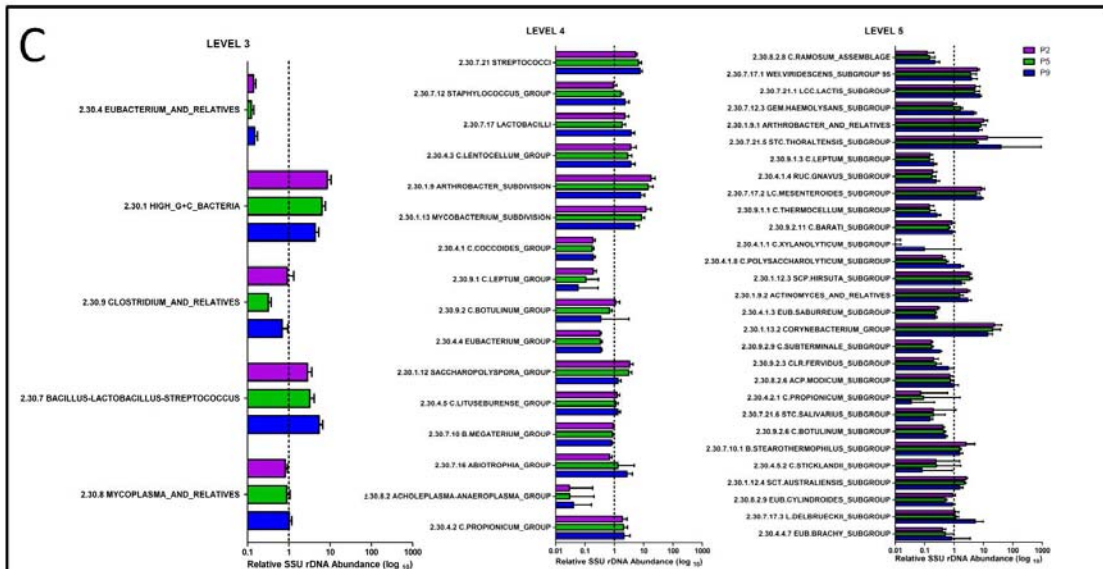
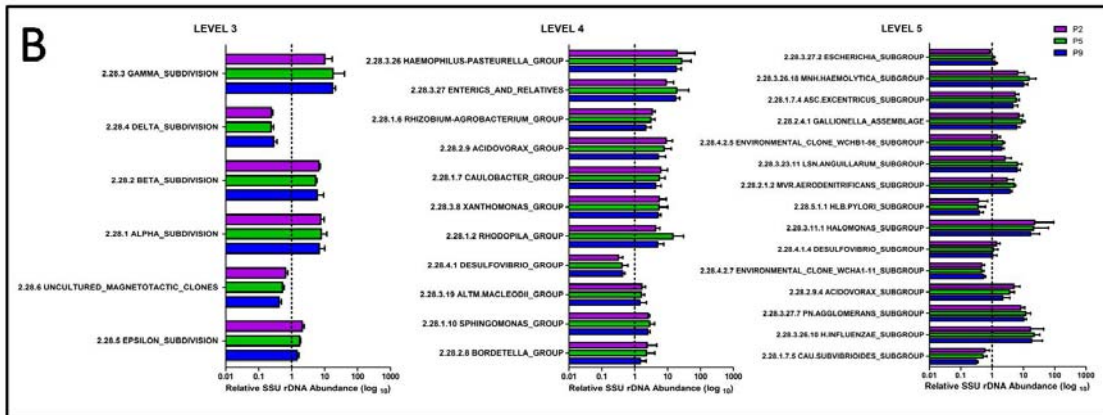
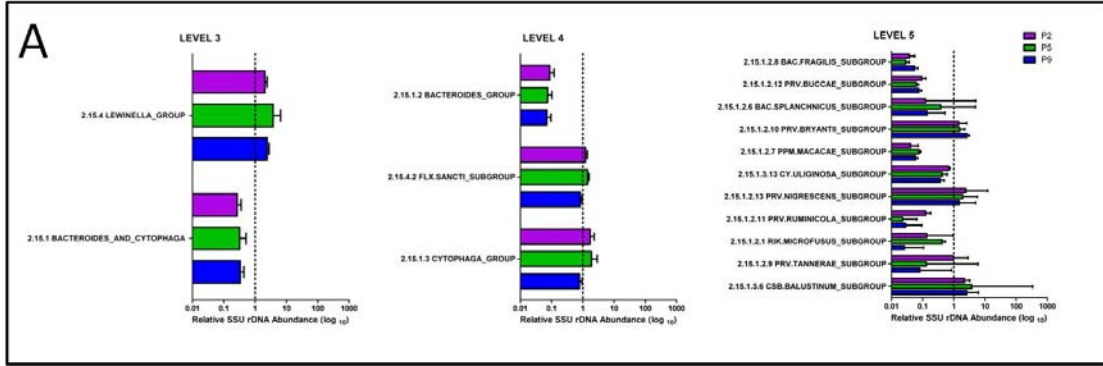


ONLINE SUPPLEMENTAL DATA

Altered innate defenses in the neonatal gastrointestinal tract in response to colonization by neuropathogenic *Escherichia coli*

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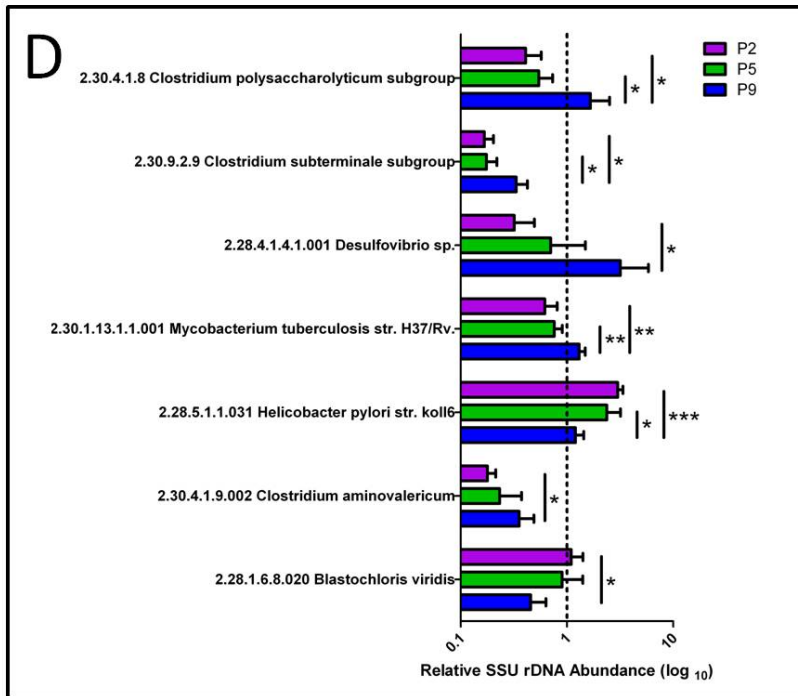


Figure S1. Comparative sub-phylum phylogenetic analysis of the composition of the GI tract microbiota of P2, P5 and P9 rat pups

Relative abundance of amplified SSU rDNA sequences from P2, P5 and P9 samples binding to class (level 3), order/family (level 4) and genus (level 5) taxonomic level microarray probes from the Bacteroidetes (A), Proteobacteria (B) and Firmicute/Actinobacteria (C) phyla. Relative abundance of SSU rDNA corresponding to 2 genus level and 5 species level probes showed significant differences between P2/P5 and P9 samples (D). P2, P5 and P9 neonatal data were normalized to adult data as indicated by the dashed lines at $x=1$. Numeric codes correspond to Ribosomal Database Project (<http://rdp.cme.msu.edu/index.jsp>) classifications for the indicated taxonomic level probes. Probes were ranked according to average Cy5 and Cy3 fluorescence across the P2, P5, and P9 datasets, with the highest at the top of each figure. Degrees of significance as determined by 2-tailed t-test are indicated in D (* = <0.05 , ** = <0.01 , *** = <0.001). We determined that the *M. tuberculosis* probe sequence included in the Agilent microarray is also present in other mycobacteria with 100% identity and binding to this probe does not therefore necessarily indicate the presence of this species.

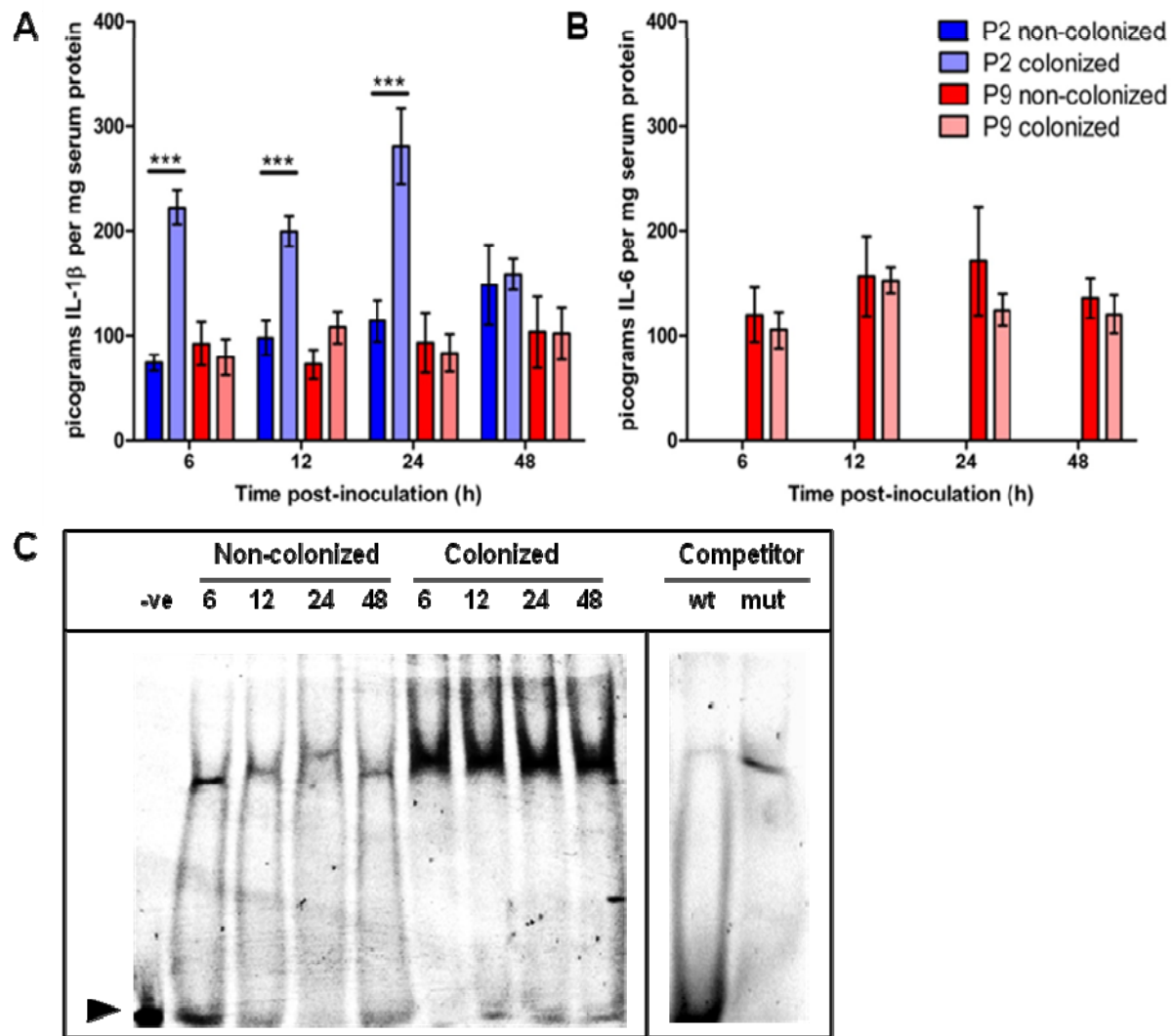


Figure S2. IL-1 β and IL-6 serum cytokine levels in P2 and P9 pups, and active NF- κ B nuclear localization in P2 neonates colonized with *E. coli* K1. Serum cytokine levels of IL-1 β (A) and IL-6 (B) were determined for non-colonized and *E. coli* K1-colonized P2 and P9 animals by sandwich-ELISA of serum from blood from animals culled 6, 12, 24 and 48 hours after feeding either broth or *E. coli* A192PP. Error bars represent the SEM (n=6); significance was determined by two-tailed t-test between colonized and non-colonized animals as indicated (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). (C) The extent of active (DNA-binding) NF- κ B localization to intestinal tissue cell nuclei was determined by electrophoretic mobility shift assay of pooled nuclear protein extracted from non-colonized and *E. coli* K1 colonized P2 neonates 6, 12, 24 and 48 h after feeding either broth or *E. coli* A192PP. Assays were performed using a Cy5 labeled dsDNA probe, containing the NF- κ B binding motif, in the presence (+ve) or absence (-ve) of protein extract. Assay specificity was assessed by binding reactions in presence of a non-labeled wild-type (wt) or mutant (mut) competitor dsDNA. The position of unbound Cy5 labeled probe is indicated (\blacktriangleright).

