01	NM_009729	*Atp6v0c*	2.35
NM_011500	*Strn*	3.00	NM_011422	*Smr1*	2.35
NM_027181	*Pin4*	3.00	NM_130877	*Peg10*	2.35
NM_026167	*Klhl13*	2.99	NM_011251	*Rbm6*	2.35
NM_133167	*Parvb*	2.99	NM_133726	*St13*	2.35
NM_029916	*Stk31*	2.99	NM_033623	*Tes3*	2.34
NM_008971	*Ptk9*	2.99	NM_011201	*Ptpn1*	2.34
NM_028640	*Whrn*	2.98	NM_027708	*Fbxo24*	2.34
NM_021344	*Tesc*	2.98	NM_009285	*Stc1*	2.34
NM_008579	*Meig1*	2.98	NM_010067	*Dnmt2*	2.34
NM_013830	*Prpf4b*	2.98	NM_007788	*Csnk2a1*	2.34
NM_029492	*Zdhhc20*	2.98	NM_011657	*Tulp3*	2.34
NM_019681	*Freq*	2.97	NM_009121	*Sat1*	2.34
NM_009356	*Tesp2*	2.97	NM_134048	*Cbll1*	2.34
NM_011022	*Ott*	2.96	NM_001081306	*Ptprz1*	2.33
NM_033616	*Csprs*	2.96	NM_025936	*Rars*	2.33
NM_018873	*P140*	2.95	NM_020026	*B3galt3*	2.33
NM_027926	*Cpa4*	2.94	NM_008980	*Ptpra*	2.33
NM_030719	*Gats*	2.94	NM_021335	*Snrpb2*	2.32
NM_010244	*Fv1*	2.94	NM_010837	*Mtap6*	2.32
NM_008446	*Kif4*	2.94	NM_021292	*Evc*	2.32
NM_013470	*Anxa3*	2.93	NM_029325	*Spinlw1*	2.32
NM_008441	*Kif1b*	2.93	NM_013774	*Tcl1b4*	2.31
NM_008403	*Itgb1bp1*	2.92	NM_008316	*Hus1*	2.31
NM_026328	*Reg4*	2.92	NM_028454	*Tm7sf2*	2.31
NM_020570	*Xrcc2*	2.91	NM_028493	*Rhobtb3*	2.31
NM_028756	*Slc35a5*	2.91	NM_025441	*Sdccag1*	2.31
NM_011168	*Prlpf*	2.91	NM_019870	*Ard1*	2.31
NM_019637	*Styx*	2.91	NM_019964	*Dnajb8*	2.31
NM_008941	*Prss7*	2.91	NM_013759	*Sepr*	2.31
NM_008187	*Gtl3*	2.91	NM_145380	*Ga17*	2.31
NM_007860	*Dio1*	2.90	NM_013848	*Ermap*	2.31
NM_011287	*Rpl10a*	2.90	M11051	*Fv4*	2.31
NM_033373	*Krt1-23*	2.90	NM_032540	*Kel*	2.31
NM_015757	*Pcdhga12*	2.90	NM_024449	*Sost*	2.30
NM_026969	*Sec31l1*	2.90	NM_007791	*Csrp1*	2.30
AF067063	*LOC380878*	2.90	NM_011690	*Vars2*	2.30
NM_025768	*Grtp1*	2.89	NM_013771	*Yme1l1*	2.30
NM_016713	*Map4k6*	2.89	NM_009639	*Crisp3*	2.30
NM_008546	*Mfap2*	2.88	NM_031493	*Xlr5*	2.30
NM_145371	*Eif2b1*	2.88	NM_021394	*Zbp1*	2.30
NM_019694	*Letm1*	2.88	NM_016884	*Hnrpc*	2.30
NM_030744	*Ropn1*	2.88	NM_007683	*Cenpc*	2.30
NM_019519	*Rabggta*	2.87	NM_017374	*Ppp2cb*	2.30
NM_009493	*V2r4*	2.87	NM_023149	*Cn2*	2.29

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_010268	*Gdap10*	2.87	NM_134017	*Mat2b*	2.29
NM_019961	*Pex3*	2.87	NM_030711	*Arts1*	2.29
NM_010795	*Mgat3*	2.87	NM_008662	*Myo6*	2.29
NM_009049	*Resp18*	2.87	NM_207687	*Espn*	2.29
NM_029211	*Rnf121*	2.87	NM_001310623	*Wbp3*	2.29
NM_145919	*Dorz1*	2.87	NM_027802	*Obox1*	2.29
NM_010686	*Laptm5*	2.86	NM_013664	*Sh3gl1*	2.29
NM_008969	*Ptgs1*	2.86	NM_009377	*Th*	2.29
NM_025606	*Mrpl16*	2.86	NM_025407	*Uqcrc1*	2.28
NM_026871	*Hint2*	2.85	NM_010758	*Mag*	2.28
NM_025989	*Gp2*	2.85	NM_001174099	*Krt1-5*	2.28
NM_029023	*Risc*	2.85	NM_031874	*Rab3d*	2.28
NM_008376	*Imap38*	2.84	NM_021286	*Sez6*	2.28
NM_009420	*Crisp2*	2.84	NM_026483	*Mphosph10*	2.28
NM_007688	*Cfl2*	2.84	NM_025301	*Mrpl17*	2.28
NM_008644	*Muc10*	2.84	NM_021360	*Neurl*	2.28
NM_009796	*Capn7*	2.84	NM_019472	*Myo10*	2.28
NM_007399	*Adam10*	2.84	NM_011656	*Tuft1*	2.28
NM_024187	*U2af1*	2.83	NM_027879	*Cdc40*	2.28
NM_025297	*Nrbf1*	2.83	NM_007400	*Adam12*	2.28
NM_009940	*Coq7*	2.83	NM_031257	*Plekha2*	2.27
NM_031403	*Dbr1*	2.83	NM_027777	*Pex1*	2.27
NM_031256	*Plekha3*	2.82	NM_007415	*Adprt1*	2.27
NM_026449	*Galnt15*	2.82	NM_019999	*Brp17*	2.27
NM_015734	*Col5a1*	2.81	NM_008186	*Gtf2h1*	2.27
NM_008625	*Mrc1*	2.81	NM_008586	*Mep1b*	2.27
NM_053115	*Acox2*	2.80	NM_011829	*Impdh1*	2.27
NM_009261	*Strbp*	2.80	NM_080638	*Mvp*	2.26
NM_013456	*Actn3*	2.80	NM_145150	*Prc1*	2.26
NM_008770	*Cldn11*	2.80	NM_025369	*Mrps36*	2.26
NM_008868	*Pla2g2c*	2.80	NM_021494	*Rab6ip1*	2.26
NM_021898	*Halapx*	2.80	NM_008939	*Prss12*	2.26
NM_030098	*Rnase6*	2.79	BC003476	*Ii*	2.26
NM_148934	*Gtrgeo22*	2.79	NM_024241	*Kif24*	2.26
NM_016664	*Mata2*	2.78	NM_009867	*Cdh4*	2.26
NM_013682	*T2*	2.78	NM_013788	*Peg12*	2.25
NM_023380	*Samsn1*	2.78	NM_133673	*Tor1b*	2.25
NM_026329	*Polr2g*	2.78	NM_009885	*Cel*	2.25
NM_013559	*Hsp105*	2.78	NM_021311	*Piwil1*	2.25
NM_013799	*Ate1*	2.78	NM_015819	*Hs6st2*	2.25
NM_011371	*Siat7a*	2.78	NM_080454	*Gja12*	2.25
NM_011452	*Serpinb9b*	2.77	NM_011884	*Rngtt*	2.25
NM_009273	*Srp14*	2.77	NM_007862	*Dlgh1*	2.25
NM_019445	*Fmn2*	2.77	NM_018798	*Ubqln2*	2.24
NM_016744	*Pde1a*	2.77	NM_008110	*Gdf9*	2.24
NM_009254	*Serpinb6a*	2.77	NM_021537	*Stk25*	2.24