Table S1. Functional categorization of genes altered at least twofold in P2 and P9 GI tract tissues 12 h after feeding of *E. coli* A192PP

Functional category ^a	P2		P9	
	Up	Down	Up	Down
Adhesion and migration	8	2	13	
Angiogenesis	1		2	
Apoptosis	1	1	9	2
Coagulation				1
Cytoskeletal reorganization	4		12	6
DNA repair	2		5	3
Electron transport	1		3	6
Exocytosis/endocytosis	2		8	1
Growth, differentiation and development	28	3	43	14
Inflammation, immune and stress response	8	4	13	8
Integral membrane proteins ^b	4		8	5
Iron homeostasis			1	
Metabolism: biosynthesis and catabolism	18	7	26	27
Nuclear structure	8		2	4
Protein and RNA processing	27	6	37	23
Signal transduction	13		48	10
Transcriptional regulation	33		34	14
Transport	13	1	34	12
Number of genes affected	267	35	367	282
Number of genes categorized ^c	171	24	298	136

^aThe number of genes in each category is shown. Genes were assigned manually to functional categories as broadly defined by Moen et al. (Microb. Pathogen. 2008; 44, 293-310); multifunctional proteins were assigned based on their primary role according to the GeneSpring database. Arrays were performed by pooling equimolar amounts of RNA from three infected rats and compared with tissues from uninfected control animals processed in the same way

^bGenes encoding molecules with features of transmembrane proteins but of no known function were assigned to this group

^cGenes encoding non-membrane proteins with no known function according to GeneSpring database were excluded from this analysis

Table S2. Genes up-regulated twofold or greater in the neonatal rat GI tract 12 h after feeding *E. coli* A192PP to P2 pups

Gene symbol	Description	Function	Mean-fold change
RT1-Aw2	RT1 class Ib, locus Aw2	Antigen presentation	17.71
Fam13a1	family with sequence similarity 13, member A1	Regulation of small GTPase mediated signal transduction	8.45
Malat1	metastasis associated lung adenocarcinoma transcript 1	Non-protein coding regulator of cell motility	6.22
Btg2	BTG family, member 2	Negative regulator of cell proliferation	5.38
Luc7l3	LUC7-like 3	RNA binding regulator of apoptosis	5.26
Setd5	SET domain containing 5	Unknown	5.11
Wdfy1	WD repeat and FYVE domain containing 1	Endosomal trafficking protein	5.08
Eif2c2	eukaryotic translation initiation factor 2C, 2	Regulator of RNA mediated gene silencing	5.05
Pdlim5	PDZ and LIM domain 5	Regulator of cytoskeletal organization	5.05
Cirbp	cold inducible RNA binding protein	Positive regulator of cellular stress response	5.04
Zeb2	zinc finger E-box binding homeobox 2	Negative regulator of cell-cell adhesion	4.89
Sltm	SAFB-like, transcription modulator	Transcriptional inhibitor promoting apoptosis	4.86
Tiparp	TCDD-inducible poly(ADP-ribose) polymerase	Protein ADP ribosylation	4.77
Sv2b	synaptic vesicle glycoprotein 2b	Endocrine cell transmembrane transporter	4.75
Hhip	hedgehog-interacting protein	Negative regulator of angiogenesis	4.64
Mfap3	microfibrillar-associated protein 3	Component of the elastin-associated microfibrils	4.54
Pja2	praja 2, RING-H2 motif containing	Ubiquitin-protein ligase	4.51
Swi5	SWI5 recombination repair homolog	DNA repair complex component	4.50
Mllt10	myeloid/lymphoid or mixed-lineage leukemia (trithorax homolog)	Transcription factor	4.39
Slc6a6	solute carrier family 6 (neurotransmitter transporter, taurine)	Taurine transporter	4.31
Evi5	ecotropic viral integration site 5	Regulator of cell cycle and cytokinesis	4.30
Ednrb	endothelin receptor type B	Non-specific receptor for endothelin	4.29
Ddx6	DEAD (Asp-Glu-Ala-Asp) box polypeptide 6	RNA degradation in cellular stress response	4.28
Clec2h	C-type lectin domain family 2 member H	Regulator of natural killer cell-mediated cytotoxicity	4.18
Bcl11b	B-cell CLL/lymphoma 11B (zinc finger protein)	Lymphocyte transcription factor	4.05
Tmed5	transmembrane emp24 protein transport domain	Type I membrane protein, unknown function	4.04
Srrm1	serine/arginine repetitive matrix 1	Spliceosome component	3.96
Xiap	X-linked inhibitor of apoptosis	Apoptotic suppressor	3.91
Cald1	caldesmon 1	Regulator of actin/myosin interactions	3.88
Lpgat1	lysophosphatidylglycerol acyltransferase 1	Catalyzes the reacylation of LPG to phosphatidylglycerol	3.68
Smurf2	SMAD specific E3 ubiquitin protein ligase 2	E3 ubiquitin-protein ligase	3.56
Arid4a	AT rich interactive domain 4A (Rbp1 like)	Transcriptional repressor	3.55
Aff4	AF4/FMR2 family, member 4	Transcription factor	3.47
Gpatch8	G patch domain containing 8	RNA binding protein, unknown function	3.44
Igfbp5	insulin-like growth factor binding protein 5	Regulator of cellular growth factors	3.44
Sptbn1	spectrin, beta, non-erythrocytic 1	Actin-membrane molecular scaffold protein	3.43
Nipbl	nipped-B homolog	DNA repair complex component	3.41
LOC81816	hypothetical protein LOC81816	Putative ubiquitin conjugating enzyme	3.39
N4bp1	Nedd4 binding protein 1	Inhibitor of the E3 ubiquitin-protein ligase ITCH	3.37
Tmem161b	transmembrane protein 161B	Multipass membrane protein, unknown function	3.37
Spnb2	spectrin β 2	Actin-membrane molecular scaffold protein	3.31

Atp8b1	ATPase, Class I, type 8B, member 1	Transport of bile acids from intestinal contents to mucosa	3.31
Jarid1a	jumonji, AT rich interactive domain 1A (Rbp2 like)	Histone demethylase regulating cell proliferation	3.28
Pum1	pumilio homolog 1	RNA binding protein regulating cell proliferation	3.28
Dock4	dedicator of cytokinesis 4	Regulator of cell-cell adhesion	3.27
Eif2c1	eukaryotic translation initiation factor 2C, 1	Regulator of RNA mediated gene silencing	3.3
Znf292	zinc finger protein 292	Putative transcriptional regulator	3.26
Sfrs2ip	splicing factor, arginine/serine-rich 2, interacting protein	Regulator of spliceosome assembly	3.24
Eif3c	eukaryotic translation initiation factor 3, subunit C	Initiator of protein synthesis	3.18
Csnk2a1	casein kinase 2, α 1 polypeptide	Serine/threonine protein kinase regulating cell proliferation	3.18
Ptprb	protein tyrosine phosphatase, receptor type, B	Signalling protein involved in maintenance of endothelial integrity	3.15
LOC100192313	hypothetical protein LOC100192313	Unknown	3.13
Cmip	c-Maf-inducing protein	Signalling protein involved in Th2 cell activation	3.11
LOC687839	hypothetical protein LOC687839	Unknown function	3.09
Zfp451	zinc finger protein 451	Putative transcriptional regulator	3.05
Tnrc6b	trinucleotide repeat containing 6B	Regulator of RNA mediated gene silencing	3.05
Dek	DEK oncogene	Involved in splice site selection during mRNA processing	3.05
Acbd3	acyl-Coenzyme A binding domain containing 3	Maintenance of Golgi structure	3.04
Rad26l	putative repair and recombination helicase	Putative DNA repair enzyme	3.01
Srpk2	SFRS protein kinase 2	Spliceosome assembly and trafficking of splicing factors	3.00
Hspca	heat shock protein 90 α (cytosolic), class A member 1	Molecular chaperone induced by cellular stress	2.98
Slc4a7	solute carrier family 4, sodium bicarbonate co-transporter, member 7	Regulator of intracellular pH	2.96
Loxl2	lysyl oxidase-like 2	Putative role in connective tissue biogenesis	2.94
Laptm4a	lysosomal protein transmembrane 4 α	Lysosomal membrane small molecule trafficking	2.91
Rc3h2	ring finger and CCCH-type zinc finger domains 2	Membrane associated DNA binding protein	2.91
Zfp91	zinc finger protein 91	Atypical E3 ubiquitin-protein ligase involved in anti-apoptosis	2.88
Crebl2	cAMP responsive element binding protein-like 2	Cell cycle regulator	2.88
Ankrd11	ankyrin repeat domain 11	Inhibitor of ligand dependent transcriptional activation	2.87
Maf	v-maf musculoaponeurotic fibrosarcoma oncogene homolog	Broad transcriptional regulator, induces T-cell apoptosis	2.86
Igf2r	insulin-like growth factor type 2	Involved in trafficking of lysosomal enzymes and T-cell activation	2.85
Mgl1	monoglyceride lipase	Gut epithelial lipase	2.85
Tlk1	tousled-like kinase 1	Nuclear signalling kinase	2.83
Ubxn4	UBX domain protein 4	Involved in endoplasmic reticulum-associated protein degradation	2.83
LOC312273	trypsin V-A	Putative digestive protease	2.82
Dhx36	DEAH (Asp-Glu-Ala-His) box polypeptide 36	Involved in mRNA degradation	2.82
Tpr	translocated promoter region	Involved in nuclear protein import	2.82
Xrn2	5'-3' exoribonuclease 2	RNase, unknown function	2.81
Tns1	tensin1	Focal adhesion component involved in ECM/cytoskeletal interaction	2.80
Creg1	cellular repressor of E1A-stimulated genes 1	Interacts with Igf2r to promote cell growth	2.79
Mga	MAX gene associated	Regulator of cell growth and apoptosis	2.79
Stat3	signal transducer and activator of transcription 3	Transcription factor mediating cytokine receptor signalling pathways	2.77
Rbm9	RNA binding motif protein 9	Regulates splicing of tissue specific exons	2.74

Snrp70	small nuclear ribonucleoprotein 70	Regulator of pre-mRNA splicing	2.72
Slc44a1	solute carrier family 44, member 1	Choline transporter involved in membrane synthesis	2.71
Dag1	dystroglycan 1 (dystrophin-associated glycoprotein 1)	Extracellular matrix receptor	2.71
Ubn1	ubiquitin 1	Regulator of cell death	2.69
Eif4g1	eukaryotic translation initiation factor 4γ 1	Involved in mRNA recruitment to ribosome	2.69
Gcap14	granule cell antiserum positive 14	Unknown function	2.68
Mobk11a	MOB1, Mps One Binder kinase activator-like 1A	Regulator of cell growth and apoptosis	2.68
Arhgef12	Rho guanine nucleotide exchange factor (GEF) 12	Regulator of RhoA GTPase activity	2.68
Reg3b	regenerating islet-derived 3β	Antimicrobial peptide with C-type lectin domain	2.63
Kcnma1	calcium-activated channel, subfamily Ma	Calcium ion activated potassium channel	2.63
Cbl	Cas-Br-M ecotropic retroviral transforming sequence	Involved in signal transduction in hematopoietic cells	2.62
Rnd3	Rho family GTPase 3	Regulator of actin cytoskeletal organization	2.61
Sox4	SRY-box 4	Transcriptional activator involved in development	2.61
Pik3r1	phosphoinositide-3-kinase, regulatory subunit 1α	Adaptor mediating association of activated kinases to the plasma membrane	2.60
Hoxb6	homeobox B6	Transcriptional regulator	2.58
Bend7	BEN domain containing 7	Unknown	2.57
Arhgap5	Rho GTPase activating protein 5	Regulator of actin cytoskeletal organization	2.56
Eml4	echinoderm microtubule associated protein like 4	Putative role in microtubule assembly dynamics	2.56
Ralgs2	Ral GEF with PH domain and SH3 binding motif 2	Putative role in cytoskeletal organization	2.55
Falz	fetal Alzheimer antigen	Histone binding component of nucleosome-remodelling factor	2.55
Il6st	interleukin 6 signal transducer	Intracellular transducer of cytokine signalling	2.55
Otub1	OTU domain, ubiquitin aldehyde binding 1	Ubiquitin hydrolase regulating T-cell energy	2.54
Topbp1	topoisomerase (DNA) II binding protein 1	Regulator of DNA damage response	2.54
Slc4a4	solute carrier family 4 (anion exchanger), member 4	Regulator of intracellular pH	2.54
Thoc2	THO complex 2	Involved in mRNA export	2.53
Hsp90ab1	heat shock protein 90kDa α (cytosolic), class B member 1	Molecular chaperone involved in cellular stress response	2.52
Itgb3	integrin β3	Mediates cellular adhesion to ECM	2.52
Rps6ka5	ribosomal protein S6 kinase, polypeptide 5	Kinase required for activation of stress-induced transcription factors	2.51
Thra	thyroid hormone receptor α	Nuclear hormone receptor	2.51
Cear1	cell division cycle and apoptosis regulator 1	Regulator of cellular proliferation	2.51
Zdhhc20	zinc finger, DHHC-type containing 20	Unknown	2.50
Clcn5	chloride channel 5, transcript variant 6	Acidification of the endosomal lumen	2.50
Cisd2	CDGSH iron sulfur domain 2	Regulator of autophagy	2.50
Lcor1	ligand dependent nuclear receptor co-repressor-like	Transcriptional regulator	2.49
Cend2	cyclin D2	Cell cycle regulator	2.48
LOC100363275	G protein-coupled receptor 124	Unknown	2.48
Itsn2	intersectin 2	Involved in T-cell receptor endocytosis	2.46
Samd8	sterile alpha motif domain containing 8	Unknown	2.46
Ubn2	ubiquitin 2	Regulator of cell death	2.46
Bmpr2	bone morphogenetic protein receptor, type II (serine/threonine kinase)	Involved in calcium regulation	2.45
Sf3b2	splicing factor 3b, subunit 2	Subunit of splicing factor SF3B	2.44
LOC681371	hypothetical protein LOC681371	Unknown function	2.44

Narg1	NMDA receptor regulated 1	Acetyltransferase involved in hematopoietic and neuronal development	2.44
Strn3	striatin, calmodulin binding protein 3	Signalling or scaffolding protein involved in modulating calmodulin activity	2.44
Pa2g4	proliferation-associated 2G4	Regulator of cell proliferation	2.44
Srm2	serine/arginine repetitive matrix 2	Involved in pre-mRNA splicing	2.42
Fermt2	fermitin family homolog 2	Participates in actin organization and cytoskeletal-ECM adhesion	2.41
Chd1	chromodomain helicase DNA binding protein 1	Chromatin remodelling	2.40
Tcf4	transcription factor 4	Enhancer of immunoglobulin expression	2.40
Ankle2	ankyrin repeat and LEM domain containing 2	Unknown function	2.40
Trio	triple functional domain (PTPRF interacting)	Involved in cytoskeletal rearrangement	2.39
Herc1	hect (homologous to the E6-AP (UBE3A) carboxyl terminus) domain and RCC1 (CHC1)-like domain (RLD) 1	Regulator of membrane trafficking	2.38
Vdac1	voltage-dependent anion channel 1	Mitochondrial membrane channel involved in apoptosis	2.38
LOC286960	preprotrypsinogen IV	Trypsin-like serine protease	2.38
Hectd1	HECT domain containing 1	Ubiquitin-protein ligase	2.38
Rbm25	RNA binding motif protein 25	Splicing regulator involved in apoptosis	2.37
Clk1	CDC-like kinase 1	Putative regulator of RNA splicing	2.37
Nfix	nuclear factor I/X (CCAAT-binding transcription factor)	Transcriptional activator	2.36
Wasl	Wiskott-Aldrich syndrome-like	Regulator of actin polymerization	2.36
Ash1l	ash1 (absent, small, or homeotic)-like	Histone methyltransferase	2.36
Traf6	Tnf receptor-associated factor 6	Ubiquitin ligase responsible for activating NFκB after IL-1 receptor signalling	2.36
Marcks	myristoylated alanine rich protein kinase C substrate	F-actin cross-linker	2.36
Rps6ka1	ribosomal protein S6 kinase polypeptide 1	Mediator of stress-induced transcriptional activation	2.35
RT1-CE12	RT1 class I, locus CE12	Antigen presentation	2.35
Cpd	carboxypeptidase D	Regulatory peptidase involved in NO synthesis during inflammation	2.35
Wbp4	WW domain binding protein 4 (formin binding protein 21)	Promotes pre-mRNA splicing	2.34
LOC685707	similar to neuron navigator 1	Similar to protein regulating neuronal development	2.34
Nktr	natural killer tumor recognition protein	NK-cell receptor	2.33
U2af1	U2 small nuclear ribonucleoprotein auxiliary factor	Involved in mRNA splicing	2.32
Ptch1	patched 1	Hedgehog gene receptor	2.32
Pgap2	post-GPI attachment to proteins 2	Involved in anchoring proteins to the plasma membrane	2.31
Zc3h11a	zinc finger CCCH-type containing 11A	Unknown function	2.31
Raph1	Ras association (RalGDS/AF-6) and pleckstrin homology domains 1	Negatively regulates cell adhesion	2.31
Mpp6	membrane protein, palmitoylated 6 (MAGUK p55 subfamily member 6)	Regulator of membrane receptor clustering	2.30
Nr2f2	nuclear receptor subfamily 2, group F, member 2	Steroid thyroid hormone receptor	2.29
Pkp4	plakophilin 4	Regulator of cadherin function	2.29
Id3	inhibitor of DNA binding 3	Inhibitor of transcription factor DNA binding	2.29
Zdhc21	zinc finger, DHHC domain containing 21	Unknown function	2.29
Ppp1r12a	protein phosphatase 1, regulatory (inhibitor) subunit 12A	Regulates myosin phosphatase activity	2.28
Pafah1b1	platelet-activating factor acetylhydrolase, isoform 1b, subunit 1	Required for proper activation of Rho GTPases and actin polymerization	2.28
Rbm5	RNA binding motif protein 5	Component of the spliceosome A complex	2.28
Lin7	lin-7 homolog C	Involved in maintaining cellular polarity	2.28
Trim39	tripartite motif containing 39	Inhibits proteosomal degradation of pro-apoptotic factors	2.27