NM_011061	*Padi4*	2.77	NM_008389	*Ipp*	2.24
NM_015785	*Zpbp*	2.77	NM_013712	*Itgb1bp2*	2.24
NM_138646	*Hps4*	2.77	NM_172253	*Twistnb*	2.24

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_010942	*Nsg1*	2.76	NM_013730	*Slamf1*	2.24
NM_019991	*Prlpm*	2.76	NM_053098	*Lmod2*	2.24
NM_009432	*Tshb*	2.75	NM_009374	*Tgm3*	2.24
NM_009015	*Rad54l*	2.75	NM_009478	*Urod*	2.24
NM_013722	*Syn3*	2.75	NM_007647	*Entpd5*	2.24
NM_010770	*Matn3*	2.75	NM_007690	*Chd1*	2.24
NM_009272	*Srm*	2.74	NM_009351	*Tep1*	2.24
NM_177369	*Myh8*	2.74	NM_016667	*Sntb1*	2.24
NM_027759	*Fsip1*	2.74	NM_028901	*Myo18b*	2.23
NM_025882	*Pole4*	2.74	NM_021525	*Rcl1*	2.23
NM_021478	*Tulp1*	2.74	NM_016962	*Spg4*	2.23
NM_019724	*Mmp16*	2.74	NM_010743	*Il1rl1*	2.23
NM_030710	*Ly108*	2.74	NM_009132	*Scin*	2.23
NM_133933	*Rpn1*	2.73	NM_016753	*Lxn*	2.23
NM_009253	*Serpina3m*	2.73	NM_025357	*Smpx*	2.23
NM_027874	*Csnk1d*	2.73	NM_011927	*Ceacam9*	2.23
NM_019753	*Cdh17*	2.73	NM_138605	*Ppp1r3f*	2.22
NM_019765	*Rsn*	2.73	NM_011375	*Siat9*	2.22
NM_010904	*Nefh*	2.72	NM_010085	*Adam26*	2.22
NM_133203	*Klra17*	2.72	NM_018736	*Mre11a*	2.22
NM_020622	*ORF9*	2.72	NM_011517	*Sycp3*	2.22
NM_145381	*Lactb2*	2.71	NM_032006	*Mmp1a*	2.22
NM_053161	*Mrpl27*	2.71	NM_023135	*Sult1e1*	2.22
NM_008397	*Itga6*	2.71	NM_008497	*Lhb*	2.21
NM_013608	*Naca*	2.71	NM_025448	*Ssr2*	2.21
NM_028038	*Ddx28*	2.71	NM_023511	*Krtap3-1*	2.21
NM_010027	*Ddt*	2.71	NM_028099	*Dusp11*	2.21
NM_019670	*Diap3*	2.71	NM_030717	*Lactb*	2.21
NM_027890	*Susd2*	2.70	NM_011240	*Ranbp2*	2.21
NM_010932	*Pnoc*	2.70	NM_020046	*Dhodh*	2.21
NM_019461	*Usp27x*	2.70	NM_022011	*Gtf2h2*	2.21
NM_019425	*Gnpnat1*	2.70	NM_031376	*Pik3ap1*	2.20
NM_024451	*Unc84a*	2.70	NM_015769	*Ercc4*	2.20
NM_029635	*Commd9*	2.70	NM_008035	*Folr2*	2.20
NM_011341	*Sdf4*	2.69	NM_013679	*Svs6*	2.20
NM_008880	*Plscr2*	2.69	NM_017397	*Ddx20*	2.20
L24160	*Btps*	2.69	NM_011910	*Uts2*	2.20
NM_011074	*Pfik1*	2.68	NM_007992	*Fbln2*	2.20
NM_021371	*Caln1*	2.68	NM_026716	*Sycn*	2.19
NR_004446	*H2-K2*	2.68	NM_009193	*Slbp*	2.19
NM_008102	*Gch*	2.68	NM_008785	*Serpina5*	2.19
NM_019834	*Git2*	2.68	NM_008547	*Mak*	2.19
NM_145705	*Tinf2*	2.67	AK009918	*Cdk3*	2.19
NM_008525	*Alad*	2.67	NM_177594	*Mtmr9*	2.19
NM_031378	*Mlze*	2.67	NM_008918	*Ppy*	2.19
NM_010917	*Nid1*	2.67	NM_009257	*Serpinb5*	2.19
NM_133355	*Grid2ip*	2.67	NM_007725	*Cnn2*	2.19
NM_007697	*Chl1*	2.67	NM_018749	*Eif3s7*	2.19
NM_020329	*Dolpp1*	2.67	NM_021489	*F12*	2.19

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_011779	*Coro1c*	2.67	NM_010121	*Eif2ak3*	2.18
NM_026314	*Dyx1c1*	2.67	NM_001285839	*Osgepl1*	2.18
NM_013879	*Cabp1*	2.67	NM_007645	*Cd37*	2.18
NM_130457	*Cntnap4*	2.67	NM_025469	*Clps*	2.18
NM_026401	*Mrp63*	2.67	NM_009755	*Bmp1*	2.18
NM_021567	*Pcbp4*	2.67	NM_053090	*Drctnnb1a*	2.18
NM_015755	*Hunk*	2.66	NM_146007	*Col6a2*	2.18
NM_146087	*Csnk1a1*	2.66	NM_029553	*Ttc8*	2.18
NM_018753	*Ywhab*	2.66	NM_017379	*Tuba8*	2.18
NM_013882	*Gtse1*	2.66	NM_009419	*Tpst2*	2.17
NM_020293	*Cldn9*	2.66	NM_007681	*Cenpa*	2.17
NM_015780	*Cfhl1*	2.66	NM_008277	*Hpd*	2.17
NM_008126	*Gjb3*	2.65	NM_009364	*Tfpi2*	2.17
NM_027749	*Cpvl*	2.65	BC003885	*MGC6735*	2.17
NM_001005223	*Myohd1*	2.65	NM_021495	*Pvrl3*	2.17
NM_007586	*Calb2*	2.65	NM_007745	*Cort*	2.17
NM_008958	*Ptch2*	2.65	NM_009645	*Aicda*	2.17
NM_019864	*Atr*	2.65	NM_011796	*Capn10*	2.17
NM_020330	*Adam21*	2.64	NM_016978	*Oat*	2.17
NM_024193	*Nol5a*	2.64	NM_011778	*Coro1b*	2.17
NM_027276	*Cdc16*	2.64	NM_019410	*Pfn2*	2.17
NM_052977	*Adarb2*	2.64	NM_133737	*Lancl2*	2.17
NM_019576	*Thsd1*	2.64	NM_019684	*Stk23*	2.17
NM_025450	*Mrps17*	2.64	NM_008536	*Tm4sf1*	2.17
NM_031997	*Tmem2*	2.64	NM_008412	*Ivl*	2.16
NM_009399	*Tnfrsf11a*	2.64	NM_027185	*Def6*	2.16
NM_027100	*Rwdd2*	2.64	NM_007990	*Fau*	2.16
NM_029735	*Eprs*	2.64	NM_020587	*Sfrs4*	2.16
NM_181073	*Plekhh1*	2.64	NM_008399	*Itgae*	2.16
NM_007919	*Ela2*	2.63	NM_010438	*Hk1*	2.16
NM_178603	*Mrpl50*	2.63	NM_030562	*Lrfn1*	2.16
NM_009947	*Cpne6*	2.63	NM_013714	*Irebf1*	2.16
NM_011166	*Prlpb*	2.63	NM_008929	*Dnajc3*	2.16
NM_009961	*Pcdha10*	2.63	NM_008634	*Mtap1b*	2.16
NM_011891	*Sgcd*	2.63	NM_052994	*Spock2*	2.15
NM_016712	*Tmod4*	2.63	NM_027892	*Ppp1r12a*	2.15
NM_030880	*Pacsin3*	2.62	NM_053124	*Smarca5*	2.15