Brd8	bromodomain containing 8	Co-activator of nuclear hormone receptors	2.27
Ap4e1	adapter-related protein complex 4 subunit ϵ -1	Involved in targeting to the endosomal/lysosomal system	2.27
Lrrc8a	leucine rich repeat containing 8 family, member A	Involved in promoting B-cell maturation	2.27
Zfp106	zinc finger protein 106	Unknown function	2.27
Adipor2	adiponectin receptor 2	Involved in lipid metabolic regulation	2.26
Fam126b	family with sequence similarity 126	Unknown function	2.26
Add3	adducin 3 γ	Calmodulin binding promoter of actin-spectrin network assembly	2.26
Adrbk2	adrenergic receptor kinase β 2	Regulator of receptor function	2.26
Cdh22	cadherin 22	Calcium dependent cell adhesion protein	2.26
Alox15	arachidonate 15-lipoxygenase	involved in the production and metabolism of fatty acid hydroperoxidases	2.25
LOC498544	hypothetical protein LOC498544	Unknown function	2.25
Rcor1	REST corepressor 1	Chromatin remodelling	2.24
Mef2a	myocyte enhancer factor 2a	Activator of numerous growth factor and stress-induced genes	2.23
Dnmt3a	DNA (cytosine-5-)-methyltransferase 3 α	DNA methylation	2.23
Vezf1	vascular endothelial zinc finger 1	Regulation of IL-3 expression	2.23
Eif5	eukaryotic translation initiation factor 5	Initiator of protein synthesis	2.22
Pip5k2a	phosphatidylinositol-5-phosphate 4-kinase, type II α	Involved in the regulation of secretion, cell proliferation, differentiation, and motility	2.22
Gatad2b	GATA zinc finger domain containing 2B	Transcriptional repressor	2.21
Ctdspl	CTD (carboxy-terminal domain, RNA polymerase II, polypeptide A) small phosphatase-like	Negative regulator of transcription	2.20
Rnf6	ring finger protein (C3H2C3 type) 6	Ubiquitin-protein ligase	2.20
Msi2	Musashi homolog 2	RNA-binding protein regulating cellular proliferation	2.20
Mxd1	MAX dimerization protein 1	Regulator of cellular proliferation and apoptosis	2.19
Arl4d	ADP-ribosylation factor-like 4D	Involved in intracellular membrane trafficking	2.18
Krt15	keratin 15	Responsible for the structural integrity of epithelial cells	2.18
Mll5	myeloid/lymphoid or mixed-lineage leukemia 5 (trithorax homolog)	Histone methyltransferase	2.17
Rbm27	RNA binding motif protein 27	Unknown function	2.17
Ptprs	protein tyrosine phosphatase, receptor type, S	Signalling protein involved in development	2.17
Entpd5	ectonucleoside triphosphate diphosphohydrolase 5	Regulator of ATP usage	2.16
Eif4a1	eukaryotic translation initiation factor 4A1	RNA-helicase allowing mRNA-ribosome interaction	2.15
Phc3	polyhomeotic-like 3	Involved in transcriptional repression	2.15
Frg1	FSHD region gene 1	Involved in processing pre-rRNA	2.15
Eif5b	eukaryotic translation initiation factor 5B	Promotes binding of methionine-tRNA to ribosome	2.15
Hmox1	heme oxygenase (decycling) 1	Essential enzyme in heme metabolism	2.14
Trove2	TROVE domain family, member 2	Regulator of Y-RNAs	2.13
Sox11	SRY-box containing gene 11	Developmental regulator	2.13
Arid4b	AT rich interactive domain 4B (Rbp1 like)	Transcriptional repressor	2.12
Mphosph8	M-phase phosphoprotein 8	Involved in cell-cycle	2.12
LOC688495	hypothetical protein LOC688495	Unknown function	2.11
Rgs4	regulator of G-protein signalling 4	Negative regulator of G-protein signaling	2.11
Meg3	maternally expressed 3	Regulator of cell proliferation	2.11
Rbm39	RNA binding motif protein 39	Involved in mRNA splicing	2.11
Trak2	trafficking protein, kinesin binding 2	Regulator of endosome to lysosome trafficking	2.10

Ahi1	Abelson helper integration site 1	Involved in neuronal development	2.10
Akap13	A kinase (PRKA) anchor protein 13	Anchors cAMP-dependent kinase	2.10
Wdr37	WD repeat domain 37	Regulator of signal transduction and apoptosis	2.09
Lgr4	leucine-rich repeat containing G protein-coupled receptor 4	Orphan receptor	2.09
C-myb	Myb proto-oncogene	Regulates differentiation of hematopoietic cells	2.09
Sfrs11	splicing factor, arginine/serine-rich 11	Involved in pre-mRNA splicing	2.08
Rdx	radixin	Binds barbed ends of actin filaments to cell membrane	2.07
Stk25	serine/threonine kinase 25 (STE20 homolog)	Stress-activated kinase regulating protein export and cell adhesion	2.06
Rhoj	ras homolog gene family, member J	Regulates cell morphology via increased F-actin formation	2.06
Rod1	ROD1 regulator of differentiation 1	Regulator of cell differentiation	2.06
Ppap2b	phosphatidic acid phosphatase type 2B	Involved in cell adhesion and cell-cell interactions	2.06
Tsc22d4	TSC22 domain family, member 4	Transcriptional repressor	2.05
Argl1	arginine and glutamate rich 1	Unknown function	2.05
Arid3a	AT rich interactive domain 3A (Bright like)	Transcription factor involved in B-cell differentiation	2.05
Rad54l2	Rad54 like 2	DNA helicase	2.04
Ppargc1b	peroxisome proliferator-activated receptor gamma, co-activator 1 β	Involved in fat oxidation and non-oxidative glucose metabolism	2.04
Scn7a	sodium channel, voltage-gated, type VII α	Mediates sodium ion permeability of membranes	2.04
Brd4	bromodomain containing 4	Chromatin remodelling	2.04
Fnip2	folliculin interacting protein 2	Signal transducer of pro-apoptotic factors	2.04
Wbp4	WW domain binding protein 4 (formin binding protein 21)	Involved in pre-mRNA splicing	2.04
Esf1	ESF1, nucleolar pre-rRNA processing protein, homolog	Transcriptional regulator	2.04
Zc3h12c	zinc finger CCCH type containing 12C	Putative RNase	2.04
Luc7l2	Luc7-like 2	Unknown function	2.03
Eef1a1	eukaryotic translation elongation factor 1 α 1	Promoter of protein biosynthesis	2.03
Rock2	Rho-associated coiled-coil containing protein kinase 2	Regulates actin assembly	2.03
Lsm12	LSM12 homolog	Unknown function	2.02
Nole1	nucleolar and coiled-body phosphoprotein 1	Involved in RNA polymerase I catalysed transcription	2.02
Safb	scaffold attachment factor B	Anchor for RNA polymerase II transcriptomal complex	2.02
Chka	choline kinase α	Involved in phospholipid biosynthesis	2.01
Polr3k	polymerase (RNA) III (DNA directed) polypeptide K	RNA polymerase III component	2.01
Sms	spermine synthase	Involved in polyamine metabolism	2.01
Axin2	axin 2	Regulates Wnt signalling by interaction with β -catenin	2.00
Fatp4	fatty acid transport protein 4	Transport of long chain fatty acids	2.00
Trps1	trichorhinophalangeal syndrome I homolog	Transcriptional regulator of columnar cell differentiation	2.00

Table S3. Genes down-regulated twofold or greater in the neonatal rat GI tract 12 h after feeding *E. coli* A192PP to P2 pups

Gene symbol	Description	Function	Mean-fold change
Tff2	trefoil factor 2	Defence of the mucosal barrier	-24.63
Mgam	Maltase-glucoamylase, intestinal	Brush border hydrolase	-5.49
RGD:727924	rRNA promoter binding protein	Regulator of cell proliferation	-4.33
Ins2	insulin 2	Hormone regulating carbohydrate and fat metabolism	-3.97
RT1-A3	RT1 class I, locus A3	Antigen presentation	-3.11
RT1-CE15	RT1 class I, locus CE15	Antigen presentation	-2.86
Wtap	Wilms tumor 1 associated protein	Transcriptional and post-transcriptional regulator	-2.65
Senp5	Sumo1/sentrin/SMT3 specific peptidase 5	Protease involved in cell division	-2.65
Ins1	insulin 1	Hormone regulating carbohydrate and fat metabolism	-2.64
Mcpt3	mast cell peptidase 3	Serine endopeptidase	-2.62
Ubd	ubiquitin D	Targeting for proteosomal degradation	-2.48
RT1-Db1	RT1 class II, locus Db1	Antigen presentation	-2.46
Pbx1	pre-B-cell leukemia transcription factor	Transcriptional regulator	-2.36
Pim1	pim-1 oncogene	Signalling kinase activity	-2.35
Dcaf12	DDB1 and CUL4 associated factor 12	Regulation of ligase activity	-2.34
Mcpt4	mast cell protease 4	Serine endopeptidase	-2.30
LOC100362483	H2-GS14-2 antigen	Regulation of antigen presentation	-2.29
Birc6	baculoviral IAP repeat containing 6	Regulation of apoptosis	-2.27
ABCB10	ATP binding cassette family	Membrane transporter	-2.26
Mcpt1	mast cell protease 1	Serine endopeptidase	-2.26
Coro1c	coronin, actin binding protein 1C	Involved in cytokinesis	-2.23
Itgav	integrin α V	Extracellular matrix receptor	-2.22
Actn4	actinin α 4	Intracellular actin anchoring	-2.20
Fam100b	family with sequence similarity 100, member B	Unknown	-2.16
Wwe1	WW and C2 domain containing 1	Transcriptional activator	-2.15
Gnptab	N-acetylglucosamine-1-phosphate transferase	Regulator of lysosomal transport	-2.13
Nfkbil1	Ikb family protein	NF κ B inhibitor relative	-2.09
Slc1a3	solute carrier family 1, member 3	Glutamate transporter	-2.05
Spag9	sperm associated antigen 9	Regulator of MAPK cascade	-2.05
Larp1	La ribonucleoprotein domain family, member 1	RNA degradation	-2.05
Pga5	pepsinogen 5, group I	Digestive protease	-2.04
Dusp6	dual specificity phosphatase 6	Regulator of MAPK cascade	-2.04
Coa5	cytochrome C oxidase assembly factor 5	mitochondrial complex IV assembly	-2.04
Amy1 ; Amy2	amylase α 1A (salivary), amylase 2, pancreatic	Hydrolase	-2.03
Socs2	suppressor of cytokine signalling 2	Regulator of cell signalling	-2.02
Daf1	Cd55 molecule	Classical complement pathway activator	-2.02

Table S4. Genes up-regulated twofold or greater in the neonatal rat GI tract 12 h after feeding *E. coli* A192PP to P9 pups

Gene Symbol	Description	Function	Mean-fold change
RT1-Bb	RT1 class II, locus Bb	Antigen presentation	11.77
Ints7	Integrator complex subunit 7	Involved in mRNA processing	5.53
Defa-rs1	defensin α -related sequence 1	α -defensin-type antimicrobial peptide	5.44
Cirbp	cold inducible RNA binding protein	Positive regulator of cellular stress response	5.21
Pdcd4	programmed cell death 4	Inhibitor of protein biosynthesis	5.08
Cct6a	chaperonin containing Tcp1, subunit 6A ξ 1	Chaperone involved in correct actin and tubulin folding	4.89
Sept2	septin 2	Filament forming cytoskeletal GTPase	4.86
RT1-CE15	RT1 class I, locus CE15	Antigen presentation	4.45
St6gal1	ST6 beta-galactosamide α -2,6-sialyltransferase 1	Transfers sialic acid to galactose containing receptor substrates	4.41
Clic4	chloride intracellular channel 4	Membrane associated ion channel	4.36
Tm9sf3	transmembrane 9 superfamily member 3	Unknown function	4.11
RT1-Aw2	RT1 class Ib, locus Aw2	Antigen presentation	3.40
Casp3	caspase 3	Effector caspase mediating apoptosis	3.95
Caprin1	cell cycle associated protein 1	Regulation of mRNA transport	3.95
Vsig10l	V-set and immunoglobulin domain containing 10 like	Unknown function	3.82
Hnrnpa2b1	heterogeneous nuclear ribonucleoprotein A2/B1	Involved in mRNA processing	3.67
Scgb1a1	secretoglobin, family 1A, member 1 (uteroglobin)	Anti-inflammatory regulator	3.63
Vcl	vinculin	Actin binding protein involved in cell-cell and cell-ECM adhesion	3.60
Nid1	nidogen 1	Laminin-associated protein involved in cell-ECM adhesion	3.59
Mylk	myosin light chain kinase	Regulator of actin-myosin interaction	3.55
Gatad2b	GATA zinc finger domain containing 2B	Transcriptional repressor	3.53
Hnf4a	hepatocyte nuclear factor 4a	Transcription factor regulating development	3.43
Car3	carbonic anhydrase 3	Reversible hydration of carbon dioxide	3.40
Actr3	ARP3 actin-related protein 3 homolog	ARP2/3 complex component, involved in cell motility	3.38
Prkacb	protein kinase, cAMP dependent, catalytic, β	Mediates cAMP-dependent signalling	3.38
RGD1309534	Similar to RIKEN cDNA 4931406C07	Unknown function	3.38
Foxn3	forkhead box N3	Transcriptional repressor responding to DNA damage	3.36
Ssr3	signal sequence receptor γ	Regulator of protein-ER attachment	3.34
Pak2	p21 protein (Cdc42/Rac)-activated kinase 2	Apoptotic regulator	3.32
Cav1	caveolin 1, caveolae protein	Co-stimulator of T-cell receptor mediated T-cell activation	3.30
Gna11	guanine nucleotide binding protein α 11	Transmembrane signalling transducer	3.30
Mat2a	methionine adenosyltransferase IIa	Catalyses the production of S-adenosylmethionine	3.28
Tgoln1	trans-golgi network protein	Unknown function	3.27
Cav2	caveolin 2	Major component of plasma membrane caveolae	3.17
Ppm1a	protein phosphatase 1A, magnesium dependent, α isoform	Negative regulator of cellular stress response	3.16
Pigt	phosphatidylinositol glycan anchor biosynthesis, class T	Involved in GPI cell surface protein anchor biosynthesis	3.15
Golph3	Golgi phosphoprotein 3 (coat-protein)	Regulator of Golgi trafficking	3.11
Defa24	defensin 24a	α -defensin-type antimicrobial peptide	3.09
Hsd3b7	hydroxy- δ -5-steroid dehydrogenase, 3 β - and steroid δ -isomerase 7	Involved in hormonal steroid biosynthesis	3.06
Canx	calnexin	Molecular chaperone ensuring correct glycoprotein	3.05

		folding	
Crk	v-crk sarcoma virus CT10 oncogene homolog	Involved in phagocytosis of apoptotic cells	3.03
Il13ra1	interleukin 13 receptor 1 α	IL-13 and IL-4 receptor	3.01
Eif1a	eukaryotic translation initiation factor 1A	Promotes accurate ribosomal assembly	3.01
Rab5b	RAB5B, member RAS oncogene family	Involved in vesicular trafficking	3.00
Lin7c	lin-7 homolog C	Involved in maintenance of cellular polarity	2.98
Cbfb	core-binding factor, β subunit	Broad transcriptional regulator	2.95
Rcc2	regulator of chromosome condensation 2	Involved in cytokinesis	2.94
Tmem47	transmembrane protein 47	Unknown function	2.94
Rnfl14	ring finger protein 114	Unknown function	2.93
Cd36	CD36 molecule (thrombospondin receptor)	Involved in cell adhesion and fatty acid transport	2.93
App	amyloid β (A4) precursor protein	Involved in neuronal growth	2.91
Zfp68	zinc finger protein 68	Unknown function	2.91
LOC683399	region containing similar to NGF-binding Ig light chain	Unknown function	2.90
Gbp1	GC-rich promoter binding protein 1	Transcriptional regulator	2.89
Mcam	melanoma cell adhesion molecule	Involved in cell adhesion	2.88
LOC683788	similar to Fascin (Singed-like protein)	Unknown function	2.86
Gga2	Golgi associated, γ adaptin ear containing, ARF binding protein 2	Regulator of endosomal-lysosomal trafficking	2.86
Rod1	ROD1 regulator of differentiation 1	Involved in cellular differentiation	2.85
Stat5b	signal transducer and activator of transcription 5B	IL-2 and IL-4 signal transducer	2.78
Prpc	prolylcarboxypeptidase (angiotensinase C)	Lysosomal prolylcarboxypeptidase	2.78
Prkci	protein kinase Ci	Involved in formation of epithelial tight junctions	2.78
Lbr	lamin B receptor	Anchors laminin and heterochromatin to the nuclear membrane	2.77
Pik3r1	phosphoinositide-3-kinase, regulatory subunit 1 α	Adaptor mediating protein-tyr kinase membrane binding	2.74
Tmem45b	transmembrane protein 45b	Unknown function	2.73
Txnrd1	thioredoxin reductase 1	Involved in protection from oxidative stress	2.72
Atp1a1	ATPase, Na ⁺ /K ⁺ transporting, α 1 polypeptide	Regulator of membrane electrochemical gradients	2.72
Lasp1	LIM and SH3 protein 1	Regulator of dynamic actin formation	2.72
Ankle2	ankyrin repeat and LEM domain containing 2	Unknown function	2.70
Gnai3	guanine nucleotide binding protein (G protein), α inhibiting 3	Modulator of trans-membrane signalling systems	2.70
Rtn4	reticulon 4	Inhibitor of Bcl-x1 and Bcl-2 anti-apoptotic activity	2.70
Col6a3	procollagen, type VI α 3	Cell binding protein	2.68
Krt15	keratin 15	Epithelial structural integrity	2.66
RGD1306148	similar to KIAA0368	Unknown function	2.65
Picalm	phosphatidylinositol binding clathrin assembly protein	Involved in clathrin coated pit formation	2.65
Cxcl12	chemokine (C-X-C motif) ligand 12 (stromal cell-derived factor 1)	T-cell and monocyte chemoattractant	2.65
Pank3	pantothenate kinase 3	Regulator of CoA biosynthesis	2.65
Myh11	myosin, heavy chain 11, smooth muscle	Involved in smooth muscle contraction	2.64
Ocln	occludin	Involved in formation and regulation of epithelial tight junctions	2.64
Galnt1	N-acetylgalactosaminyltransferase 1 (GalNAc-T1)	Catalyses O-linked oligosaccharide formation	2.64
Akirin2	akirin 2	Downstream effector of cytokine signalling	2.63
Fnbp11	formin binding protein 1-like	Involved in actin reorganization during endocytosis	2.62
Stard5	StAR-related lipid transfer (START) domain containing 5	Involved in intracellular transport of sterols and other lipids	2.62

Far1	fatty acyl CoA reductase 1	Catalyzes the reduction of saturated fatty acyl-CoA	2.62
S100a6	S100 calcium binding protein A6	Calcium sensor involved in cellular differentiation	2.62
Ptprs	protein tyrosine phosphatase, receptor type, S	Transmembrane signalling transducer	2.61
Zyg11b	zyg-II homolog B	E3 ubiquitin-ligase complex component	2.61
Hspa2	heat shock protein 2 α	Stress-induced molecular chaperone	2.61
Slc5a1	solute carrier family 5 (sodium/glucose cotransporter), member 1	Mediates glucose/galactose uptake from intestinal lumen	2.61
Rbpj	recombination signal binding protein for immunoglobulin κ J region	Transcriptional regulator of NOTCH (cell-cell) signalling	2.59
Rab31	RAB31, member RAS oncogene family	Involved in vesicle and granule targeting	2.58
Eif3s6ip	eukaryotic translation initiation factor 3, subunit 6 interacting protein	Initiator of protein synthesis	2.58
Smtn	smoothelin	Stress fibre cytoskeletal component	2.58
Arl2bp	ADP-ribosylation factor-like 2 binding protein	Regulator of STAT activity	2.57
Ireb2	iron responsive element binding protein 2	Regulator of ferritin/transferrin expression	2.57
Nov	nephroblastoma over-expressed gene	Regulator of cell growth	2.55
Stk17b	serine/threonine kinase 17b	Positive regulator of apoptosis	2.55
Ppp2r4	protein phosphatase 2A activator, regulatory subunit 4	Involved in apoptosis and negative regulation of cell growth	2.55
Cap1	CD40 associated protein 1	Inhibitor of NF κ B activation	2.55
Tmed2	transmembrane emp24 domain trafficking protein 2	Involved in vesicular trafficking	2.55
Calm3	calmodulin 3	Calcium binding regulator of inflammation, apoptosis and muscle contraction	2.54
Fstl1	follistatin-like 1	Involved in cellular differentiation	2.53
Hoxb13	homeo box B13	Transcription factor regulating development	2.53
Actr2	ARP2 actin-related protein 2 homolog	Involved in actin polymerization	2.53
Id3	inhibitor of DNA binding 3	Regulator of transcription factor function	2.53
Xiap	X-linked inhibitor of apoptosis	Apoptotic suppressor	2.52
Efna1	ephrin A1	Regulator of angiogenesis	2.52
Scamp2	secretory carrier membrane protein 2	Involved in post-Golgi trafficking to the surface membrane	2.52
Ctnnb1	catenin (cadherin associated protein) 1 β	Structural component of adherent junctions, and regulator of Wnt responsive genes	2.51
Casp2	caspase 2	Initiator caspase mediating apoptosis	2.51
Jak2	Janus kinase 2	Cytokine receptor signal transducer	2.51
Myh9	myosin, heavy chain 9, non-muscle	Involved in cytokinesis	2.50
Gng2	guanine nucleotide binding protein (G protein) 2 γ	Modulator of trans-membrane signalling systems	2.50
Cdx1	caudal type homeo box 1	Regulator of enterocyte differentiation	2.50
Plekhb2	pleckstrin homology domain containing, family B (evectins) member 2	Unknown function	2.50
Ddx3x	DEAD (Asp-Glu-Ala-Asp) box polypeptide 3, X-linked	Helicase involved in interferon response	2.49
Rnf6	ring finger protein (C3H2C3 type) 6	Ubiquitin-protein ligase	2.49
Ap3d1	adaptor-related protein complex 3 1 Δ subunit	Involved in intracellular granule trafficking	2.47
Elovl5	ELOVL family member 5, elongation of long chain fatty acids	Involved in elongation of long-chain fatty acids	2.47
Rab5a	RAB5A, member RAS oncogene family	Promotes membrane-endosomal fusion	2.47
Asah1	N-acylsphingosine amidohydrolase (acid ceramidase) 1	Hydrolyzes the sphingolipid ceramide to sphingosine (signalling lipid) and fatty acid	2.46
Kitlg	KIT ligand	Stimulates proliferation of Mast cells	2.46
Arpc2	actin related protein 2/3 complex, subunit 2	Actin binding component of Arp2/3 complex	2.46
Hsph1	heat shock 105kDa/110kDa protein 1	Prevents aggregation of denatured proteins during cellular stress	2.46
Tle4	transducin-like enhancer of split 4 (E(sp1) homolog	Transcriptional co-repressor	2.46

Cdc42se2	CDC42 small effector 2	Involved in actin organization during phagocytosis	2.46
Eif2s3x	eukaryotic translation initiation factor 2, subunit 3, structural gene X-linked	Involved in protein biosynthesis	2.46
Pfkm	phosphofructokinase, muscle	Regulator of glycolysis	2.45
Dck	deoxycytidine kinase	Phosphorylates deoxynucleotides	2.45
Csnk1a1	casein kinase 1 1 α	Participates in Wnt signalling	2.44
Nedd4	neural precursor cell expressed, developmentally down-regulated 4	Ubiquitin-protein ligase	2.44
Slco2b1	solute carrier organic anion transporter family, member 2b1	Organic ion uptake	2.44
Prss35	Protease, serine, 35	Unknown function	2.43
Slc31a1	solute carrier family 31 (copper transporters), member 1	Copper uptake	2.43
Adam10	ADAM metallopeptidase domain 10	Cleaves membrane bound TNF-alpha precursor to its mature form	2.43
Cdkn2b	cyclin-dependent kinase inhibitor 2B (p15, inhibits CDK4)	Effector of TGF-beta induced cell-cycle arrest	2.42
Sptlc1	serine palmitoyltransferase, long chain base subunit 1	Key enzyme in sphingolipid synthesis	2.42
Rnf4	ring finger protein 4	Ubiquitin-protein ligase	2.42
Cacybp	calcyclin binding protein	Involved in calcium-dependent ubiquitination	2.42
Tmprss8	transmembrane protease, serine 8 (intestinal)	Unknown function	2.41
Pat1	protein associated with topoisomerase II homolog 1	Involved in RNA degradation	2.41
Sesn3	sestrin 3	Involved in cellular stress response	2.41
Cfh	complement factor H	Regulator of complement activation and microbial specificity	2.40
Tpm1	tropomyosin 1 α	Regulator of actin mechanics	2.40
Tspan2	tetraspanin 2	Mediator of trans-membrane signalling systems	2.40
Ahcy11	adenosylhomocysteinase-like 1	Unknown function	2.40
Tgfr2	transforming growth factor β receptor II	Receptor inducing apoptosis and negatively regulating phagocyte activation	2.40
Scarf2	scavenger receptor class F, member 2	Involved in cell adhesion	2.39
Ipo5	importin 5	Involved in nuclear protein import	2.39
Sept7	septin 7	Involved in actin cytoskeletal organization	2.39
LOC100363366	amyloid β (A4) precursor-like protein 2-like	Unknown function, interacts with MHC class I molecules	2.38
Dazap2	DAZ associated protein 2	Involved in TGF-beta signalling and stress granule formation	2.38
Rbm9	RNA binding motif protein 9	Regulator of alternative exon splicing	2.38
Drg1	developmentally regulated GTP binding protein 1	May play a role in cell proliferation, differentiation and death	2.38
Slc30a9	solute carrier family 30 (zinc transporter), member 9	Involved in activation of Wnt responsive genes	2.38
Pfn2	profilin 2	Regulator of actin polymerization	2.38
Cebpa	CCAAT/enhancer binding protein (C/EBP), alpha	Transcriptional regulator	2.38
Cd44	Cd44 molecule	Hyaluronic acid (ECM) receptor, involved in lymphocyte activation	2.37
Efnb1	ephrin B1	Involved in cell adhesion	2.37
Klc1	kinesin light chain 1	Involved in organelle transport	2.36
Kctd12	potassium channel tetramerisation domain containing 12	GABA-B receptor subunit	2.36
Nolc1	nucleolar and coiled-body phosphoprotein 1	Involved in RNA polymerase I transcription	2.36
Pgrmc2	progesterone receptor membrane component 2	Putative steroid receptor	2.36
Vezf1	vascular endothelial zinc finger 1	Transcription factor regulating cell differentiation	2.36
Reep6	receptor accessory protein 6	Unknown function	2.35
Atp2b4	ATPase, Ca ⁺⁺ transporting, plasma membrane 4	Regulator of intracellular calcium homeostatis	2.35