NM_026033	*Odag*	2.62	NM_020605	*Jph3*	2.15
NM_022565	*Ndst4*	2.62	NM_009358	*Ppp2r5d*	2.15
NM_011729	*Ercc5*	2.61	NM_011992	*Rcn2*	2.15
NM_016740	*S100a11*	2.61	NM_021505	*Anapc5*	2.15
NM_033572	*Wbscr16*	2.61	NM_025294	*Gtlf3b*	2.15
NM_033612	*Ela1*	2.61	NM_009179	*Siat5*	2.15
AK008824	*Nudt7*	2.61	NM_011561	*Tdg*	2.15
NM_008254	*Hmgcl*	2.60	NM_029963	*Mrps5*	2.15
NM_009647	*Ak4*	2.60	NM_017468	*Enam*	2.15
NM_011995	*Pclo*	2.60	NM_027351	*Ppil3*	2.15
NM_016662	*Mad3*	2.60	NM_001025599	*Trim26*	2.15
NM_027570	*Ldhd*	2.60	NM_020566	*Dnajc4*	2.15

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_019636	*Tbc1d1*	2.60	NM_144800	*Mtss1*	2.14
NM_016963	*Tmod3*	2.60	NM_010238	*Brd2*	2.14
NM_007730	*Col12a1*	2.60	NM_008590	*Mest*	2.14
NM_013754	*Insl6*	2.60	NM_009310	*Pvr*	2.14
NM_027117	*Klhdc2*	2.59	NM_011906	*Tpra40*	2.14
NM_010418	*Herc2*	2.59	NM_175337	*Mlh3*	2.14
NM_027151	*Dctn2*	2.59	NM_025520	*Lsm5*	2.14
NM_011285	*Rpgr*	2.58	NM_007936	*Epha4*	2.14
NM_009868	*Cdh5*	2.58	NM_026129	*Erp29*	2.13
NM_009369	*Tgfbi*	2.57	NM_011304	*Ruvbl2*	2.13
NM_013747	*Golga5*	2.57	NM_013760	*Dnajb9*	2.13
NM_027907	*Agxt2l1*	2.57	NM_028782	*Prss15*	2.13
NM_031248	*Mapbpip*	2.57	NM_007839	*Dhx15*	2.13
NM_008081	*Galgt2*	2.57	NM_026425	*Nat5*	2.13
NM_011840	*Map2k5*	2.57	NM_172451	*Galnt6*	2.13
NM_030737	*V3R7*	2.57	NM_008448	*Kif5b*	2.13
NM_019487	*Hebp2*	2.56	NM_008696	*Map4k4*	2.12
NM_007958	*Smarcad1*	2.56	NM_026171	*Nvl*	2.12
NM_011215	*Ptprn2*	2.56	NM_013763	*Tbl2*	2.12
NM_018883	*Camkk1*	2.56	NM_009475	*Upa*	2.12
NM_013552	*Hmmr*	2.55	NM_026154	*Mrpl10*	2.12
NM_011776	*Zp3*	2.55	NM_007401	*Adam5*	2.12
NM_026123	*Unc50*	2.55	NM_016924	*ORF5*	2.12
NM_029157	*Sf3a3*	2.55	NM_009903	*Cldn4*	2.12
NM_027294	*Cklfsf8*	2.55	NM_027366	*Ly6g6e*	2.12
NM_019983	*Rabgef1*	2.55	NM_009443	*Tgoln1*	2.12
NM_011035	*Pak1*	2.55	NM_021347	*Gsdm*	2.12
NM_009515	*Was*	2.55	M63245	*Alas1*	2.11
NM_009175	*St6gal1*	2.55	NM_031164	*F13b*	2.11
NM_033268	*Actn2*	2.55	NM_013490	*Chk*	2.11
NM_054069	*Psbpc1*	2.55	NM_023587	*Ptplb*	2.11
NM_033073	*Krt2-7*	2.54	NM_011284	*Rpa2*	2.11
NM_031398	*Usmg1*	2.54	NM_010631	*Kifc3*	2.11