Lgr4	leucine-rich repeat-containing G protein-coupled receptor 4	Orphan receptor	2.35
Pdlim7	PDZ and LIM domain 7	Involved in actin cytoskeletal organization	2.35
Bid	BH3 interacting domain death agonist	Pro-apoptotic mediator inducing cytochrome c release and inhibiting Bcl-2 activity	2.34
Soat1	sterol O-acyltransferase 1	Involved in lipoprotein assembly and cholesterol absorption	2.34
Gtf2h1	general transcription factor IIH, polypeptide 1	Involved in nucleotide excision repair during transcription	2.34
Mbnl2	muscleblind-like 2	Mediates pre-mRNA splicing regulation	2.34
Sesn1	sestrin 1	Involved in the reduction of peroxiredoxins	2.34
Prkar2a	protein kinase, cAMP dependent regulatory, type II α	Involved in membrane association of MAP2 kinase	2.33
Atp2a3	ATPase, Ca ⁺⁺ transporting, ubiquitous	Transports calcium from the cytosol to the endoplasmic reticulum	2.32
Nfyc	nuclear transcription factor-Y γ	Regulator of transcription at CCAAT enhancer motifs	2.31
Pkn2	protein kinase N2	Inhibits Akt induced anti-apoptotic activity	2.31
Pi4k2b	phosphatidylinositol 4-kinase type 2 β	Regulator of vesicular trafficking	2.31
Gdi2	GDP dissociation inhibitor 2	Involved in vesicular trafficking	2.31
Larp4	La ribonucleoprotein domain family, member 4	Unknown function	2.30
Prim1	DNA primase, p49 subunit	Component of DNA polymerase which synthesizes small Okazaki fragment primers	2.30
Tpm4	tropomyosin 4	Regulator of myosin-actin interactions	2.29
Cdc26	cell division cycle 26	Ubiquitin-ligase involved in cell cycle	2.29
LOC501268	nidogen 2	Basement membrane component involved in adhesion and apoptosis	2.29
Tm9sf4	transmembrane 9 superfamily protein member 4	Unknown function	2.28
Tfrc	transferrin receptor	Mediator of iron uptake	2.27
Bhlhe40	basic helix-loop-helix family, member e40	Involved in control of cell differentiation	2.27
Reg3b	regenerating islet-derived 3 β	Antimicrobial peptide with C-type lectin domain	2.27
Tollip	toll interacting protein	Negative regulator of NF κ B activation by IL-1 pathway	2.26
Cd3e	CD3 molecule, epsilon polypeptide	Involved in coupling antigen recognition to intracellular signalling pathways	2.26
Rfc1	replication factor C (activator 1) 1	Involved in DNA replication and repair	2.26
Arl8b	ADP-ribosylation factor-like 8B	Involved in lysosomal motility	2.26
Oaz2	ornithine decarboxylase antizyme 2	Regulator of polyamine synthesis	2.26
LOC690372	similar to U2 (RNU2) small nuclear RNA auxiliary factor 2 isoform b	Unknown function	2.26
Slc9a3r1	solute carrier family 9 (sodium/hydrogen exchanger), member 3 regulator 1	Involved in regulating interactions between cytoskeleton and membrane proteins	2.25
Leprot	leptin receptor overlapping transcript	Decreases cellular response to leptin hormone	2.25
Med14	mediator complex subunit 14	Involved in regulation of RNA polymerase II transcription	2.24
Toe1	target of EGR1, member 1 (nuclear)	Positive regulator of TGF-beta expression	2.24
Cd55	Cd55 molecule	Negative regulator of the complement cascade	2.24
Mgea5	Meningioma expressed antigen 5 (hyaluronidase)	Glycosidase that removes O-GlcNAc from glycoproteins	2.24
Fytd1	forty-two-three domain containing 1	Involved in mRNA export	2.24
Pla2g10	phospholipase A2, group X	Regulator of cellular lipid content	2.24
Cebpg	CCAAT/enhancer binding protein (C/EBP), gamma	Positive regulator of IL-4 expression	2.23
Parva	parvin α	Regulator of cellular adhesion	2.23
Pmm2	phosphomannomutase 2	Involved in glycoprotein biosynthesis	2.23
Cdkn2aipnl	CDKN2A interacting protein N-terminal like	Unknown function	2.22
Ndr1	N-myc downstream regulated gene 1	Involved in stress response and cell differentiation	2.22
Angptl2	angiopoietin-like 2	Induces sprouting in endothelial cells	2.22

Sox4	SRY (sex determining region Y)-box 4	Transcriptional activator that binds to T-cell enhancer motifs	2.22
Arfp1	ADP-ribosylation factor interacting protein 1	Arf1 target protein	2.22
Dlg3	discs, large homolog 3	Regulator of synaptic plasticity	2.22
Rfk	riboflavin kinase	Involved in utilization of vitamin B2	2.22
Ppp3r1	protein phosphatase 3, regulatory subunit B, α isoform	Regulator of calmodulin stimulated protein phosphatase	2.21
Vps4a	vacuolar protein sorting 4 homolog A	Involved in intracellular protein trafficking	2.21
RT1-A2	RT1 class Ia, locus A2	Antigen presentation	2.21
Map4k5	mitogen-activated protein kinase 5	Involved in transducing cell stress signals	2.21
Ppp4c	protein phosphatase 4, catalytic subunit	Phosphatase regulating several cellular processes	2.21
Tra2a	transformer 2a homolog	Regulator of pre-mRNA splicing	2.211
Galnt4	N-acetylgalactosaminyltransferase 4	Catalyses initial reaction in O-linked oligosaccharide biosynthesis	2.21
Arl6ip5	ADP-ribosylation-like factor 6 interacting protein 5	Regulates intracellular concentrations of taurine and glutamate	2.21
Casp8	caspase 8	Initiator caspase mediating apoptosis	2.20
Pcsk5	Pro-protein convertase subtilisin/kexin type 5 defective in cullin neddylation 1, domain containing 1	Involved processing multiple pro-proteins to their mature forms	2.20
Dcn1	ubiquitin-protein ligase	Ubiquitin-protein ligase	2.20
Lyn	v-src-1 Yamaguchi sarcoma viral related oncogene homolog	Regulator of cytokinesis and adhesion	2.20
Hdac1	histone deacetylase 1	Regulator of cell-cycle and development	2.20
Dnajc5	DnaJ (Hsp40) homolog, subfamily C, member 5	Involved in membrane trafficking and protein folding	2.20
Ghr	growth hormone receptor	Involved in post-natal tissue development	2.20
Pkia	protein kinase (cAMP-dependent, catalytic) inhibitor α	Regulator of intracellular signalling	2.20
Epas1	endothelial PAS domain protein 1	Involved in the induction of oxygen regulated genes	2.20
Elmod2	ELMO/CED-12 domain containing 2	Positive regulator of interferon response	2.19
Hpcal1	hippocalcin-like 1	Involved in calcium-dependent regulation of rhodopsin phosphorylation	2.19
Ppp2r5e	protein phosphatase 2, regulatory subunit B', epsilon isoform	Negative regulator of cell growth	2.19
LOC363060	similar to RIKEN cDNA 1600029D21	Unknown function	2.19
Kcne3	potassium voltage-gated channel, Isk-related subfamily, gene 3	Involved in epithelial electrolyte transport	2.19
Gsr	glutathione reductase	Involved in cellular antioxidant defence	2.19
Csnk1d	casein kinase 1 Δ	Participates in Wnt signalling	2.19
Arpp19	cAMP-regulated phosphoprotein 19	Regulator of mitosis	2.18
Tubb4	tubulin 4 β	Major microtubule component	2.18
Smad4	SMAD family member 4	Mediator of signal transduction by TGF-beta	2.18
Eif4g2	eukaryotic translation initiation factor 4 2 γ	General repressor of translation	2.18
Ebag9	estrogen receptor binding site associated, antigen, 9	Caspase 3 activator involved in apoptosis	2.18
Aktip	AKT interacting protein	Regulator of apoptosis via interactions with Akt1	2.17
Snx11	sorting nexin 11	Involved in intracellular trafficking	2.17
Nsf	N-ethylmaleimide-sensitive factor	Involved in ER-Golgi transport	2.16
Ssbp3	single stranded DNA binding protein 3	Regulator of collagen expression	2.16
Mapk1	mitogen activated protein kinase 1	Extracellular signal regulated kinase	2.16
Arl5a	ADP-ribosylation factor-like 5A	GTP-binding protein involved in development	2.16
Heg1	HEG homolog 1	Unknown function	2.16
Shfm1	split hand/foot malformation (ectrodactyly) type 1	Involved in ubiquitin dependent proteolysis	2.16
Hsd17b6	hydroxysteroid (17- β) dehydrogenase 6	NAD-dependent oxidoreductase with broad substrate range	2.16

Ankrd12	ankyrin repeat domain 12	Inhibitor of nuclear receptor transcriptional activity	2.15
Rhoa	ras homolog gene family, member A	Regulator of membrane-actin stress fibre signal transduction	2.15
Gpd1	glycerol-3-phosphate dehydrogenase 1	Involved in lipid biosynthesis	2.15
Wdr33	WD repeat domain 33	Involved in cellular differentiation	2.15
Ldlr	low density lipoprotein receptor	Mediator of LDL endocytosis	2.15
Cdc16	cell division cycle 16 homolog	Regulator of cell-cycle	2.15
Psen1	presenilin 1	Increases cytoplasmic B-catenenin concentration during apoptosis	2.15
Lamc1	Laminin 1 γ	Mediator of cellular adhesion and migration	2.15
Spink4	serine peptidase inhibitor, Kazal type 4	Gastrointestinal protease inhibitor	2.15
Isoc1	isochorismatase domain containing 1	Unknown function	2.14
Frem2	Fras1 related extracellular matrix protein 2	ECM protein involved in maintenance of epithelial integrity	2.14
Map3k3	mitogen activated protein kinase kinase kinase 3	Component of protein kinase signal cascade	2.14
Ifnar1	interferon (α , β and ω) receptor 1	Mediator of type I interferon signalling	2.14
Ube2h	ubiquitin-conjugating enzyme E2H	Catalyses covalent attachment of ubiquitin to other proteins	2.14
Rnf4	ring finger protein 4	Ubiquitin-protein ligase	2.14
Pld1	phospholipase D1	Involved in signal transduction and membrane trafficking	2.14
Add1	adducin 1 α	Calmodulin binding promoter of actin-spectrin network assembly	2.13
Tsnax	translin-associated factor X	Nuclear targeting protein	2.13
Pmp22	peripheral myelin protein 22	Major component of myelin in the peripheral nervous system	2.13
Rab6a	RAB6A, member RAS oncogene family	Regulator of membrane traffic from the Golgi apparatus	2.13
Ddx21	DEAD (Asp-Glu-Ala-Asp) box polypeptide 21	RNA helicase involved in ribosome synthesis and innate immunity	2.13
Csnk1g3	casein kinase 1 3 γ	Participates in Wnt signalling	2.13
Pnrc2	proline-rich nuclear receptor co-activator 2	Involved in mRNA processing	2.13
Eif3a	eukaryotic translation initiation factor 3, subunit A	Involved in protein biosynthesis	2.12
Slc30a1	solute carrier family 30 (zinc transporter), member 1	Involved in zinc export	2.12
Ddx17	DEAD (Asp-Glu-Ala-Asp) box polypeptide 17	RNA helicase	2.12
LOC685179	similar to SWI/SNF-related regulator of chromatin c2	Unknown function	2.12
Epb4113	erythrocyte protein band 4.1-like 3	Unknown function	2.11
Fam46a	family with sequence similarity 46, member A	Unknown function	2.11
Dlg1	discs, large homolog 1	Involved in maintenance of cellular polarity and lymphocyte activation	2.11
Pdha1	pyruvate dehydrogenase (lipoamide) 1 α	Involved in linking glycolysis and the TCA cycle	2.11
Hnf4	hepatocyte nuclear factor 4	Regulator of liver, kidney and intestinal development	2.11
Ensa	endosulfine α	Modulator of insulin secretion	2.11
Ifnar1	interferon (α , β and ω) receptor 1	Mediator of interferons alpha and beta signalling	2.11
Pafah1b1	platelet-activating factor acetylhydrolase, isoform 1b, subunit 1	Involved in several dynein and microtubule-dependent processes	2.11
Mtpn	myotrophin	Involved in neuronal differentiation	2.10
Galnt2	N-acetylgalactosaminyltransferase 2 (GalNAc-T2)	Catalyzes initial reaction in O-linked glycosylation of mucins	2.10
Eif4h	eukaryotic translation initiation factor 4H	Involved in protein biosynthesis	2.10
Rbp4	retinol binding protein 4, plasma	Mediator of vitamin A (retinol) transport	2.01
Tcrb	T-cell receptor beta chain	Recognizes MHC bound antigens on antigen presenting cells	2.09
Rab27a	RAB27A, member RAS oncogene family	Mediates cytotoxic granule exocytosis in lymphocytes	2.09

Nrp2	neuropilin 2, transcript variant 4	Involved in transmembrane signalling	2.09
Klra17	killer cell lectin-like receptor, subfamily A, member 17	NK-cell pathogen recognition receptor	2.09
Tnks2	tankyrase, TRF1-interacting ankyrin-related ADP-ribose polymerase 2	Inhibitor of Wnt signalling	2.09
Dnajb14	DnaJ (Hsp40) homolog, subfamily B, member 14	Involved in membrane trafficking and protein folding	2.09
Grin1a	glutamate receptor, ionotropic, N-methyl D-aspartate-like 1A	Regulator of transcriptional activation	2.09
Mafg	v-maf musculoaponeurotic fibrosarcoma oncogene homolog G	Transcriptional regulator	2.09
Snx18	sorting nexin 18	Involved in several stages of endocytosis	2.08
Sdccag3	serologically defined colon cancer antigen 3	May be involved in modulation of the TNF response	2.08
Glipr2	GLI pathogenesis-related 2	Involved in apoptosis and macrophage differentiation	2.08
Sec61a1	Sec61 1a subunit	Involved in assembly of membrane and secretory proteins	2.08
Slc16a1	solute carrier family 16, member 1 (monocarboxylic acid transporter 1)	Lactate and pyruvate transporter	2.08
Ak2	adenylate kinase 2	Involved in energy metabolism and nucleotide synthesis	2.08
Tcea1	transcription elongation factor A (SII) 1	Involved in RNA polymerase II transcription	2.07
Eprs	glutamyl-prolyl-tRNA synthetase	Catalyzes the attachment of the cognate amino acid to the corresponding tRNA	2.07
Hyal3	hyaluronoglucosaminidase 3	ECM regulator	2.07
Senp5	Sumo1/sentrin/SMT3 specific peptidase 5	Component of the SUMO post-translational modification pathway	2.07
Arf6	ADP-ribosylation factor 6	Involved in vesicular trafficking and actin remodelling	2.07
Ubl3	ubiquitin-like 3	Unknown function	2.07
Dsta	dystonin transcript variant a	Component of adhesion junctions	2.06
Rab5b	RAB5B, member RAS oncogene family	GTPase modulating endosomal trafficking	2.06
Akt1s1	AKT1 substrate 1 (proline-rich)	Regulator of cell growth	2.06
LOC686428	similar to Emu2	Unknown function	2.06
Usf1	upstream transcription factor 1	Transcriptional regulator	2.06
Mki67ip	Mki67 (FHA domain) interacting nucleolar phosphoprotein	Involved in the cell-cycle	2.06
Vdac1	voltage-dependent anion channel 1	Mediator of cytochrome-c release during apoptosis	2.06
Akt2	v-akt murine thymoma viral oncogene homolog 2	General protein kinase	2.05
Ccl2	chemokine (C-C motif) ligand 2	Recruits monocytes, T(mem)-cells and dendritic cells to site of infection	2.05
Zdhhc3	zinc finger, DHHC-type containing 3	Regulator of cell surface stability	2.05
Gtpbp4	GTP binding protein 4	Involved in ribosomal synthesis	2.05
Zdhhc17	zinc finger, DHHC domain containing 17	Involved in endocytosis	2.05
LOC363060	similar to RIKEN cDNA 1600029D21	Unknown function	2.05
LOC366300	hypothetical LOC366300	Unknown function	2.04
Selt	selenoprotein T	Involved in redox regulation and cell adhesion	2.04
Rab11b	RAB11B, member RAS oncogene family	Regulator of exo/endocytosis	2.04
Arf1	ADP-ribosylation factor 1	Involved in vesicular trafficking and actin remodelling	2.04
Sf3b5	splicing factor 3b, subunit 5	Spliceosome component	2.03
Cul4b	cullin 4B	Ubiquitin-protein ligase	2.03
Nkx2-3	NK2 transcription factor related, locus 3	Transcription factor; possible role in cell differentiation	2.03
LOC681825	similar to Prefoldin subunit 3	Unknown function	2.02
Gna12	guanine nucleotide binding protein 12a	Membrane signal transducer	2.02
Siah1a	seven in absentia 1A	Ubiquitin-protein ligase	2.02

Camk2d	calcium/calmodulin-dependent protein kinase II delta	Transducer of calcium/calmodulin signalling	2.02
Cobl	cordon-bleu homolog	May be involved in actin modulation	2.02
Cd3d	CD3 molecule delta polypeptide	T-cell TCR/CD3 complex component mediating signal transduction	2.02
Cops4	COP9 constitutive photomorphogenic homolog subunit 4 (Arabidopsis)	Regulator of several signalling pathways	2.02
LOC288913	Similar to Leydig cell tumor 10 kD protein	Unknown function	2.02
Rcc2	regulator of chromosome condensation 2	Involved in mitosis and cytokinesis	2.02
Mrpl52	mitochondrial ribosomal protein L52	Mito-ribosomal protein component	2.01
Prlr	prolactin receptor	Hormone receptor	2.01
Jam2	junctional adhesion molecule 2	Tight junction component involved in lymphocyte homing	2.01
Smek2	SMEK homolog 2, suppressor of mek1	Regulator of microtubule organization	2.01
Prpf38b	PRP38 pre-mRNA processing factor 38 domain containing B	May be required for pre-mRNA splicing	2.01
Dusp1	dual specificity phosphatase 1	Negatively regulates mitogen-associated protein kinases (MAPK's)	2.01
Marveld2	membrane-associating domain containing 2	Integral tight junction component	2.01
Tmem20	transmembrane protein 20	Unknown function	2.01
Tbc1d1	TBC1 domain family, member 1	May regulate cell growth and differentiation	2.01
Gpkow	G patch domain and KOW motifs	Unknown function	2.01
Phf11	PHD finger protein 11	Regulator of Th1-type cytokine expression	2.01
Sema4g	sema domain, Ig, transmembrane and short cytoplasmic domain 4G	Axon guidance ligand	2.01
Foxa2	forkhead box A2	Transcription factor involved in development	2.00
Dffb	DNA fragmentation factor, β polypeptide	Pro-apoptotic caspase activated Dnase	2.00
Arih1	ariadne ubiquitin-conjugating enzyme E2 binding protein homolog 1	Ubiquitin-protein ligase	2.00
Cdc42bpb	CDC42 binding protein kinase beta (DMPK-like)	CDC42 effector involved in cytoskeletal organization	2.00
Itga6	integrin 6α	Involved in cell adhesion and cell-surface signalling	2.00

Table S5. Genes down-regulated twofold or greater in the neonatal rat GI tract 12 h after feeding *E. coli* A192PP to P9 pups

Gene Symbol	Description	Function	Mean-fold change
Nucks1	nuclear casein kinase and cyclin-dependent kinase substrate 1	May be involved in cell proliferation	-11.81
Afp	α -fetoprotein	Major plasma protein	-11.71
Tmsb10	thymosin 10 β	Inhibitor of actin polymerization	-8.62
RT1-Db1	RT1 class II, locus Db1	Antigen presentation	-7.46
Adfp	Adipose differentiation related protein	Involved in sequestering lipids	-6.33
RT1-A	RT1 class I, locus A	Antigen presentation	-5.85
Cav2	caveolin 2	Involved in signal transduction	-5.00
Epsti1	epithelial stromal interaction 1	Unknown function	-5.00
Pacsin1	protein kinase C and casein kinase substrate in neurons 1	May be involved in vesicle transport	-4.95
LOC100362483	H2-GS14-2 antigen	RT1 homologue	-4.67
Tbc1d20	TBC1 domain family, member 20	GTPase-activator for Rab family proteins	-4.61
LOC688090	similar to RT1 class II, locus Bb	Antigen presentation	-4.42
Mfsd2	major facilitator superfamily domain containing 2	May regulate cell proliferation	-4.35
Amy2	amylase 2, pancreatic	Involved in starch hydrolysis	-4.33
Lox	lysyl oxidase	Initiator of collagen-elastic cross-linking	-4.22
Krit1	KRIT1, ankyrin repeat containing	Involved in microtubule formation and maintenance of endothelial integrity	-3.97
RGD1308772	similar to KIAA0564 protein	Unknown function	-3.89
Ptpn3	protein tyrosine phosphatase, non-receptor type 3	Regulator of cell adhesion	-3.88
Smrce1	SWI/SNF related regulator of chromatin e1	Regulator of transcription via chromatin remodelling	-3.66
Rsu1	Ras suppressor protein 1	Suppressor of Ras mediated signalling	-3.61
Galnt1	N-acetylgalactosaminyltransferase 1 (Galnt1), transcript variant 2	Catalyzes initial reaction in O-linked glycosylation of mucins	-3.52
Tgfb2	transforming growth factor 2 β	Suppressor of IL-2 mediated T-cell growth	-3.51
8430427H17Rik	RIKEN cDNA 8430427H17 gene	Unknown function	-3.47
Ints7	integrator complex subunit 7	Involved in processing small nuclear RNA's	-3.42
Mtmr1	myotubularin related protein 1	May be involved in signalling	-3.41
Tlk2	tousled-like kinase 2	Involved in cell cycle regulation	-3.41
Phlda3	pleckstrin homology-like domain, family A, member 3	Repressor of Akt signalling	-3.40
Nr3c1	nuclear receptor subfamily 3, group C, member 1	Regulator of trans-nuclear membrane signalling	-3.25
Srp54a	signal recognition particle 54a	May mediate targeting to the ER	-3.25
Zfp191	zinc finger protein 191	Transcriptional repressor involved in development	-3.17
Wwc1	WW and C2 domain containing 1	Regulator of proliferation and apoptosis	-3.16
Pim1	proviral integration site 1	Involved in cell proliferation	-3.14
Ass1	argininosuccinate synthetase 1	Involved in arginine biosynthesis	-3.13
Ahi1	Abelson helper integration site 1	Involved in neuronal development	-3.11
Ttc21b	tetratricopeptide repeat domain 21B	Negative modulator of sonic hedgehog signal transduction	-3.09
Zfp422	zinc finger protein 422	Transcriptional regulator	-3.09
Stox2	storkhead box 2	Involved in development	-3.07
CP-2	Cyclic Protein-2	Involved in iron transport	-3.06
Tcf712	transcription factor 7-like 2, T-cell specific, HMG-box	Transcription factor involved in Wnt signalling	-3.05
Eml4	echinoderm microtubule associated protein like 4	May modify assembly dynamics of microtubules	-3.04

Znf503	zinc finger protein 503	Transcriptional repressor	-3.03
Stard3	StAR-related lipid transfer (START) domain containing 3	Cholesterol transporter	-2.99
Dlst	dihydropyrimidinase (E2 component of 2-oxo-glutarate complex)	Involved in fatty acid metabolism	-2.96
Id4	Inhibitor of DNA binding 4	Regulator of DNA binding	-2.95
Pafah1b1	platelet-activating factor acetylhydrolase, isoform 1b, subunit 1	Involved in cytoskeletal organization	-2.95
Cyfp1	cytoplasmic FMR1 interacting protein 1	Mediator of translational repression	-2.94
Mrp194	mitochondrial ribosomal protein L49	Component of the mitochondrial ribosome	-2.94
Plcx2	phosphatidylinositol-specific phospholipase C, X domain containing 2	Involved in signal transduction	-2.93
Dpep1	dipeptidase 1	Hydrolysis of dipeptides	-2.91
Crim1	Cysteine-rich transmembrane BMP regulator 1 (chordin like)	May play a role in angiogenesis	-2.89
Acd	adrenocortical dysplasia homolog	Telosome component	-2.87
Tmem38b	transmembrane protein 38B	Mediator of rapid intracellular calcium release	-2.87
Gnas	Gs α subunit	Involved in signal transduction	-2.86
Vash1	vasohibin 1	Angiogenesis inhibitor	-2.85
RT1-Ba	RT1 class II, locus Ba	Antigen presentation	-2.83
Adam33	a disintegrin and metallopeptidase domain 33 (predicted)-like	May be involved in cell adhesion	-2.82
Mocs2	molybdenum cofactor synthesis 2	Involved in molybdopterin biosynthesis	-2.82
Tsc22d2	TSC22 domain family, member 2	Unknown function	-2.82
Tmem131	transmembrane protein 131	May be involved in immune response	-2.80
Hnrnpa1	heterogeneous nuclear ribonucleoprotein A1	Involved in pre-mRNA processing	-2.78
Ptpnb	protein tyrosine phosphatase, receptor type, B	Regulator of angiogenesis	-2.78
Tmem14a	transmembrane protein 14A	Unknown function	-2.78
Thbs2	thrombospondin 2	Adhesive glycoprotein mediating cell adhesion to ECM	-2.75
Senp7	SUMO1/sentrin specific peptidase 7	Catalyzes the removal of SUMO protein markers	-2.73
Slc30a2	solute carrier family 30 (zinc transporter), member 2	Zinc transporter	-2.71
Neu1	sialidase 1 (lysosomal sialidase)	Catalyzes the removal of sialic acids from proteins	-2.70
Rab30	RAB30, member RAS oncogene family	Golgi-associated signalling protein	-2.69
Tiparp	TCDD-inducible poly(ADP-ribose) polymerase	May play a role in adaptive response to chemical exposure	-2.69
Capn7	calpain 7	Ubiquitous calcium regulated protease	-2.68
Pik3r2	phosphoinositide-3-kinase, regulatory subunit 2 β	Adaptor mediating association of activated kinases to the plasma membrane	-2.67
Ube2cbp	ubiquitin-conjugating enzyme E2C binding protein	Ubiquitin-protein ligase	-2.67
Sgcb	sarcoglycan, beta (dystrophin-associated glycoprotein)	Involved in anchoring F-actin to the ECM	-2.67
Mcpt3	mast cell peptidase 3	Serine endopeptidase	-2.65
Dcaf10	DDB1 and CUL4 associated factor 10	Involved in ubiquitin-protein ligation	-2.65
Slc30a7	solute carrier family 30 (zinc transporter), member 7	Regulator of zinc homeostatis	-2.65
Slc20a1	solute carrier family 20 (phosphate transporter), member 1	Regulator of phosphate homeostatis	-2.64
Itgal	integrin L α	Intercellular adhesion molecule receptor involved in immune cell interactions	-2.62
Ppp1r8	protein phosphatase 1, regulatory (inhibitor) subunit 8	Involved in pre-mRNA processing	-2.61
Hspa5	heat shock protein 5	Involved in regulating protein folding in the ER	-2.60
Tmem33	transmembrane protein 33	Unknown function	-2.59
Eif1b	eukaryotic translation initiation factor 1B	May be involved in translation	-2.58

Greb1	gene regulated by estrogen in breast cancer	Hormone-dependent growth regulator	-2.58
Mreg	melanoregulin	Involved in membrane fusion	-2.58
Anxa7	annexin A7	Membrane fusion promoter involved in exocytosis	-2.57
Slc34a3	solute carrier family 34 (sodium phosphate), member 3	Active phosphate importer	-2.56
Stk24	serine/threonine kinase 24	Involved in signal transduction	-2.56
Gjb3	gap junction protein, beta 3	Mediator of intercellular connexin transport	-2.55
Rnf2	ring finger protein 2	Ubiquitin-protein ligase	-2.54
Itih3	inter- α -trypsin inhibitor, heavy chain 3	Involved in binding hyaluronan to other ECM proteins	-2.53
Tmem178	transmembrane protein 178	Unknown function	-2.53
Icmt	isoprenylcysteine carboxyl methyltransferase	Involved in targeting proteins to the membrane	-2.51
Jag1	jagged 1	Notch receptor ligand and mediator of Notch signaling	-2.49
Mmp15	matrix metalloproteinase 15	Peptidase that degrades ECM components	-2.48
RGD1359529	similar to chromosome 1 open reading frame 63	Unknown function	-2.48
Romo1	reactive oxygen species modulator 1	Induces ROS production to stimulate cell proliferation	-2.46
Spsb4	sp1A/ryanodine receptor domain and SOCS box containing 4	Involved in ubiquitin-protein ligation	-2.46
Lpin2	lipin 2	Regulator of fatty acid metabolism	-2.44
Mcoln1	mucopolin 1	Regulator of endo/exocytosis	-2.44
Kif26a	kinesin family member 26A	Modulator of enteric neuronal development	-2.43
Dedd	death effector domain-containing	Modulator of Caspase 3 activity	-2.43
Tcirg1	T-cell, immune regulator 1, ATPase, H ⁺ transporting, lysosomal V0 subunit A3	Proton channel involved in T-cell activation	-2.43
Idh2	isocitrate dehydrogenase 2 (NADP ⁺), mitochondrial	Involved in energy production and metabolism	-2.42
Arhgef10	Rho guanine nucleotide exchange factor 10	Involved in development	-2.42
Med13	mediator complex subunit 13	Co-activator of RNA polymerase II transcription	-2.41
Pign	phosphatidylinositol glycan anchor biosynthesis, class N	Involved in GPI-anchor biosynthesis	-2.41
Smad5	SMAD family member 5	Transcriptional modulator	-2.41
Procr	protein C receptor, endothelial	Involved in protein C-mediated blood coagulation	-2.40
Znf618	zinc finger protein 618	May be involved in transcriptional regulation	-2.40
Acot2	Acyl-CoA thioesterase 2	Regulator of intracellular fatty acid levels	-2.39
Tcf4	transcription factor 4, transcript variant 1	Involved in cellular differentiation	-2.39
Hsd12	hydroxysteroid dehydrogenase like 2	Unknown function	-2.39
Ankrd28	ankyrin repeat domain 28	Involved in regulating TNF-alpha induced NFkB activation	-2.38
LOC687609	similar to ras homolog gene family, member f	Unknown function	-2.38
Ndufa5	NADH dehydrogenase (ubiquinone) 1 α subcomplex 5	Involved in respiratory chain	-2.38
Park7	Parkinson disease (autosomal recessive, early onset) 7	Redox sensitive chaperone	-2.38
Smc2	structural maintenance of chromosomes 2	Involved in DNA repair	-2.37
Malat1	metastasis associated lung adenocarcinoma transcript 1	Non-protein coding regulator of cell motility	-2.36
LOC100364467	rCG36634-like	Unknown function	-2.34
LOC682058	similar to nucleolar protein with MIF4G domain 1	Unknown function	-2.33
Fam64a	family with sequence similarity 64, member A	Unknown function	-2.33
Mnt	max binding protein	Regulator of cell growth	-2.33
Pbx1	pre B-cell leukemia transcription factor 1	Transcriptional regulator	-2.33
Wfdc3	WAP four-disulfide core domain 3	Protease inhibitor	-2.32