NM_021278	*Tmsb4x*	2.54	NM_019421	*425O18-1*	2.11
NM_011289	*Rpl27*	2.54	NM_008769	*Otc*	2.11
NM_025595	*Mrpl51*	2.53	NM_020508	*Brd4*	2.10
NM_020498	*Ly6i*	2.53	NM_010480	*Hspca*	2.10
NM_027982	*Ppp2cz*	2.53	NM_025900	*Dek*	2.10
NM_009092	*Rps17*	2.53	NM_026102	*Daam1*	2.10
NM_025449	*Nicn1*	2.53	NM_031181	*Siglecl1*	2.10
NM_010330	*Emb*	2.53	NM_011579	*Tgtp*	2.10
NM_021331	*G6pc-rs*	2.53	NM_029271	*Mrpl32*	2.10
NM_010058	*Dmwd*	2.52	NM_027560	*Arrdc2*	2.10
NM_001037756	*Brms1l*	2.52	NM_009100	*Rptn*	2.10
NM_033078	*Klrk1*	2.52	NM_011858	*Odz4*	2.10
NM_028785	*Dock8*	2.52	NM_011223	*Pxn*	2.10
NM_029967	*Adamtsl1*	2.51	NM_013821	*Hsd3b6*	2.10
NM_010243	*Fut9*	2.51	NM_001033173	*Usp31*	2.10
NM_145628	*Usp11*	2.51	NM_026384	*Dgat2*	2.09

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_013773	*Tcl1b1*	2.51	NM_008458	*Serpina3c*	2.09
NM_008294	*Hsd3b4*	2.51	NM_021432	*Nap1l5*	2.09
NM_013638	*Prm3*	2.50	NM_007573	*C1qbp*	2.09
NM_010173	*Faah*	2.50	NM_030703	*Cpn1*	2.09
NM_021406	*Trem1*	2.50	NM_010326	*Gp1ba*	2.09
NM_022814	*Polydom*	2.50	NM_013925	*Adat1*	2.09
NM_009598	*Ace*	2.50	NM_031379	*Tktl1*	2.09
NM_015776	*Mfap5*	2.50	NM_027481	*Sf4*	2.09
NM_007927	*Emd*	2.50	NM_133854	*Snapap*	2.08
AK016135	*Etnk1*	2.50	NM_001271433	*Haghl*	2.08
NM_029977	*Polq*	2.50	NM_027526	*Rasgef1a*	2.08
NM_007916	*Ddx19*	2.49	NM_007733	*Col19a1*	2.08
NM_010762	*Mal*	2.49	NM_008474	*Krt2-16*	2.08
NM_025548	*Ckap1*	2.49	NM_010221	*Fkbp10*	2.08
NM_007744	*Comt*	2.49	NM_010065	*Dnm*	2.08
NM_007800	*Ctsg*	2.49	NM_009079	*Rpl22*	2.08
NM_007933	*Eno3*	2.49	NM_024266	*Rps25*	2.08
NM_029791	*Bicd2*	2.48	NM_011782	*Adamts5*	2.07
NM_021385	*Rad18*	2.48	NM_007767	*Pcdha6*	2.07
NM_010883	*Ndph*	2.48	NM_007391	*Acrv1*	2.07
NM_011651	*Stk22s1*	2.48	NM_009038	*Rcvrn*	2.07
NM_026389	*Poldip2*	2.47	NM_028105	*Adck1*	2.07
NM_007841	*Ddx6*	2.47	NM_007738	*Col7a1*	2.07
NM_008872	*Plat*	2.47	NM_007926	*Scye1*	2.06
NM_016866	*Stk39*	2.47	NM_009613	*Adam11*	2.06
NM_007902	*Edn2*	2.47	NM_009410	*Top3a*	2.06
NM_023210	*Anp32e*	2.46	NM_013514	*Epb4.9*	2.06
NM_008508	*Lor*	2.46	NM_009130	*Scg3*	2.06
NM_013742	*Cars*	2.46	NM_007434	*Akt2*	2.05