Mlt10	myeloid (trithorax) homolog 10	Involved in transcriptional regulation	-2.31
Thsd4	thrombospondin, type I, domain containing 4	Promotes ECM assembly	-2.31
Adar	adenosine deaminase, RNA-specific	Positive regulator of IL-2 expression in T-cells	-2.30
Cdk7	cyclin-dependent kinase 7	Regulator of cell cycle progression	-2.30
RGD1305457	similar to RIKEN cDNA 1700023M03	Unknown function	-2.30
RGD1565983	similar to apurinic/aprimidinic endonuclease 2	Unknown function	-2.30
Spon2	spondin 2, extracellular matrix protein	Bacterial LPS binding ECM component that functions as opsonin for macrophages	-2.30
Tulp4	tubby like protein 4	Ubiquitin-protein ligase component	-2.30
Zbtb4	zinc finger and BTB domain containing 4	May be involved in transcriptional regulation	-2.30
Zfp347	zinc finger protein 347	Unknown function	-2.29
Klf5	Kruppel-like factor 5	Transcriptional regulator	-2.28
Cyp17a1	cytochrome P450, family 17, subfamily a, polypeptide 1	Involved in lipid biosynthesis	-2.28
Foxn3	forkhead box N3	Transcriptional repressor responding to DNA damage	-2.28
Hgd	homogentisate 1, 2-dioxygenase	Involved in amino acid catabolism	-2.28
Dapk3	death-associated protein kinase 3	Regulator of apoptosis	-2.27
Terf2	telomeric repeat binding factor 2	Regulator of telomeric stability	-2.27
Neur1a	neuronalized homolog 1A	Unknown function	-2.26
Kctd5	potassium channel tetramerisation domain containing 5	Ubiquitin ligase substrate adapter	-2.25
Tcf3	transcription factor E3	Activator of T-cell CD40L expression	-2.25
Eif2b3	eukaryotic translation initiation factor 2B, subunit 3γ	Involved in protein biosynthesis	-2.25
Ada	adenosine deaminase	Positive regulator of T-cell co-activator	-2.24
Slu7	SLU7 splicing factor homolog	Involved in pre-mRNA splicing	-2.24
Timp2	tissue inhibitor of metalloproteinase 2	ECM Protease inhibitor	-2.24
Tubgcp2	tubulin, gamma complex associated protein 2	Involved in tubulin assembly	-2.24
Cubn	cubilin (intrinsic factor-cobalamin receptor)	Co-transporter involved in iron metabolism	-2.23
Asx1	additional sex combs like 1	Involved in development	-2.23
Abcc2	ATP-binding cassette, sub-family C (CFTR/MRP), member 2	Mediator of bile secretion	-2.22
Hsf1	heat shock transcription factor 1	Activates heat shock responsive genes	-2.21
Nubp1	nucleotide binding protein 1	Involved in cytosolic Fe/S protein assembly	-2.21
Pnpla6	patatin-like phospholipase domain containing 6	Regulator of neuronal differentiation	-2.21
Sox4	SRY-box 4	T-cell activator	-2.21
F8	coagulation factor VIII, procoagulant component	Involved in blood coagulation	-2.21
Pigy	phosphatidylinositol glycan anchor biosynthesis, class Y	Initiator of GPI anchor biosynthesis	-2.20
Atad2	ATPase family, AAA domain containing 2	Involved in cell proliferation	-2.19
Osbpl3	oxysterol binding protein-like 3	Intracellular lipid receptor	-2.19
Vt1a	vesicle transport through interaction with t-SNAREs 1B-like	Mediator of vesicle transport pathways	-2.19
Ccdc109a	coiled-coil domain containing 109A	Unknown function	-2.18
Rnf216	ring finger protein 216	Co-activator of Il-1 induced NF-κB activation	-2.18
Smad1	stromal membrane-associated protein 1	Involved in clathrin-dependent endocytosis	-2.18
Npas2	neuronal PAS domain protein 2	Transcriptional regulator	-2.17
Smg7	Smg-7 homolog, nonsense mediated mRNA decay factor	Involved in nonsense-mediated mRNA decay	-2.17
Ard1a	ARD1 homolog A, N-acetyltransferase	Mediator of n-α acetylation of proteins	-2.17
Timp1	TIMP metalloproteinase inhibitor 1	ECM Protease inhibitor	-2.17

Clta	clathrin, light chain (Lca)	Mediator of endocytosis	-2.16
Mudeng	MU-2/APIM2 domain containing, death-inducing	May be involved in apoptosis	-2.16
Pls3	plastin 3 (T-isoform)	Actin bundling protein in microvilli	-2.16
Smurf1	SMAD specific E3 ubiquitin protein ligase 1	Ubiquitin-protein ligase	-2.16
LOC680155	hypothetical protein LOC680155	Unknown function	-2.16
Dnajb5	DnaJ (Hsp40) homolog, subfamily B, member 5	May be involved in protein folding and transport	-2.15
Ptpn12	protein tyrosine phosphatase, non-receptor type 12	Signalling molecule involved in cell motility	-2.15
Mall	mal, T-cell differentiation protein-like	Involved in raft-mediated membrane trafficking	-2.15
Ubxn2b	UBX domain protein 2B	Involved in maintenance of ER and Golgi	-2.15
Nudt11	nudix (nucleoside diphosphate linked moiety X)-type motif 11	May play a role in signal transduction	-2.14
C8g	complement component 8, γ polypeptide	Component of the membrane attack complex	-2.14
Slc38a7	solute carrier family 38, member 7	Amino acid transporter	-2.14
Atxn2	ataxin 2	Unknown function	-2.13
Tgfb1i1	transforming growth factor 1 β induced transcript 1	Regulator of Tgfb and Wnt signalling pathways	-2.13
Slc5a12	solute carrier family 5, member 12	Mediator of transport of monocarboxylates from intestinal lumen	-2.12
Bat5	HLA-B associated transcript 5	May be involved in immune response	-2.12
Acot1	acyl-CoA thioesterase 1	Regulator of intracellular acyl-CoA's	-2.11
LOC681665	similar to integrator complex subunit 6 isoform a	Unknown function	-2.11
Ipo11	importin 11	Receptor for nuclear localization signals	-2.11
Rnf114	ring finger protein 114	Involved in chromatin remodelling	-2.11
Ncapd2	non-SMC condensin I complex, subunit D2	Involved in protein degradation	-2.11
Psmc6	proteasome (prosome, macropain) 26S subunit, ATPase, 6	Steroid hormone receptor	-2.10
Paqr8	progesterin and adipoQ receptor family member VIII	Regulator of microtubule interactions	-2.09
Ppp4r2	protein phosphatase 4, regulatory subunit 2	Unknown function	-2.09
Zfp445	zinc finger protein 445	Receptor for various ECM components	-2.08
Itgb3	integrin beta 3	Ubiquitin-protein ligase	-2.08
Ube2q1	ubiquitin-conjugating enzyme E2Q (putative) 1	Involved in microtubule-dependent cell motility	-2.08
Hdac6	histone deacetylase 6	Unknown function	-2.07
Fam82a1	family with sequence similarity 82, member A1	May be involved in mRNA splicing	-2.07
Luc7l	LUC7-like	Involved in T-cell receptor and leptin receptor signaling	-2.07
Khdrbs1	KH domain containing, RNA binding, signal transduction associated 1	Stabilizes actin cytoskeleton	-2.07
Tpm3	tropomyosin 3 γ	Regulates stabilization of actin filaments	-2.07
Fam24a	family with sequence similarity 24, member A	Unknown function	-2.06
Inpp11	inositol polyphosphate phosphatase-like 1	Regulator of actin cytoskeleton remodelling	-2.06
Ptpcr	protein tyrosine phosphatase, receptor type, C	Positive regulator of T-cell co-activation	-2.06
Terf1	telomeric repeat binding factor (NIMA-interacting) 1	Involved in telomeric regulation	-2.06
Mrpl51	mitochondrial ribosomal protein L51	Component of the mitochondrial ribosome	-2.05
Sfrs14	splicing factor, arginine/serine-rich 14	May play a role in mRNA splicing	-2.05
Psd3	pleckstrin and Sec7 domain containing 3	Unknown function	-2.05
Slc30a3	solute carrier family 30 (zinc transporter), member 3	Zinc transporter	-2.05
Speg	SPEG complex locus	Regulator of cytoskeletal development	-2.05
Abhd12	abhydrolase domain containing 12	Unknown function	-2.04
Acbd3	acyl-Coenzyme A binding domain containing 3	Involved in maintenance of Golgi	-2.04

Adarb1	adenosine deaminase, RNA-specific, B1	Involved in RNA editing	-2.04
Cela2a	chymotrypsin-like elastase family, member 2A	Elastin (ECM component) specific protease	-2.04
Ints1	integrator complex subunit 1	Involved in small nuclear RNA processing	-2.04
Itpkc	inositol 1,4,5-trisphosphate 3-kinase C	Involved in nuclear export/import	-2.04
Rcn1	Reticulocalbin 1, EF-hand calcium binding domain	Regulator of Ca-dependent activities in the ER	-2.04
Clcn5	chloride channel 5	Mediator of acidification of endosomal lumen	-2.04
Abo	ABO blood group	Blood group antigen protein	-2.03
Ankrd16	ankyrin repeat domain 16	Unknown function	-2.03
Mt2A	metallothionein 2A	Heavy metal responsive protein	-2.03
Retsat	retinol saturase (all trans retinol 13,14 reductase)	May be involved in vitamin A metabolism	-2.03
Slc4a10	solute carrier family 4, sodium bicarbonate co-transporter-like, member 10	Regulator of intracellular pH	-2.03
Luc7l3	LUC7-like 3	Involved in mRNA splicing	-2.02
Mfsd7b	major facilitator superfamily domain containing 7B	Heme transporter	-2.02
Cox4i1	cytochrome c oxidase subunit IV isoform 1	Involved in mitochondrial respiratory chain	-2.02
Hunk	hormonally up-regulated neu tumor-associated kinase	Unknown function	-2.02
Mbnl1	muscleblind-like 1	Mediator of pre-mRNA splicing	-2.02
Scaper	S-phase cyclin A-associated protein in the ER	Regulator of cell cycle progression	-2.02
Serf2	small EDRK-rich factor 2	Unknown function	-2.02
Chst3	carbohydrate (chondroitin 6/keratan) sulfotransferase 3	May play a role in maintenance of T-cells	-2.02
Eftud2	elongation factor Tu GTP binding domain containing 2	Involved in pre-mRNA splicing	-2.02
Maf	v-maf AS42 oncogene homolog	Developmental regulator	-2.02
Brd1	bromodomain containing 1	Unknown function	-2.01
Cdc45l	CDC45 cell division cycle 45-like	Involved in DNA replication	-2.01
Rbbp5	retinoblastoma binding protein 5	Regulator of cell proliferation	-2.01
Traf6	Tnf receptor-associated factor 6	NFκB signal transducer	-2.01
Gnb1	guanine nucleotide binding protein (G protein), beta polypeptide 1	Modulator of transmembrane signalling systems	-2.01
Mttr12	myotubularin related protein 12	Unknown function	-2.00
Slbp	stem-loop binding protein	May be involved in cell cycle	-2.00
A2l1d1	AIG2-like domain 1	Involved in protein degradation	-2.00
Aqp7	aquaporin 7	Water/glycerol channel	-2.00
Mfap3	microfibrillar-associated protein 3	Unknown function	-2.00

Table S6. Up- and down-regulated genes shared between P2 and P9 data sets

Gene Symbol	Description	Function	Mean-fold change ¹
RT1-Aw2	RT1 class Ib, locus Aw2	Antigen presentation	17.7/4.00
Cirbp	cold inducible RNA binding protein	Positive regulator of cellular stress response	5.04
Xiap	X-linked inhibitor of apoptosis	Apoptotic suppressor	3.91/2.52
LOC81816	hypothetical protein LOC81816	Putative ubiquitin conjugating enzyme	3.39
Rbm9	RNA binding motif protein 9	Regulates splicing of tissue specific exons	2.74
Reg3b	regenerating islet-derived 3 β	Antimicrobial peptide with C-type lectin domain	2.63
Sox4	SRY (sex determining region Y)-box 4	Transcriptional activator that binds to T-cell enhancer motifs	2.61/2.22
Pik3r1	phosphoinositide-3-kinase, regulatory subunit 1 α	Adaptor mediating association of activated kinases with plasma membrane	2.60/2.74
Hoxb6	homeobox B6	Transcriptional regulator	2.58
Ankle2	ankyrin repeat and LEM domain containing 2	Unknown function	2.40
Vdac1	voltage-dependent anion channel 1	Mitochondrial membrane channel involved in apoptosis	2.38
Id3	inhibitor of DNA binding 3	Inhibitor of transcription factor DNA binding	2.29
Pafah1b1	platelet-activating factor acetylhydrolase, isoform 1b, subunit 1	Required for proper activation of Rho GTPases and actin polymerization	2.28
Vezf1	vascular endothelial zinc finger 1	Regulation of IL-3 expression	2.23/2.36
Gata2b	GATA zinc finger domain containing 2B	Transcriptional repressor	2.21
Rnf6	ring finger protein (C3H2C3 type) 6	Ubiquitin-protein ligase	2.20
Krt15	keratin 15	Responsible for the structural integrity of epithelial cells	2.18
Ptprs	protein tyrosine phosphatase, receptor type, S	Signalling protein involved in development	2.17
Lgr4	leucine-rich repeat containing G protein-coupled receptor 4	Orphan receptor	2.09/2.35
Rod1	ROD1 regulator of differentiation 1	Regulator of cell differentiation	2.06
Eef1a1	eukaryotic translation elongation factor 1 α 1	Prompter of protein biosynthesis	2.03
Nolc1	nucleolar and coiled-body phosphoprotein 1	Involved in RNA polymerase I catalysed transcription	2.02/2.4
RT1-A3	RT1 class I, locus A3	Antigen presentation	-3.11
Mcpt3	mast cell peptidase 3	Serine endopeptidase	-2.62
RT1-Db1	RT1 class II, locus Db1	Antigen presentation	-2.46
Pbx1	pre-B-cell leukemia transcription factor	Transcriptional regulator	-2.36
Pim1	pim-1 oncogene	Signalling kinase activity	-2.35
LOC100362483	H2-GS14-2 antigen	Regulation of antigen presentation	-2.29
Wwc1	WW and C2 domain containing 1	Transcriptional activator	-2.15
Amy1 ; Amy2	amylase, alpha 1A (salivary), amylase 2, pancreatic	Hydrolase	-2.03

¹In most cases there was complete concordance between the extent of gene modulation at P2 and P9; two values are shown when there were quantitative differences between values from the two sets of animals (P2 ranked and shown first).

Supplemental methods

***E. coli* K1 *neuS*-based qPCR assay**

Culture methods for detecting *E. coli* K1 in stool and tissue samples are laborious and relatively insensitive; a qPCR assay based on amplification of the *neuS* gene of the K1-capsule biosynthesis and export *kps* gene cluster using a specific primer pair was developed.

Validation of the qPCR assay

The utility of *neuS* qPCR for the quantification of *E. coli* K1 was examined by real-time monitoring of PCR using *E. coli* K1 DNA as a genomic standard and by generation of reproducible standard curves. The use of the technique in quantifying *E. coli* K1 from intestinal tissue and stool DNA extractions was validated by spiking samples with A192PP DNA prior to qPCR.

Total genomic DNA was extracted in triplicate from standardized cultures of A192PP; DNA extracts were serially diluted to produce a range of DNA dilutions for use as qPCR standards. This range covered genomic DNA corresponding to 10^1 - 10^7 A192PP CFU. Representative data produced by real-time monitoring of PCR reactions utilizing these standards as template DNA is shown in Fig. S3. Amplification of PCR products was detected in all dilutions tested but not in no-template controls (Fig. S3A), demonstrating that this method was able to detect ≤ 10 genome copies. Melt-curve analysis detected a single PCR product with an estimated T_m of 78 °C (Fig. S3B). The C_t values produced by amplification of standard DNA from replicate cultures were highly reproducible, allowed the generation of standard curves (Fig. S3C) and facilitated the determination of PCR efficiencies, which ranged from 96-102%. Thus, *neuS* PCR falls within the parameters required for accurate qPCR-based quantification and represents a valid method for quantification of *E. coli* K1.

Sample spiking was used to determine the capacity of the qPCR assay to quantify *E. coli* K1 DNA from samples containing complex mixtures of bacterial and host DNA. DNA was extracted from four adult stools and neonatal tissue homogenates containing no *E. coli* K1 detected by culture and phage typing. PCRs containing these DNA extracts were spiked with known quantities of A192PP DNA representing a range of 10^1 - 10^6 CFU. *E. coli* K1 was quantified by *neuS* qPCR and the results compared to spiked CFU values (Fig. S4). Within the 10^1 - 10^5 CFU spike range, no significant differences were observed between spike

inoculum CFU values and qPCR results derived from analysis of DNA extracted from either stool or tissue homogenates. However, significantly less *E. coli* K1 was detected by qPCR in both sample types in assays utilizing a 10^6 CFU spike. Melt-curve analysis of PCRs from spiked samples indicated a single amplification product with the same T_m as observed previously. No amplification was observed in non-spiked stool and tissue samples. These results demonstrate the capacity of the *neuS* qPCR assay to quantify *E. coli* K1 DNA from adult and neonatal intestinal DNA extracts and shows that the upper limit of detection of the assay is $\sim 10^5$ CFU for each PCR.

Comparison of culture/phage and qPCR methods for examination of animal samples

The capacity of the *neuS* qPCR method to quantify *E. coli* K1 from animal samples was compared to ‘gold-standard’ culture and phage typing (Fig. S5). DNA was extracted from the intestinal tissue homogenates of 24 P2 neonatal pups and stool homogenates from twelve adult rats colonized with A192PP. *E. coli* K1 was quantified by qPCR or by culture of homogenates and subsequent phage typing of coliform isolates; CFU/g values were compared and two sub-populations resolved. With the majority of samples, there was a strong correlation between culture/phage and qPCR data for both tissue (n=21) and stool (n=8), with Spearman R^2 values of 0.87 and 0.95 respectively. However, a minority of tissue (n=4) and stool (n=4) samples yielded *E. coli* K1 by qPCR but not by culture/phage typing. Melt-curve analysis of DNA amplified from these samples indicated a single product with the same T_m as the *neuS* amplification product. Moreover, the CFU/g values determined by qPCR were either near or below the LOD for culture and phage typing, as determined previously by normalization to mean tissue and stool mass, indicating that qPCR detected *E. coli* K1 from samples that were negative by culture/phage typing. Calculation of qPCR LOD values for both sample types, based on the dilution steps required for DNA extraction and the sensitivity of the qPCR assay, showed that qPCR was 62.5-fold more sensitive for quantification of *E. coli* K1 than culture/phage typing. Taken as a whole, these results demonstrate that quantification of *E. coli* K1 by qPCR assay was more sensitive and more reliable than culture and phage typing.

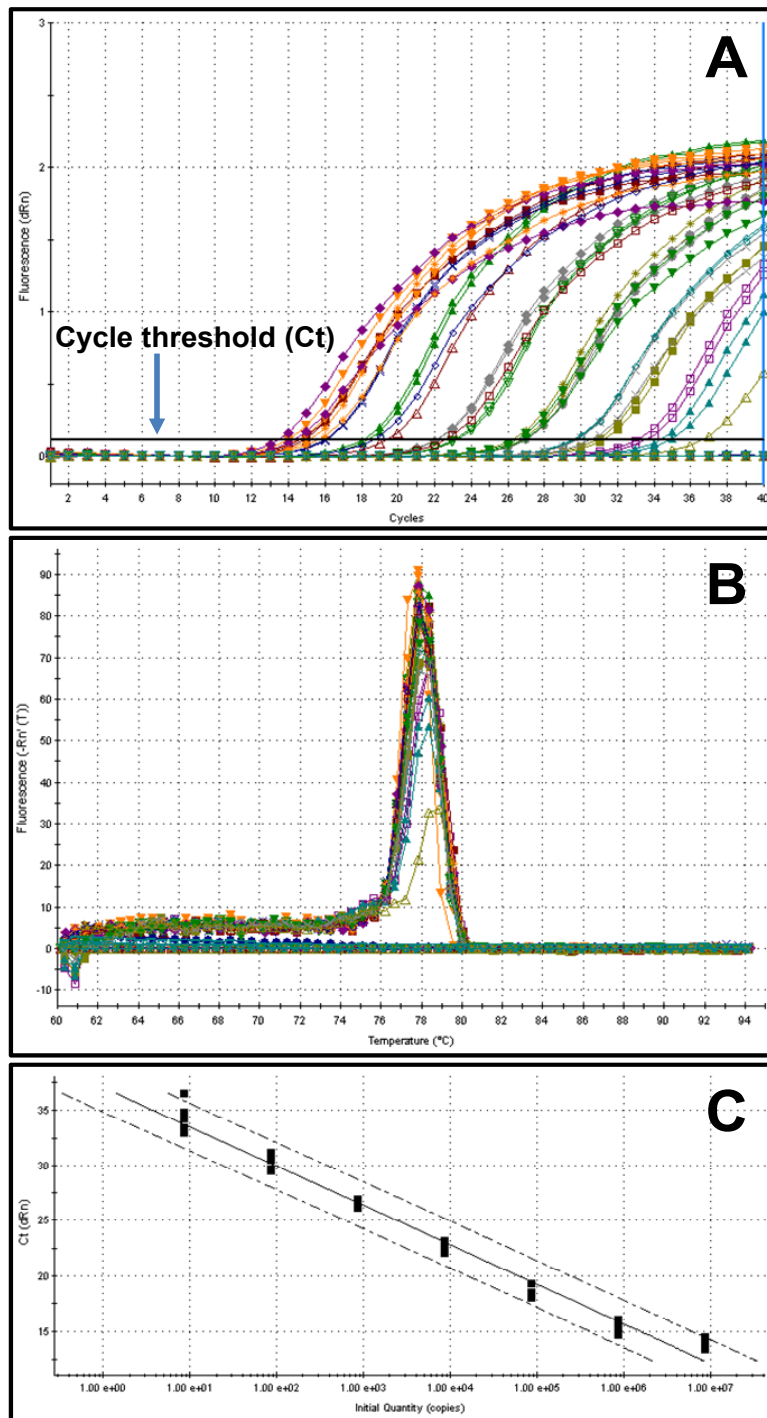


Figure S3. qPCR of the neuS gene using tenfold serial dilutions of A192PP DNA. Quantities of DNA corresponding to 10^1 - 10^7 CFU were amplified by PCR and reactions monitored in real-time. (A) PCR cycle number against fluorescence. Post-amplification reactions were subjected to melt-curve analysis (B), comparing temperature and Δ (fluorescence). Standard curves (C) were constructed by plotting copy number (CFU) against Ct values obtained in A. The cycle threshold is indicated in (A) and the 95% confidence interval (----) in (C).

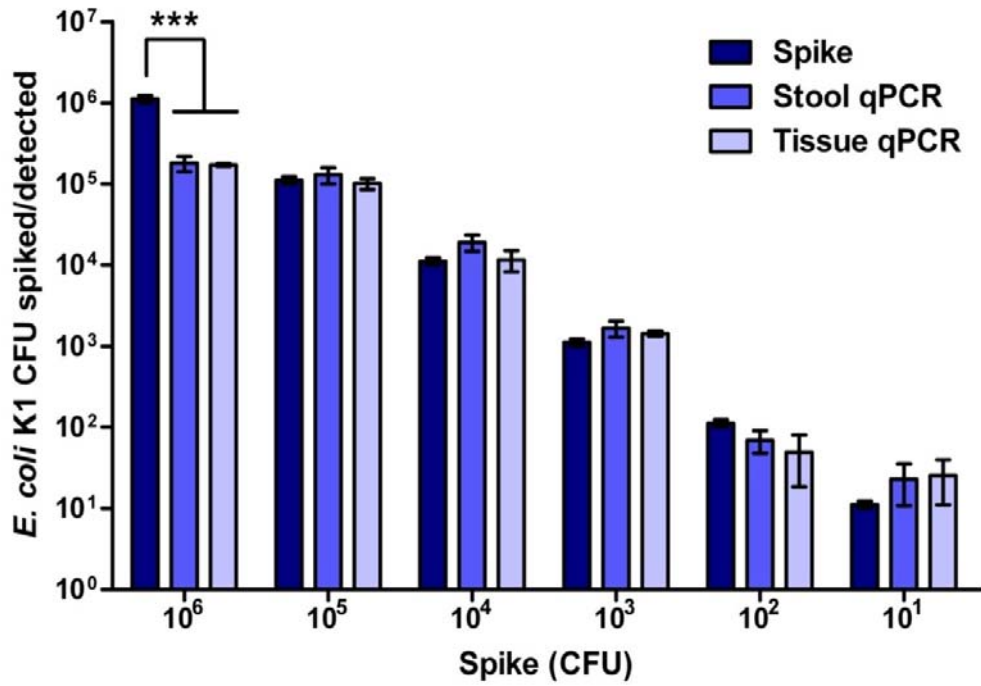


Figure S4. *E. coli* K1 detected by qPCR of DNA extracted from adult stool and neonatal tissue homogenates spiked with known quantities of A192PP DNA. Error bars represent the SEM from four independent experiments. Differences determined by 2 way ANOVA are indicated (***) p<0.001).

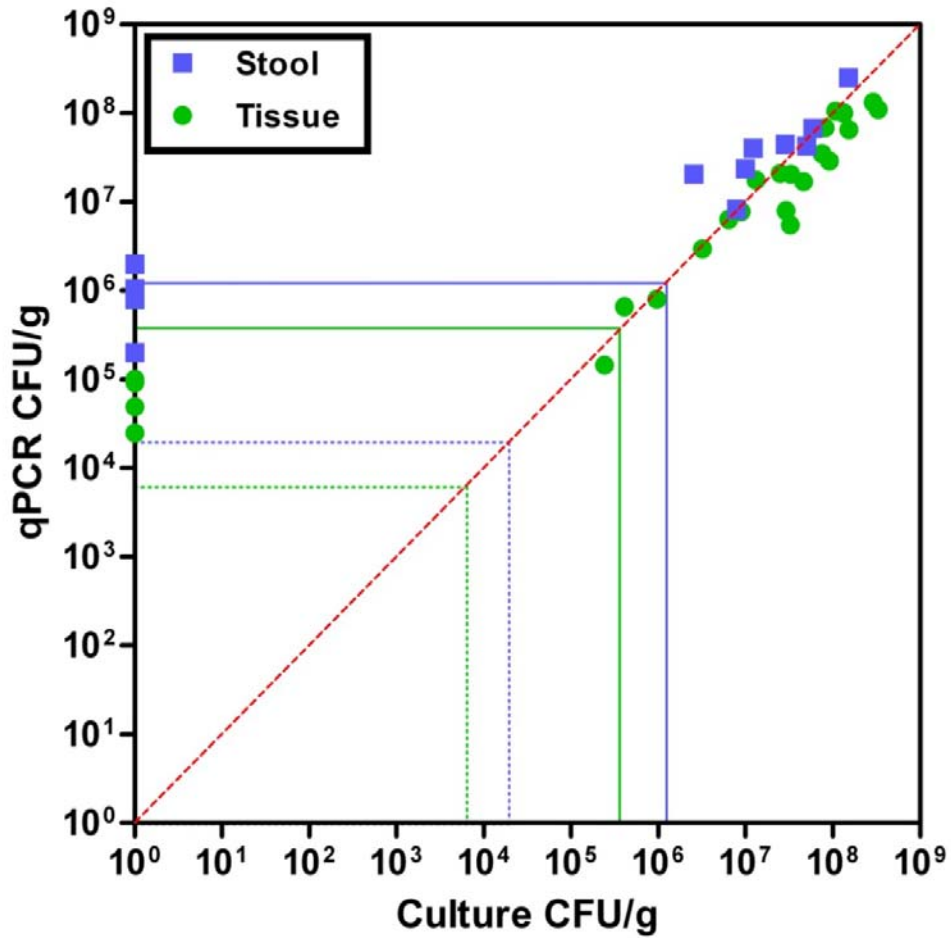


Figure S5. Comparison of *E. coli* K1 CFU/g detected by qPCR and culture methods. *E. coli* K1 was quantified from 24 neonatal tissue and twelve adult stool homogenates from A192PP-colonized animals. The LODs of culture (solid lines) and qPCR (dotted lines) are indicated for stool (blue) and tissue (green) samples. $R^2 = 1$ (perfect correlation; ----).