NM_010491	*Iapp*	2.46	NM_134104	*Ndufs5*	2.05
NM_025718	*Dnase1l2*	2.46	NM_013750	*Phlda3*	2.05
NM_013893	*Ingaprp*	2.45	NM_011580	*Thbs1*	2.05
NM_029337	*Ep400*	2.45	NM_020564	*Sult5a1*	2.05
NM_001098170	*Pcdh10*	2.45	NM_029360	*Tm4sf5*	2.05
NM_008475	*Krt2-4*	2.45	NM_008402	*Itgav*	2.05
NM_009483	*Utx*	2.45	NM_011855	*Odz1*	2.05
NM_019645	*Pkp1*	2.45	NM_018765	*Wbp4*	2.04
NM_027681	*Gnpda2*	2.45	NM_029796	*Lrg1*	2.04
NM_019517	*Bace2*	2.44	NM_013560	*Hspb1*	2.04
NM_053068	*Chrac1*	2.44	NM_011883	*Rnf13*	2.04
NM_032544	*Gtpbp3*	2.44	NM_029815	*Bcas1*	2.04
NM_011917	*Xrn2*	2.44	NM_031843	*Dpp7*	2.04
NM_007495	*Astn1*	2.44	NM_028477	*Plpcd*	2.03
NM_011693	*Vcam1*	2.44	NM_019871	*Amac1*	2.03
NM_026639	*Art4*	2.44	NM_009536	*Ywhae*	2.03
NM_011213	*Ptprf*	2.44	NM_010910	*Nefl*	2.03
NM_011844	*Mgll*	2.43	NM_010590	*Jub*	2.03
NM_008100	*Gcg*	2.43	NM_008613	*Mns1*	2.03
NM_030689	*Nptxr*	2.43	NM_013525	*Gas5*	2.03

Table 21. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_028152	*Mms19l*	2.43	NM_008408	*Itm1*	2.03
NM_009274	*Srpk2*	2.43	NM_023876	*Elp4*	2.02
NM_009957	*Pcdha7*	2.43	NM_021891	*Fignl1*	2.02
NM_009614	*Adam15*	2.43	NM_013706	*Cd52*	2.02
NM_012053	*Rpl8*	2.43	NM_025878	*Mrps18b*	2.02
NM_019467	*Aif1*	2.42	NM_026116	*Bbs2*	2.02
NM_013600	*Msh5*	2.42	NM_016843	*Sca10*	2.02
NM_009705	*Arg2*	2.42	NM_145567	*Hibadh*	2.02
NM_019501	*Tprt*	2.42	NM_010363	*Gstz1*	2.02
NM_011740	*Ywhaz*	2.42	NM_020494	*Ddx24*	2.01
NM_053103	*Entpd7*	2.42	NM_027135	*Sec24d*	2.01
NM_008061	*G6pc*	2.41	NM_009960	*Pcdha11*	2.01
NM_011789	*Apc2*	2.41	NM_021527	*Mkks*	2.01
NM_008028	*Flot2*	2.41	NM_019744	*Ncoa4*	2.01
NM_145516	*Plekhb2*	2.41	NM_007419	*Adrb1*	2.01
NM_023554	*Nol7*	2.41	NM_053192	*Ucc1*	2.01
AF282275	*MOR171-24*	2.41	NM_019429	*Prss16*	2.01
NM_011120	*Plfr*	2.41	NM_022989	*Arl6ip6*	2.00
NM_008150	*Gpc4*	2.40	NM_008253	*Hmgb3*	2.00
NM_027246	*Snrpf*	2.40	NM_025540	*Sln*	2.00
NM_011987	*Pla2g10*	2.40	NM_028787	*Slc35f5*	2.00
NM_011519	*Sdc1*	2.40	NM_028874	*Snx19*	2.00
NM_011521	*Sdc4*	2.40			

Table 22. Other down-regulated genes in the mouse fetal liver following gestational Cd exposure.

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_025336	*Chchd3*	0.232	NM_009413	*Tpd52l1*	0.448
NM_152821	*Purg*	0.247	NM_145396	*Tbl3*	0.449
NM_030699	*Ntng1*	0.273	NM_011214	*Ptpru*	0.450
NM_133724	*Cno*	0.275	NM_021304	*Abhd1*	0.456
NR_001463	*Xist*	0.279	NM_183296	*Krtap16-3*	0.456
NM_147095	*MOR32-1*	0.282	NM_009115	*S100b*	0.457
NM_009933	*Col6a1*	0.286	NM_020296	*Rbms1*	0.457
NM_134240	*V1rh16*	0.289	NM_001081210	*Mrpl44*	0.460
NM_007801	*Ctsh*	0.307	NM_007742	*Col1a1*	0.461
NM_028216	*Psca*	0.333	NM_010581	*Cd47*	0.461
NM_013643	*Ptpn5*	0.334	NM_145613	*C1qtnf5*	0.461
NM_011626	*Tparl*	0.337	NM_025768	*Grtp1*	0.462
NM_029963	*Mrps5*	0.363	NM_023202	*Ndufa7*	0.465
NM_021433	*Stx6*	0.364	NM_023240	*Eef1d*	0.467
NM_010915	*Ngfa*	0.370	NM_021314	*Tacc2*	0.469
NM_023248	*Sbds*	0.376	NM_033525	*Npnt*	0.471
NM_011271	*Rnase1*	0.377	NM_030082	*Hist3h2ba*	0.472
NM_028233	*Lrpprc*	0.386	NM_009936	*Col9a3*	0.474
NM_138747	*Nol1*	0.392	NM_021422	*Dnaja4*	0.474
NM_145139	*Eif3s6ip*	0.405	NM_008513	*Lrp5*	0.475
NM_009418	*Tpp2*	0.406	NM_011079	*Phkg*	0.477
NM_007376	*Pzp*	0.407	NM_029010	*Glb1l*	0.480

Table 22. (Continued).

Accession Number	Gene Name	Fold of change	Accession Number	Gene Name	Fold of change
NM_144868	*Pcnxl3*	0.412	NM_019873	*Fkbpl*	0.481
AY073109	*MOR229-1*	0.414	NM_011045	*Pcna*	0.482
NM_013457	*Add1*	0.414	NM_011560	*Tcte3*	0.482
NM_010722	*Lmnb2*	0.418	NM_145226	*Oas3*	0.485
NM_010717	*Limk1*	0.420	NM_133734	*Wdr23*	0.486
NM_021296	*Grpel2*	0.422	NM_145575	*Cald1*	0.490
NM_023314	*Eif4el3*	0.422	NM_134158	*Igsf7*	0.493
NM_177345	*Mapkap1*	0.425	NM_010702	*Lect2*	0.493
NM_010683	*Lamc1*	0.427	NM_134230	*V1re11*	0.494
NM_007918	*Eif4ebp1*	0.427	NM_010485	*Elavl1*	0.495
NM_008836	*Phxr5*	0.428	NM_008299	*Dnajb3*	0.496
NM_025287	*Spop*	0.431	NM_009291	*Stra6*	0.496
NM_021327	*Tnip1*	0.436	NM_011353	*Serf1*	0.497
NM_009932	*Col4a2*	0.436	NM_009304	*Syngr2*	0.497
NM_011664	*Ubb*	0.441	NM_022722	*Dpys*	0.498
NM_022980	*Dscr1l2*	0.441	NM_148948	*Dicer1*	0.500
NM_021300	*Ehox*	0.445			

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